Master's thesis

NTNU
Norwegian University of Science and Technology
Faculty of Engineering
Department of Civil and Environmental Engineering

Yimrhane Abebe

Performance Information Risk Management System: benefits and challenges observed among pilot projects in Norway

Master's thesis in Master of Science in Engineering in Project Management
Supervisor: Ole Jonny Klakegg
June 2022

NTNU
Norwegian University of Science and Technology

Yimrhane Abebe

Performance Information Risk Management System: benefits and challenges observed among pilot projects in Norway

Master's thesis in Master of Science in Engineering in Project Management
Supervisor: Ole Jonny Klakegg
June 2022

Norwegian University of Science and Technology
Faculty of Engineering
Department of Civil and Environmental Engineering

NTNU
Norwegian University of
Science and Technology

Preface

This master's thesis constitutes 30 credit hours. It marks the final step in my Project Management master's degree at the Norwegian University of Science and Technology, Department of Construction and Environmental Engineering. The thesis was This thesis is a continuation of the knowledge gap identified during the literature review of the specialization project written in the autumn of 2021 as part of the course TBA 4530.

I have used this opportunity to understand the Best Value Approach model, emphasizing on the risk management model Performance Information Risk Management System (PIRMS). By studying the effects of PIRMS on risk management, I have gained enhanced knowledge of the current challenges and examined possible solutions to increase the utility of PIRMS.

My greatest debt of gratitude goes to almighty God. Secondly, I would like to sincerely thank my advisor, Ole Jonny Klakegg, for constructive feedbacks and engaging discussions. I would also like to thank each informant that provided me with the data without which this thesis would not exist. Last but not least, my parents deserve heartfelt thanks for always supporting me.

Trondheim, June 2022

Yimrhane Abebe

Summary

The Norwegian Agency for Public and Financial Management (DFØ) has recommended the Best Value Procurement (BVP) to increase public procurement professionalism and effectiveness. Since 2016, BVP has been piloted in over 20 projects in Norway. Performance Information Risk Management System (PIRMS) has been used as part of the BVP piloting initiative. This thesis sought to assess the benefits and challenges of PIRMS. It also explored the core problems motivating poor risk management by analyzing the effects of PIRMS on the pilot projects. The study used an exploratory qualitative research method to answer the research questions. The data was collected by conducting in-depth interviews and document reviews. The interviews were analyzed using thematic analysis, and the documents were assessed using content analysis. The following research questions were explored.

1. What are the critical factors needed to optimally apply the PIRMS model?

   1 A. How should PIRMS be implemented, and what was practiced?
   1 B. Which situational factors influenced how PIRMS was practiced?
   1 C. Theory of PIRMS and practice discrepancies, why they occur?

2. Which advantages and disadvantages of current PRIMS practice were observed?
3. What can be done to better apply the PIRMS model and increase its utility?

Findings indicate that the critical factors needed to optimally apply PIRMS include enhanced understanding of the BVA model, practitioners must genuinely be willing to apply the model, and the PIRMS model must be improved. The model lacks comprehensiveness, undermining its utility potential. Overall, the factors that have likely contributed to mediocre implementations seem to be due to passive forms of change resistance.

Improvements needed to better implement PIRMS comprise knowledge enhancement, enhanced collaborative efforts, a structured working practice, formulating function-based project deliverable descriptions, and avoiding the implementation of hybrids. Generally, findings suggest that PIRMS leads to a better risk management process and prevents some of the poor risk management factors. However, it does not seem to solve the core issues motivating poor risk management. This thesis recommends expanding the utility function area of PIRMS by increasing the incentive mechanisms. Further research is recommended to test for correlation between opportunism and risk maturity, with incentive mechanisms as moderators.

Summary in Norwegian

Direktoratet for forvaltning og økonomistyring (DFØ) har anbefalt Best Value Procurement (BVP) for å øke profesjonalitet og effektivitet i offentlige anskaffelser. Siden 2016, har BVP vært pilotert i over 20 prosjekter i Norge. Performance Information Risk Management System (PIRMS) har blitt brukt som en del av BVP pilotinitiativet. Denne oppgaven søkte å undersøke fordeler og utfordringer ved PIRMS. Den undersøkte også kjerneproblemene som motiverer mangelfull risikostyring ved å analysere effekten av PIRMS på pilotprosjektene. Studien brukte en utforskende kvalitativ forskningsmetode for å besvare forskningsspørsmålene. Dataene ble samlet inn ved å gjennomføre dybdeintervjuer og dokumentstudier. Tematiskanalyse ble brukt for å analysere intervjuene, og innholdsanalyse ble brukt for dokumentene. Følgende forskningsspørsmål ble utforsket.

1. Hva er de kritiske faktorene for å gunstig iverksette PIRMS-modellen?

    1 A. Hvordan bør PIRMS iverksettes, og hva ble praktisert?
    1 B. Hvilke forholdsfaktorer påvirket hvordan PIRMS ble praktisert?
    1 C. Teori om PIRMS og praksisavvik, hvorfor oppstår de?

2. Hvilke fordeler og ulemper ble observert ved dagens praksis?
3. Hva kan gjøres for å bedre anvendelse av PIRMS, og øke nytteverdien?

De kritiske faktorene som trengs for å anvende PIRMS gunstig omfatter: økt forståelse av BVA-modellen, prosjekt eiere og entreprenører må genuint ville anvende modellen, og modellen må forbedres. Den mangler helhet som minker nytteverdipotensialet. Generelt, ser det ut til at faktorene som ført til en middelmådig implementering skyldes en passiv form for endringsmotstand.

Forbedringer som trengs for forbedret fremtidig implementering av PIRMS omfatter: kunnskapsforbedring, forbedret samarbeidsinnsats, en strukturert arbeidspraksis, bruk av funksjonsbasert prosjektbeskrivelser og unngåelse av hybrid gjennomføring. Samlet sett, tyder funn på at PIRMS fører til en bedre risikostyringsprosess og motvirker noe av de faktorene som motiverer mangelfull risikostyring. Det ser imidlertid ikke ut til at PIRMS løser kjerneproblemene som motiverer mangelfull risikostyring. Denne oppgaven anbefaler å utvide nyttefunksjonsarealet til PIRMS ved å øke insentivmekanismene. Videre forskning anbefales for å teste for korrelasjon mellom opportunisme og risikomodenhet, med insentivmekanismer som moderatorer.

Contents

List of figures

List of Tables

Abbreviations

BVA	Best Value Approach
BVP	Best Value Procurement
ECI	Early contractor involvement
KSM	Kashiwagi Solution Mondel
PBSRG	Performance Based Studies Research Group
PIPS	Performance Information Procurement System
PIRMS	Performance Information Risk Management System
RA	Risk analysis
RM	Risk management
RMM	Risk management model
RMP	Risk management plan
TCT	Transaction Cost Theory
WRR	Weekly risk report

Terms and definitions

Terms may have been used interchangeably, but an effort was made to maintain consistency.

Risk Management**:** "The process of risk identification, risk analysis, plan risk measures, implement risk measures, and monitor risks" (Project Management Institute, 2017).

Event: "Anything that happens which takes time" (Kashiwagi, 2016a, p. G-2).

Initial conditions: " The sum of all factors and information (initial conditions and natural laws) that make up the beginning of the event" (Kashiwagi, 2016a, p. G-3).

Final conditions: " The end result of an event. Controlled by the initial conditions and natural laws" (Kashiwagi, 2016a, p. G-3).

Dominant information: "A “no brainer”, “common sense”, “easy to understand” information, or where there is no requirement to use one’s unique experience to predict the next state or future action" (Kashiwagi, 2016b, pp. 2–2).

Thesis structure

The study explores research questions that require a broad understanding of risk management and the factors that influence how it is practiced. Each chapter is a contribution to form an understanding . A short summary of the main chapters is provided below.

Chapter	Content
Chapter 1	Contains a background motivating this research and identifies current developments. The research questions are developed, and the purpose and objectives are described.
Chapter 2	Presents the BVA & PIRMS model and describes and how it works.
Chapter 3	The methodology is presented and the choice of research design data collection, analysis methods, and interpretations are described. Trustworthiness and dependability measures are established. Finally, the criteria to evaluate transferability is set.
Chapter 4	Provides a comprehensive theory divided into three sub-chapters: (1) understanding risk in construction, (2) risk management: perspectives from behavioral and economic theories, and (3) risk management and the PIRMS solution.
Chapter 5	Presents findings and discussions together for greater readability and understanding. The three research questions are answered.
Chapter 6	Concludes the thesis by presenting major findings. Whether the findings are transferable is evaluated and a recommendation recommendation for further research is forwarded.

1 Introduction

During the pre-project term paper in the autumn of 2021, a literature review revealed a research gap on the effects of Performance Information Risk Management System (PIRMS) on BVP pilot projects in Norway. PIRMS is the risk management model of the Best Value Approach project delivery model. The purpose of PIRMS is to minimize risk mismanagement (Kashiwagi, 2016a, chap. 1). The Norwegian Agency for Public and Financial Management (DFØ) has taken note of the need to find efficient and productive solutions (DFØ, 2020a). In 2016, DFØ invited major sector players to pilot the Best Value Procurement (BVP), in which the risk management model used was PIRMS. Many of the pilot projects are now complete. This thesis attempts to fill the knowledge gap by exploring whether PIRMS solves fundamental risk mismanagement issues. Risk management is a broad field. Exploring poor risk management issues through PIRMS limits the scope of the study.

For a basic understanding of the current poor risk management factors, a scoping literature review was initially conducted. It identified relevant behavioral science and economic theories, initiating an examination of their effect on risk management. Findings indicate that there are situations that cause problems, propagating a reaction rather than a solution. Based on the findings from theory, conceptual figures were developed illustrating typical risk management patterns using behavioral science and economic theories to explore poor risk management factors. A conceptual figure was also developed showing how PIRMS solves risk management issues. Chapter five explores the issues and evaluates whether the perceived benefits of PIRMS were good as a solution. Additionally, recommendations are given to enhance future implementations. Based on the total impression, a proposal to tackle risk mismanagement is developed to motivate further research.

1.1 Establishing current risk management problems and practices

Concerns about risks seem to increase as the complexity and magnitude of construction grow (Luo et al., 2017). The last decades have seen a tremendous surge in new problem areas as technological advancements have enabled the construction of highly intricate designs (Williams, 1999; Rivera et al., 2016; Luo et al., 2017). Despite advancements in construction capabilities, the ability to manage risks has not had the same progress.

Testament to risk management malpractice is the recurring statistical performance indexes. The sector is consistently ranked among the least performing sectors across multiple measures (Rivera et al., 2016; McKinsey Global Institute, 2017; TODSEN, 2018). Poor performance includes cost overrun, poor quality deliverables, project delay, and low stakeholder satisfaction. They are all a manifestation of poor risk management (Beatham et al., 2004; Hillson, 2009; Snippert et al., 2015; Mahamid, 2016; Welde, 2017). Most of the established models and practices deal with risks by risk transferring or sharing mechanisms (Ogunsanmi, Salako and Ajayi, 2011; Bos, Kashiwagi and Kashiwagi, 2020). Among other newer models is the Performance Information Measurement System (PIRMS) which is the

risk management model of the BVA project delivery model (Kashiwagi et al., 2015). It is described as a game-changer in the field of risk management (Kashiwagi, Parmar and Savicky, 2004; Kashiwagi et al., 2015) Could PIRMS be the remedy the sector has been searching?

PIRMS is considered unique by its promoters since it uses incentive mechanisms to higher effects (Kashiwagi, Parmar and Savicky, 2004; Kashiwagi and Scholar, 2011). The developers show a success rate of above 90 % in delivering projects within budget, on time, and meeting stakeholders' expectations.

1.2 A need for a better risk management approach and where this study fits in

The Norwegian Agency for Public and Financial Management (DFØ) has recommended the Best Value Procurement (BVP) to increase public procurement professionalism and effectiveness(DFØ, 2020a). In 2016, DFØ invited major sector players to pilot the Best Value Procurement (BVP) model. Although none of the pilot projects were pure BVA projects, they all have utilized PIRMS. The purpose was to promote improvements in project implementation, procurement, and reducing conflict levels in public construction projects (DFØ, 2020a). Many pilot projects are now delivered, providing opportunities to study the effects.

Literature shows that most previous studies to date have limited their scope to documenting the experiences linked to using the procurement model of BVA. Few have identified the advantages and disadvantages of PIRMS on a surface level. To the best of the author's knowledge, there appears to have been no dedicated research done to examine PIRMS and its effect on risk management in Norway. This research is an attempt to fill that research gap.

There are several approach angles to study the research gap identified. A literature review conducted in the autumn for the project report revealed that risk management has strong ties to behavioral science, which ultimately governs risk management practice. Therefore, the focus has been on exploring the effects of PIRMS by describing and analyzing empirical findings from behavioral science and relevant economic theory perspectives. This study has explored the advantages and disadvantages in greater detail. Moreover, it has identified the implementation challenges and recommends improvements. The study aims to contribute to knowledge by (1) evaluating whether the implementation of PIRMS has resolved the core factors contributing to poor risk management issues, (2) recommending ways to better implement PIRMS, and (3) by developing a proposal to increase the utility of PIRMS.

1.3 Purposes of the research

This study explores how PIRMS affects risk management by assessing the effects on pilot projects in Norway. The research has two purposes (1) to assess the advantages and disadvantages of PRIMS, and (2) to explore the core problems motivating poor risk management by analyzing the effects of PIRMS on the pilot projects. Risk management is a

broad field, hence studying the issues through PIRMS limits the scope of the study. The theory chapter includes relevant behavioral science and economic theories. Literature indicates that there are situations that cause problems, propagating a reaction rather than a solution. Figures developed depict situations, problems, and conventional solutions to illustrate patterns. While the first two figures show typical conduct, the third figure illustrates how, Kashiwagi, the developer of the PIRMS, proposes PIRMS as a solution. Chapter four explores the issues and evaluates whether the perceived benefits of PIRMS were good as a solution. Additionally, recommendations are given to enhance future implementations. Based on the total impression, a proposal to tackle risk mismanagement is developed to motivate further research.

1.4 Research questions and relevance to the purposes of the research

Given the background presented above, the following research questions were developed.

1. What are the critical factors needed to optimally apply the PIRMS model?

   1 A. How should PIRMS be implemented, and what was practiced?

   1 B. Which situational factors influenced how PIRMS was practiced?

   1 C. Theory of PIRMS and practice discrepancies, why they occur?

2. Which advantages and disadvantages of current practice were observed?
3. What can be done to better apply the PIRMS model and increase its utility?

The rational for developing the stated research questions are the following. The questions are structure in a manner that seeks convergence towards a possible solution in question 3, beginning with identifying the situation in question 1.

Question 1 A: The rational is to evaluate whether PIRMS implementation recommendations are converted into practice. For this a theoretical implementation model is developed based on the reference books to compare with practical implementations in the pilot projects.

Question 1 B: The rational is to understand why the pilot projects implemented the model in a particular way. For this behavioral science factors and relevant economic theories that explain factors that can affect the implementation will be reviewed.

Question 1 C: Exploring why there might be differences between theory and practice could reveal what may have caused deviations in practice.

Question 2: The intent is to evaluate whether the advantages attained reflect the six mechanisms underlying PIRMS (Kashiwagi, 2016a, chaps 6–7), as presented in 4.5 here. The second intention is to evaluate whether the advantages agree with benefits remarked in other BVP studies. The third intent is to evaluate what did and did not work well in the Norwegian market.

Question 3: The intent is to address what is needed to improve future implementations of the model, and to propose a way to increase the utility of PIRMS.

1.5 Research objectives

I. To identify factors that challenged the implementation of PIRMS
II. To discuss whether PIRMS improves current risk management practices
III. To identify advantages and disadvantages of using PIRMS
IV. To evaluate whether elements of PIRMS can be transferable to projects with other project delivery models
V. To recommend what can be done to implement PIRMS better
VI. To discuss ways that can increase the utility of PIRMS

1.6 Scope and limitations

Defining scope limiting factors

The limited-time of 20 weeks constrains how detailed the research can be in content. The topic is broad and naturally necessitates examining different theories and angles to answer the research questions. However, boundaries are necessary to make research scientifically interesting without compromising rigor.

The backgrounds that initiated this research put a natural scope boundary. The pilot projects' cause of initiation was used to define the scope. I.e., studying the effects of PIRMS functions as a boundary.

The participants in the pilot projects comprised project owners and contractors. Although PIRMS affects other relevant stakeholders, data is retrieved only from the project owners and the contractors. Hence the scope of this study is limited to the perspectives of contractors and project owners.

Another scope limiting factor was defined to confine the literature areas explored. Behavioral science theories and relevant economic theories were explored. However, given the broad nature of the topics chosen, it had to be limited in scope. From behavioral science theories, risk culture limited to risk attitude theory was included. From economic theories, transaction cost theory, the principal-agent problem, and power dynamics were examined, focusing on a selection of topics contained in the theories.

Limitations and anticipated consequences

Limitations are necessary boundaries to make the research practically doable and content-wise interesting (Creswell and Creswell, 2018, pp. 178–182). The issue raised in this research is broad and complex. Studying a risk management issue in its vast form would only amount to confusion at best. Limiting to what has been possible to comprehend and reflect on in a mere 20 weeks is necessary. In that sense, limitations also function to foster quality over quantity. This thesis has confined the boundaries to explore risk management using PIRMS as

a limiting factor. I.e., the focus is on studying how PIRMS ultimately affects risk management.

Limitations may ease the workload and could promote quality. However, implications on the trustworthiness, dependability, and transferability of findings are inevitable. The following limitations apply in this study.

Trustworthiness limiting factors

Literature bias: Most of the literature related to PIRMS is written by promoters of the model. The information can therefore be biased.

Representativeness of the literature: The literature review to a large degree reflects the risk management culture of well-developed western societies.

Limited to public building projects: The pilot projects examined comprise public-funded building projects. Hence, the findings may not be representative of infrastructure projects.

An uneven number of informants: The sampling suffers from uneven representative number between contractors and project owners. This can compromise trustworthiness.

Researcher's experience and bias: It is impossible to avoid introducing bias as a researcher. And lack of experience exacerbates the problem. Bias can be introduced in a variety of ways, and this study may bear a reflection on that. Though the risk management issues are likely the same, the operational risk management problems could be different.

Timebound limitations: It resulted in a struggle to ensure comprehensiveness while keeping the broad content concise and interesting. The representativeness of reality in terms of trustworthiness could have been reduced.

Dependability limiting factors

Dependability of documents: The WRRs and the RMPs lack in completeness. This could provide the wrong representation of how well PIRMS works. More importantly, is compromises trustworthiness.

Analysis limitations: Though rigor was emphasized by using a thick description of findings from the thematic analysis, there is a substantial interpretation involved in the inductive approach used. The coding and theme generating process bear a reflection of interpretive findings. This can limit the dependability of the findings.

Transferability limiting factors

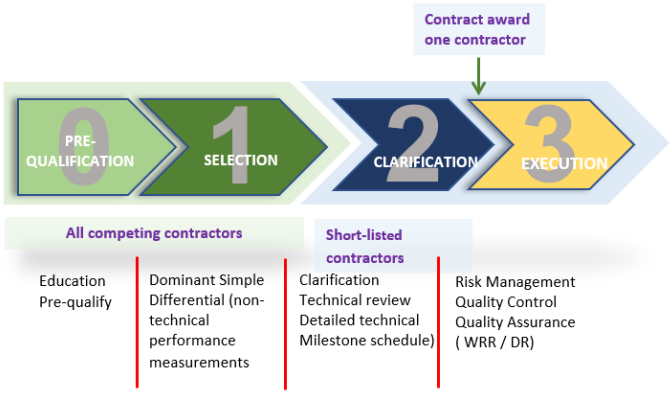
Research design limitations: This study is a qualitative study. It should be enhanced with quantitative design to verify findings and increase generalizability.

Limited to experiences in Norway: The interviews and document analysis reflect experiences from Norway. This reduces the likelihood of findings being useful in other countries.

2 Performance Information Risk Management System (PIRMS)

To better understand what what PIRMS entails, a brief introduction of the BVA model is beneficial. The BVA is a project delivery model incorporating a procurement model (BVP), a risk management model (PIRMS) , and a project management model (Kashiwagi, 2016a, chap. 1) It was developed in 1991 by Dean Kashiwagi and is based on Information Measurement Theory (IMT). There are two referral books explaining the inner workings of the model and how to apply it: 2016 Information Measurement Theory (IMT) and 2016 Best Value Approach. The BVA has four consecutive phases. PIRMS is applied throughout all phases.

Figure 2-1: The BVA model (based on Kashiwagi, 2016a, chaps 9–2)



As illustrated in Figure 2-1, during the selection phase, qualified contractors that have passed phase 0 submit a six-page document containing two-pages for each of the following: past performance, risk management plan (RMP), and added value (Kashiwagi, 2016a, chap. 9). Based on a total of score given by the project owner committee, only short-listed contractors enter the clarification phase. Finally, one contractor is chosen for an in-depth interview . The construction phase begins at phase three.

Central to the BVA philosophy is dominant information. According to Kashiwagi and Scholar (2011), dominant information is used to explain complicated situations to non-experts in a clear, concise and indisputable manner backed with evidence. It increases transparency. Each phase of the model proceeds using dominant information. Dominant information is one of the backbones of IMT.

2.1 How the PIRMS model functions

The fundamentals of the PIRMS begins with ensuring the procurement of the right contractor. The contractors submit a total of a six-page document during the procurement phase (DFØ, 2020b). Taking two-pages in this document is the contractor's risk mitigation plan (RMP) containing the project owner's significant risks. The RMP must outlines the following:

1. The client's greatest risks
2. Why these risks are significant

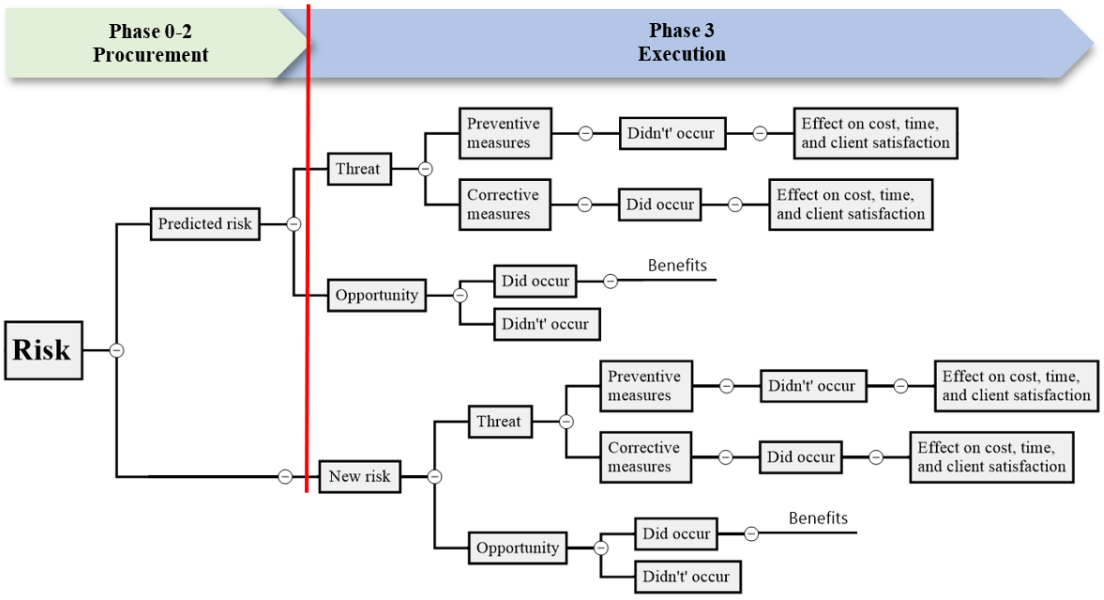
3. Explanation of how the risks might arise
4. Description of which preventive measures will be used by documenting the effect of the preventive measures with dominant information
5. Statement of which corrective measures will be taken should the risk materialize along with preventative measures to reduce the negative effect.

The RMP developed during the procurement phase must be updated during the clarification phase with input from the project owner (DFØ, 2020b). Additionally, KPIs developed by the contractor must be reviewed and approved by the project owner.

During the execution phase, the contractor must submit a WRR to the project owner containing which risks that occurred during that particular week (predicted and new once), what measures were taken and the effect on time, cost and quality. Since unpredicted risks may occur during the execution phase, the contractor must update the RPM whenever new risks that have a consequence on time, cost, and project goals materialize. Moreover, the KPIs must be measured and submitted to the project owner for assessment at an agreed frequency. The performance of the contractor is rated to ensure quality control.

The objective of the RMP is to establish who is best suited to mitigate risks and perform quality control (Kashiwagi, 2002; DFØ, 2020b). PIRMS is a continuous process of staying at the forefront of risks. The figure below shows how risk is managed throughout the three phases. The procurement phase is where the risk steering framework is developed, incorporating a risk management plan. The risk management plan is then usen to manage risk during the excursion phase.

Figure 2-2: Risk management structure in PIRMS



3 Methodology

3.1 Research paradigm

This section presents my understanding of ontology and epistemology. A researcher's philosophical beliefs influence the methodology designed to address a research question (Creswell and Creswell, 2018, chap. 1). And bias is an inevitable part of any research that partially stems from one's philosophical viewpoints. Defining my epistemology and the assumptions I bring to the study here was thus necessary. The choices of analysis methods and interpretations are discussed in light of my epistemology.

The research paradigm encompasses ontology and epistemology (Creswell and Creswell, 2018, pp. 44–48). While ontology examines what reality is, epistemology regards how reality can be examined. Several ontologies and epistemologies exist, but I subscribe to the following. Ontologically, I believe that there can be multiple realities. Epistemologically, I believe that knowledge should be interpreted to uncover the underlying meanings. This is perhaps driven by my belief that the perception of reality is different in the ease of the beholder - and therefore necessitates reading between the lines. My viewpoints on ontology and epistemology makes me a constructivist.

3.2 Research design

This section rationalizes the choice of an explorative qualitative research design. The research design defines a method of data collection, analysis, and interpretation tailored to address the research question (Creswell and Creswell, 2018, chap. 1). Three research design approaches exist: quantitative, qualitative, and mixed methods (Creswell and Creswell, 2018, p. 43, figure 1.1).

The core effort in risk management research remains developing a model to address risk management malpractice (Taroun, Yang and Lowe, 2011; Taroun, 2014; Hillson, 2019, chap. 1). The ultimate intention of this study is to contribute to knowledge by sparking questions that instigate further research on predictors of opportunistic risk management. Motivated by personal interest for the field and the initiation of pilot projects to address the issue, the PIRMS model was chosen as a lens to gain an explorative insight into the problems. Also, an exploration of how well PIRMS has worked is of interest. In an explorative approach, one seeks a general understanding from different perspectives. In that sense, explorative designs provide a broader selection of tools to understand complex issues. Overall, adopting a qualitative approach fits well with the intentions described above.

Research designs can be experimental, quasi-experimental, or non-experimental Creswell and Creswell, (2018, chap. 5). This thesis is a non-experimental study. Qualitative studies are also divided into cross-sectional and longitudinal research. This study is a cross-sectional study. The details of data collection, analysis, and interpretations procedures were conducted as follows. An overview of the studies design is illustrated below.

3.3 Data collection method

Literature review, document analysis, and interviews are used to answer the research questions. Two considerations formed the basis for choice. (1) The research design adopted as outlined in 3.21.4 for suitable methods to address the research questions, and (2) practicality, data availability, and accessibility were considered. In the following, the rationale for each method chosen is described by presenting the advantages and disadvantages.

3.3.1 Literature review

The purpose of a literature review is varied (Creswell and Creswell, 2018, pp. 66–81). Using literature review as a method enables one to identify and process previous research that supports or contrasts the chosen studied topic. The literature review should not only identify the works of others, but it should also be a part of answering the research question. In this research, the literature review had two purposes. (1) answer research question 1 A and (2) provide a good understanding of the research topic. There are, however, advantages and disadvantages to consider.

Most importantly, a literature review provides the researcher with an overview and a broad understanding of other related studies (Creswell and Creswell, 2018, chap. 2). The study undertaken can thus be related to previous and current discourses. This enables the researcher to fill a knowledge gap or perhaps enhance existing understanding. The literature review is also essential to underpin the importance of the study by providing a means to compare results against the works of others.

Time plays a critical role in how comprehensive a literature review can be. The limited timeframe of 20 weeks to finish this research constrains how broad the literature review could be, posing a disadvantage. It meant that other relevant literature inevitably was left out.

The amount of literature, or lack of it, could be a disadvantage. Yet, while there may have been somewhat limited material on PIRMS, sufficient literature was found on the broader topic of risk. This can present a challenge when aligning the different viewpoints to the topic studied here. Another weakness that can compromise validity is the bias of authors behind publications.

A notable weakness observed during the literature review regards literature related to the Best Value Approach model. The literature is written by the founder Dean Kashiwagi and other researchers with strong ties to the BVA model research group (PIBRG). Much of the literature is focused on promoting merits. Despite the conflict of interests, these publications are perhaps the best gateway to understanding PIRMS.

3.3.2 Document analysis

Document analysis is considered a constituent component of qualitative research (Guest, Namey, and Mitchell, 2013, chap. 6). The following paragraphs reflect on the advantages and disadvantages.

One significant advantage is that the data is readily available, circumventing the need to generate it. The content in a document can contain detail-rich data that can verify findings from primary sources. It saves valuable time. Usually, three main disadvantages are linked to document analysis: an overwhelming amount of information, relevance issues, and quality of data (Guest, Namey and Mitchell, 2013, chap. 6).

Despite the sheer amount of data needing sorting, extracting the relevant information was relatively forgiving. The datasets chosen provided highly relevant information. The quality of the documents was decent. Most project owners did review the WRRs and he

RMPs, enhancing trustworthiness. However, the documents are not completely trustworthy.

Each project included in this research had conducted the risk reporting and the performance measurement to different standards. Some were better than others. A critical analysis was necessary. Another challenge regards the researcher's intentional or unintentional introduction of bias when interpreting the data.

3.3.3 Interviews

Interviews provide detail-rich sources of information (Creswell and Creswell, 2018, chap. 6). This study is explorative in design and can draw great benefits by employing interviews to gain insights into different perspectives. Overall, human actions and behaviors determine the successful applicability of a theoretical model in practice. Interviews provide insight into how theories underpinning PIRMS get converted into practice. While interviews offer great benefits, misconduct can compromise trustworthiness and dependability.

The advantages that had exceptional value to this research include gaining insight into how project owners and contractors understand and apply PIRMS, which challenges were impeding high utility, and what would pave the way for greater utilization. To some degree, the interviews allowed some insight into the informant's risk perception. That said, perception can reflect bias. Both the researcher and informants can introduce bias.

The researcher can introduce bias by, for instance, asking leading questions. Informants can introduce bias due to subjectivity, knowingly and unknowingly. A common weakness concerns memory. An inconsistent recollection of events that happened in the past can promote bias. Most of the projects included in this research are complete. Therefore, informants may have given information that may not be completely accurate.

Conducting interviews and transcribing is time-consuming. The workload can lead to fatigue over time. Despite all efforts, negligence may have occurred during transcribing. However, to verify the accuracy of the information, a summary of the transcript email was sent to informants.

3.3.4 Anonymizing

When agreement terms dictate anonymity, anonymizing participants or documents are ethical considerations (Creswell and Creswell, 2018, pp. 151–152). Due to sensitive information contained within the documents, agreements dictate confidentiality. The documents' sources are not disclosed. Instead, they are referred to as project 1, project 2, project 3, etc. The names, and the organizations of where informants work are coded. Participants are referred to as informants 1, 2, 3, etc. and their workplace is represented as the contractor's side of the project owner's side.

3.4 Data collection procedure

3.4.1 Literature search

Literature search has been a continuous process throughout the study as concepts matured. Various techniques exist to search for literature (Creswell and Creswell, 2018, pp. 70–78). The broadness of the risk management field necessitates searching for literature in a focused manner without compromising comprehensiveness.

The approach devised was to divide the literature search into two phases that include focused topic areas. Searching within a targeted knowledge area can provide an advantage of an effective literature search process and limits the search scope. Literature was retrieved using two main techniques; searching in databases and using the reference list of relevant literature retrieved from the databases. What follows is an account of how literature was searched and the basis of inclusion and exclusion.

Search engines used

Not all sources of information are appropriate for research (Creswell and Creswell, 2018, pp. 63–69). knowledge acquired from questionable sources will undermine the research. Most empirical research publications in scholarly journals are found in databases and are accessible through search engines. The choice of search engines was made on the basis that they must generate peer-reviewed publications and enable advanced searches. Each database was accessed through the university's subscription. Table 3-1 shows the search engines used, and the specific advantages as indicated in (NTNU Universitetsbiblioteket, 2020).

Table 3-1: Search engines

Search engin	Specific advantage
Oria	▪ Enables a nationwide access to identify and gather master's and doctoral thesis related to the study topic here ▪ Mis-spelling can still result in relevant hits
Scopus	▪ Indexing advantages ▪ Every publication retrevied is peer-reviewd ▪ A large selection of articles and conference papers
ISI Web of Science	▪ Enables cited reference modus ▪ Provides eaccess to more databases within different academic diciplines ▪ Retrives journals with a high impact factor

Search strategy

The literature search was divided into two phases. During the first phase, the scope as defined in 1.6 was used to limit the topic area to search. The topic search areas focused on: general literature on risk and risk management, the BVA and PIRMS model, and literature on factors affecting risk management as defined in the scope.

The second phase was conducted after identifying findings from the thematic analysis. Given the explorative nature of the research design, it necessitates identifying factors at play first. To identify the factors at play, findings from the five topic groups presented in Table 7-6 were analyzed. 17 factors were identified. Narrowing the scope of topic areas to search for was necessary. By grouping similar factors, three topic areas emerged: bad risk culture factors, change resistance factors, and opportunistic behavior factors. The literature search was conducted focusing on those topics. Literature from the three topic areas were used to discuss the analysis of thematic networks developed.

Searching techniques applied

The first step involved identifying keywords. Publications use keywords to index key topics in their study. Hence searching using specific keywords enables a convenient identification of relevant literature (Creswell and Creswell, 2018, pp. 70–72).

The literature search started by constructing search phrases using keywords. Identifying keywords from the research questions and the objectives was a natural choice. The keywords and synonyms were used in several databases to ensure an adequate inclusion of relevant publications. While this enables the identification of related and relevant literature, the disadvantage is that it also results in the retrieval of duplicates.

Boolean operators (AND, OR, NOT), truncating, and searching filters were used when searching (MIT Libraries, 2022; NTNU Universitetsbiblioteket, 2022). This enables the phrases to be broad enough to account for different aspects and narrow enough to generate manageable and topic-specific search hits. Boolean operators expand and limit the phrases searched. This was achieved by combining phrases using one or more Boolean operators.

Another search technique applied is truncating. It refers to word abbreviation and is used to search for words with different endings. Truncation broadens the search to include various word endings and spellings. This can include root words that have multiple endings. And it could also be words spelled differently but with the same meaning. In this study, examples are BVP and PIPS, Prestisjeinnkjøp and Best Value Procurement, etc. Below is an example of keywords and synonyms used.

Table 3-2: Keywords searched during the first main literature review phase

Keywords	Synonyms
BVP	PIPS
The Best Value Approach risk management model	PIRMS
BVA	Best Value Approach
BVP	Prestisjeinnkjøp

Cited referencing was also used. It links subject areas. For example, one can see which researchers are recurring in a particular field. And one can identify who has used a specific publication in the literature of concern. ISL Web of Science and Scopus are search engines that enable cited references as searching modus.

Cited references can be viewed as an automated way of snowballing. Granted, it has more application than snowballing. However, the basic principle is the same in that both techniques allow one to retrieve literature by following up on the sources other authors referenced. Snowballing was in this regard performed by manually going through the reference list in relevant publications to look for related studies.

Though snowballing can be an effective method, sampling bias can be an issue. Researchers tend to cherry-pick which can result in a skewed selection of publications. In this study, finding relevant literature on PIRMS was challenging due to the literature being few. This might have amplified the downside of snowballing as explained.

Critical evaluation of sources: inclusion criteria

Research should base the theoretical foundation on sound studies as a source of information. The search results were evaluated critically using the TONE principle to ensure that rigor was applied when assessing the quality of the literature found which translates to reliability, objectivity, accuracy, and relevance (NTNU Universitetsbiblioteket, 2020). The four criteria formed the basis for the inclusion and exclusion of searched literature. Table 2 lists the criteria used to evaluate sources. Inclusion criteria are factors to be met for literature to be used.

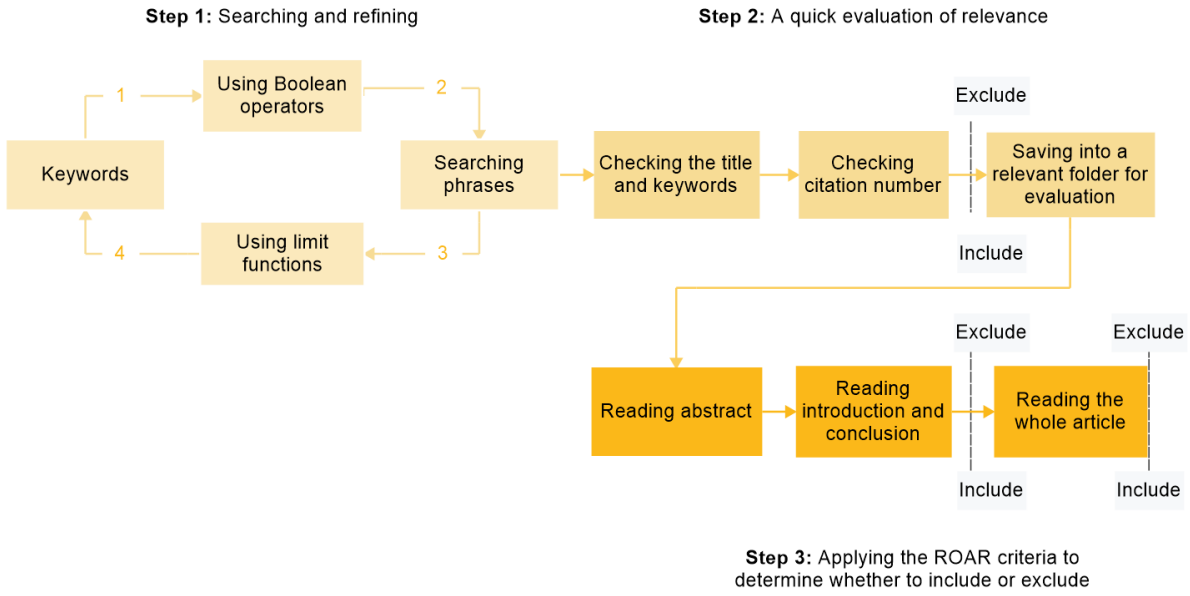
Table 3-3: Critical source evaluation criteria

Criteria	Inclusion requirements
Reliability	▪ Must be peer-reviewed ▪ High citation numbers are good indication ▪ Known author in the subject area ▪ References include scholarly sources
Objectivity	▪ None-biased perspectives or findings ▪ Absence of conflict of interests ▪ Factual rather than opinionated
Accuracy	▪ Refers to to other known publications ▪ Cited by other prominent scholars
Relevance	▪ Must be pertinent to the study topic

Identifying and selecting relevant literature

Using phrases with keywords did help to limit the search hits. However, there was a need to strategize steps to identify relevant literature. Three steps were taken to assess the relevance of the literature in question as follows:

Figure 3-1: Literature assessment steps



Step one involved constructing phrases and searching using Boolean operators and the limit functions to target search. In step two, a brief evaluation of the target search was conducted by looking at the title keywords and citation numbers. If the literature was found relevant, it was saved into a relevant folder created in the search engine used. Step three regarded the critical evaluation of literature saved in the folders. The literature was first examined for relevance by reading the abstract, introduction, and conclusion. If found highly relevant, the whole text was read and an overall evaluation of reliability, objectivity, accuracy, and relevance was taken. The literature would then be either included or excluded.

An example of the search results is given in table 3 and 4 from the first and second phases of the literature review. The examples show search hits after applying step 1 (termed search hits), those that were included further into step 3 and after applying step 2 (termed relevant). See Figure 3-2

Figure 3-2: Literature search example

Search phrases	**DATABASES**					
	ISI WEB OF SCIENCE		SCOPUS		Oria	
	Search hits	**Relevant**	Search hits	**Relevant**	Search hits	**Relevant**
Success factors to best implementthe Best-value approach	2	**1**	1	**0**		
BVP i Norge					25	**6**
Contractor performance evaluation of projects with a best value approach	10	**2**	17	**2**		
Asset specificity AND construction	49	**7**	65	**9**		
Early contractor involvementin a best value project	16	**1**	21	**9**		
Challenges and opportunities in adopting the best value approach	11	**1**	16	**1**		
Power dynamics AND construction risk management	0	**0**	91	**2**		
Best value approach AND risk management	42	**2**	21	**3**		
Principle-agent theory AND moral hazard	5	**0**	14	**1**		

Included literature

Much of the literature included to gain a background in understanding risk as a concept was retrieved from the Concept Research Program at NTNU, and books written or co-authored by David Hillson. Supporting articles were also used to broaden understanding. To understand

the BVA and PIRMS model, the two reference books were used. Publications from the PIBRG were also used. Most of the literature on the topics of resistance to change, opportunism, and risk attitude was retrieved using snowballing techniques.

3.4.2 Obtaining documents

Accessibility is a challenge linked to obtaining documents with sensitive information. Having a good cause for inquiry is beneficial when asking organizations to entrust a researcher with sensitive documents. In that regard, the willful cooperation of helpful contact persons has made it possible to obtain the documents needed. Three document types comprise tender documents for procurement, RAs, RMPs, and WRRs. Relevant contact persons from the project owners' and contractors' sides were contacted by phone and email to inquire about accessibility to the documents. Table 3-4 shows the documents obtained.

Table 3-4: List of documents obtained

Document type			
Tenders	**Risk Assessments**	**Risk Management Plans**	**Weekly risk reports**

3.4.3 Semi-structured interviews

As part of the overall data collection procedure for interviews, Creswell and Creswell (2018 chap. 7) highlights six steps to follow: identifying the site/individual, gaining access, and making a report, purposeful sampling, collecting data, recording information, resolving field issues, and sorting data. This study began by identifying potential participants to include. There was an already established contact with some participants courtesy of the pre-project preceding this thesis.

Study participants

Participants were selected based on a purposeful sampling procedure (Creswell and Creswell, 2018 chap. 7). The selected participants in this study consisted of project managers, project directors, and a project chief, see

Table 3-5. They were directly involved in the risk management process and handled the WRR register for the projects. All participants have a master's degree in civil engineering and vast work experience.

Informant	Position	Experience [y]	Representing	Project type
1	Project director	15-20	Contractor	Public
2	Project manager and developer	20-25	Project owner	Public
3	Project chief	15-20	Contractor	Public
4	Project manager	20-25	Project owner	Public
5	Project manager	15-20	contractor	Public
6	Project manager	15-20	Contractor	Public

Table 3-5: List of informants

Informant	Position	Experience [y]	Representing	Project type
1	Project director	15-20	Contractor	Public
2	Project manager and developer	20-25	Project owner	Public
3	Project chief	15-20	Contractor	Public
4	Project manager	20-25	Project owner	Public
5	Project manager	15-20	contractor	Public
6	Project manager	15-20	Contractor	Public

Determining number of participants

The study in this thesis does not strictly adhere to one of the five qualitative study designs but has most of the characteristics of a phenomenology study. Overall, this study is considered a generic qualitative study. Thus, the number of participants was determined based on two factors. (1) The recommended number of participants for a phenomenology design was considered. According to Creswell and Creswell (2018, p. 262), it is 3-10 participants. (2) It was believed that including participants from as many of the pilot projects would be beneficial. However, for practical reasons, time limitations, and availability of participants, the number was limited to six participants.

Development of interview guide

Interview guides were developed for informants representing the project owners' and the contractors' sides. The questions are similar content-wise, except for some differences regarding the formulation of questions. The interview guide had three parts comprising introductory questions, main questions, and closing questions. The main questions had multiple sub-questions.

Conducting the interviews

Open-ended semi-structured interviews were conducted per guidelines in (Creswell and Creswell (2018 chap. 7). All participants were first contacted by phone and asked if they would be willing to participate as informants. Following their immediate acceptance, a formal meeting arrangement was sent out by email along with the topic of discussion.

Four of the interviews were physical, and two were through a virtual video conference using Microsoft Teams. The latter was due to time limitations and the location of participants. Each interview was voice-recorded. Approval from the Norwegian Centre for Research Data (NSD) was obtained see appendix B, and the consent of each participant.

Table 3-6: list of interview durations

Interview	How	date	duration [h]
1	Physically	May/29/2022	0.42

2	Physically	May/30/2022	0.51
3	Physically	May/31/2022	0.46
4	Virtually	April/04/202	0.54
5	Virtually	April/07/202	0,41
6	Physically	April/11/2022	0,48

Advantages and disadvantages of open-ended interviews

The suitability of interviews to obtain relevant and adequate data was considered appropriate. Interviews provide a content-rich and detailed source of information (Creswell and Creswell, 2018, chap. 9).

Open-ended questions allow informants to give varied information from different angles (Creswell and Creswell, 2018, chap. 9). It makes it ideal for explorative research. Follow-up questions are a natural part of the conduct. It increases the likelihood of extracting valuable information that a closed-ended interview would not enable.

Given the time-consuming nature of conducting semi-structured interviews and the practical issues, the sample size is usually small (Creswell and Creswell, 2018, chap. 9). Representativeness is thus low, affecting the transferability of findings. Planning, conducting, and analyzing semi-structured interviews are time-consuming activities, creating time pressure. Moreover, the interview guide could have leading questions, introducing bias.

Creswell and Creswell (2018, pp. 259–261) emphasize that the inquirer's bias affects trustworthiness. Bias can be introduced in various forms and causes an obscured representation of reality. Patten and Newhart (2018, chap. 2) highlight that most researchers are susceptible to biases that lead to overestimating the value of some information and underestimating the value of another. It is known as confirmation bias. It has significant implications for trustworthiness and dependability. The conclusion chapter discuss the issue further.

3.5 Data analysis

This section presents a documentation of how data was analyzed.

Table 3-7: Overview of data analysis method

X represents the primary method while (x) represents the secondary method

Data collection method	Analysis method		
	Content analysis	Descriptive statistics	Thematic analysis
1. Literature review	X		

2.	Documents	X	(x)	
3.	Semi-structured interview			X

3.5.1 Interpretive literature review

The literature search strategy comprised two main literature review phases. However, the search process was a continual effort throughout the study, nonetheless.

During the first literature review phase, publications on general risk management and factors that affect decision-making from behavioral science and economic theories were analyzed. As stated in the purpose statement, the findings show a pattern explaining how current risk poor risk management occurs. Figures that illustrate these patterns are developed by combining theory findings and are used in the findings and discussion chapter. The second literature review phase began once the thematic analysis findings were complete. Literature on bad risk culture factors, change resistance factors, and opportunistic behavior factors were reviewed and used to discuss findings from the analysis.

3.5.2 Content analysis

The documents analyzed comprise tender documents, RAs, RMPs, and WRRs. The documents were analyzed to answer research questions 1 A. Relevant information was retrieved from the documents and analyzed using excel. Based on the proposal developed on how to implement PIMRS, a criteria list group was made in Excel. The findings from the documents were then compared to evaluate which criteria were met and which were not. Based on the results, a simple descriptive analysis was conducted to generate percentage frequency from the six projects examined.

3.5.3 Thematic analysis

Thematic analysis was used to analyze empirical data from the interviews. The thematic analysis procedure described in Attride-Stirling (2001); and Braun and Clarke (2006) were followed in this study. Thematic analysis is a process that helps identify and analyze patterns (themes) within a data set (Braun and Clarke, 2006). "A theme captures something important about the data concerning the research question, and represents some level of patterned response or meaning within the data set "(Braun and Clarke, 2006).

Thematic networks

Thematic networks explore the understanding of an issue or the significance of an idea (Attride-Stirling, 2001). Applying thematic networks organizes a thematic analysis. The purpose of thematic analysis is to "unearth the themes that are prominent in a text at different levels " (Attride-Stirling, 2001).

Constituents of a thematic network

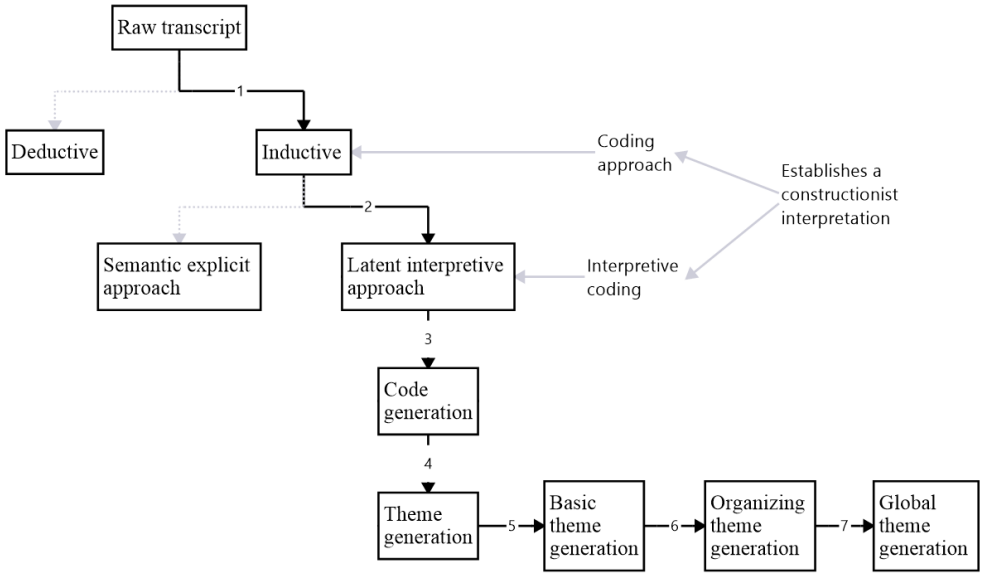
A Thematic network is a web-like network, containing themes at three different level that rationalize the procedures of going from codes to interpretation (Attride-Stirling, 2001). The thematic network is described by three types of themes called: Basic themes, Organizing themes, and Global themes. The basic themes are classified together based on their underlying issue, forming organizing themes. Similarly, organizing themes are categorized to form one global theme.

Coding framework

A theme denotes the importance of discussions emerging from coded excerpts (Braun and Clarke, 2006). It is not only the frequency of theme occurrence that constitutes significance. A theme can be of significance in a data set despite low frequency.

There are various ways of accounting for theme significance. In this study, theme significance was determined by occurrence frequency across interviews. And whether it captures something important to the overall research question, despite low frequency. When informants highlight important aspects, follow-up questions were asked. This was also an indication of significance during the analysis stage. The following paragraphs describe each step taken to develop the thematic networks. Beginning with coding the transcript, it ends with a thematic network. The codes and them lists are provided in Table 7-1, Table 7-2, Table 7-3, Table 7-4, and Table 7-5

Figure 3-3: Thematic analysis procedure



Inductive coding

An inductive approach is a data-driven theme-generating process (Braun and Clarke, 2006). The intent of this study is partially to explore and present the reality of factors that motivate poor risk management. My constructivist epistemology has likely influenced the decision to adopt an inductive approach. Inductive analysis is a process of coding the data without attempting to fit codes into an established coding frame. However, I recognize that my preconceived understandings will inevitably influence the coding process.

latent interpretive coding

A latent interpretive approach investigates beyond the surface-level meaning of themes (Braun and Clarke, 2006). It explores and identifies the underlying ideas, assumptions, and conceptualizations. The researcher's epistemology guides what can be said about the data and informs how the researcher theorizes meaning (Braun and Clarke, 2006). Given my constructionist epistemology, I seek to explore different aspects of the informants' perceptions and motives. Thus, a latent interpretive approach can enable exploration of the underlying issues causing poor in risk management.

Developing thematic networks

Thematic networks are used to organize a thematic analysis (Attride-Stirling, 2001). The process begins with coding and ends up with a thematic network describing one or more core issues. The steps involved in this study were as follows.

Based on the topics that emerged from the codes of excepts, the codes were grouped into five topic groups that are perception, motives for ways of implementation, influencing factors from conventional practice, implementation challenges, and unique factors observed. The codes in the topic groups from each informant were then combined to form themes. The themes in each topic group were then combined combined to generate basic themes. Then, the basic themes from each informant were combined in each topic group to form an Organizing theme. Lastly, the organizing themes were combined to form global themes.

The thematic networks comprising the basic, organizing, and global themes were developed Using the MindManager software. The procedure described above was applied to the contractors' and the project owners' perspectives separately.

3.6 Establishing trustworthiness, dependability, and setting transferability criteria

This section presents measures taken to enhance trustworthiness and dependability. Also, it sets transferability criteria for the research.

Trustworthiness

Trustworthiness regards whether the findings are accurate and how much truth is in the data collected, analyzed, and interpreted (Creswell and Creswell, 2018, pp. 274–276). Three trustworthiness strategies that are triangulation, clarification of bias, and negative case analysis are applied in this study.

Triangulation Is of critical value to establish a constructivist epistemology as reality is understood in different ways (Creswell and Creswell, 2018, pp. 274–276). Triangulation was

established by triangulating data sources and by using multiple projects. Data source triangulation was established by sourcing data from interviews, documents, and literature. Secondary data was used to verify primary data using findings from RAs, RMPs, and WRRs. The literature review was also a form of triangulation, providing substantiating theoretical evidence. Six pilot projects were examined which establishes triangulation by enabling a comparison of findings across the projects.

Clarification of bias undermines dependability and trustworthiness (Creswell and Creswell, 2018, pp. 274–276). My epistemology was disclosed since it influences data collection, interpretation, and analysis. For example, disclosing my epistemology has functioned as a reminder to avoid preconceived perceptions from introducing bias in the interview guide. To check for bias during the interview, informants were asked to give their feedback on whether leading questions were asked. Moreover, bias may have been introduced through a literature review. It could have shaped my perception, which can influence the data analysis during coding. The codes and themes may bare a reflection of this, compromising objectivity.

Negative case analysis was used throughout the data collection process and during data analysis. Negative case analysis intentionally seeks information that presents negative sides of the topic in question (Creswell and Creswell, 2018, pp. 274–276). For instance, questions on how PIRMS compares to other models were asked during the interviews. For example, one respondent gave accounts of why PIRMS might not be suitable. The information was valuable since it came from a winning contractor.

Dependability

In qualitative designs, dependability regards replicability. Replicability is often a challenging parameter to satisfy in qualitative research (Creswell and Creswell, 2018, pp. 274–276). (Creswell). Efforts were made to ensure that the data analysis method was consistent for each step taken. This can help others possibly attain the same results if the procedures here are replicated. Two methods were used to enhance dependability.

A coding framework was created (See Figure 3-3) to ensure that the same procedures were applied to analyze data from the contractors' and project owners' perspectives. It could enhance replicability. Member checking was used to verify the accuracy of the findings. The categorized themes were emailed to the informants. The informants have evaluated and confirmed the accuracy of the information.

Transferability

Transferability in qualitative research does not seek to establish a broad generalization of findings from a sample to a population (Creswell and Creswell, 2018, p. 41). Transferability concerns whether results from the study apply to new settings, people, or samples.

According to Lincoln and Guba (1985, chap. 5), the degree to which findings from a study are transferable to another context depends on the context similarities. Lincoln and Guba (1985, chap. 5); Creswell and Creswell (2018, chap. 9) emphasize that studies should strive for extending the study's relevance in other contexts. This study aims to assess the advantages

and disadvantages of PIRMS and explore factors that motivate poor risk management. This, however, necessities arguing why the study might have a transferable value in other contexts. The evaluation of transferability will be discussed in the conclusion chapter.

Transferability can be achieved through a thick description of findings and analysis (Lincoln and Guba, 1985, chap. 5; Creswell and Creswell, 2018, chap. 9). The reader judges whether the findings are convincingly transferable. This study will attempt to give a detailed description of finding and analys

4 Theory

This chapter presents theory. Two broad areas are covered as defined in the scope for literature: Understanding risk in construction and factors influencing risk management.

Understanding risk in construction

4.1 The concept of risk and why managing it matters

Distinguishing risk and uncertainty

A clear distinction between the terms risk and uncertainty remains elusive (Aven and Renn, 2009; De Groot and Thurik, 2018). Though related, and seemingly congruent, risk and uncertainty differ fundamentally. Consequently, decision-making under risk and uncertainty are inherently different.

The research community in Norway defines uncertainty as "the difference between the information needed to take a certain decision and the information available at the time of decision-making" (Austeng, Midtbø and Jordanger, 2005, p. 17). Uncertainty has two elements, risk and opportunity (Austeng, Midtbø and Jordanger, 2005, p. 20). While risk denotes a negative outcome, opportunity signifies positive outcomes.

Literature within the English research community, and in particular, the works of David Hillson, explains that risk has two characteristics: one related to uncertainty and the other related to consequence (Hillson and Murray-Webster, 2005, chap. 1). According to Hillson (2009), risk is "uncertainty that matters" because not all uncertainties matter or have an influence/impact on objectives. Overall, Hillson and Murray include negatives (threats) and positive (opportunity) attributes, too.

In recognition of the different definitions in existence and because I tend to use the term risk, this thesis uses Hillson's definition of risk moving forward. Risk has two elements: negative (threats) and positive (opportunities) attribute. The term risk management (RM) in this thesis is an umbrella term encompassing the management of threats and opportunities.

The concept of risk

Research indicates that different definitions of risk exist (Austeng, Midtbø and Jordanger, 2005; Weaver, 2008; Aven and Renn, 2009; Hillson, 2009, 2019; Zou, Chen and Chan, 2010; Spikin, 2013; Perrenoud et al., 2017). The underlying similarity shared by some definitions is that a risk is an uncertain event with ramifications for a given activity (Aven and Renn, 2009; Spikin, 2013; Perrenoud et al., 2017). Aven and Renn (2009) had defined risk as: " Risk refers to uncertainty about and severity of the consequences (or outcomes) of an activity to something that humans value". Aven and Renn argue that a clarification is necessary to avoid terminology confusion. Similarly, Hillson (2019, pp. 35–37) defines risk as: "uncertainty that matters". Hillson underlines that not all uncertainties are necessarily bad. According to

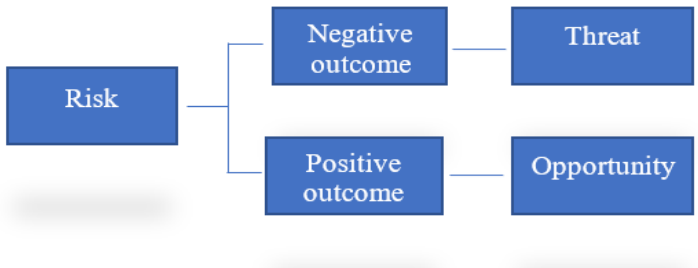
Weaver (2008), the Project Management Body of Knowledge (PMBOK Guide) defines risk as: "An uncertain event or condition, that if it occurs, has a positive or negative effect on a project's objective". In the latter definition, the severity of the risk is also included. This extension of risk definition seems to characterize the types of risks found within the construction sector.

Hillson (2009, pp. 12–16) highlights the growing inclination to regard risk as a phenomenon that includes adverse outcomes (threats) and positive attributes (opportunities). As argued in Hillson (2009, pp. 6–10), defining risk has a broader definition necessitating to include opportunity as part of the definition. Hillson (2009, pp. 6–10) argues three generic principles apply: "uncertainty is everywhere, not all uncertainty matters, and not all uncertainties that matter are bad". It has become an accepted fact (Zou, Chen, and Chan, 2010; Hillson, 2019, pp. 34–35).

Within the research community in Norway, there appears to be a prevailing notion explaining why it is vital to consider the threats and opportunities of a risk (Austeng et al., 2005, pp. 22–23). The notion stems from the understanding that knowing the future is an impossibility.

Based on the description above, the primary purpose of risk management seems to entail increasing the opportunities and decreasing the threats. Unifying the perspectives of (Weaver, 2008; Aven and Renn, 2009; Hillson, 2009; Spikin, 2013), the term risk in this study refers to the occurrence of an uncertainty (opportunity or thereat) that has a consequence on project objectives financially and otherwise.

Figure 4-1: Risk definition



Why risk management matters

Most literature on risk management indicates complexity and competition as reasons why risk management is essential (Hillson, 2009; Spikin, 2013; Bracci et al., 2021). It has necessitated the implementation of at least some level of risk consciousness and management practice. Technological advancement has also played an important role in why risk management matters. It is undeniable that the emergence of new technology has improved organizations' efficiency. However, technology has also opened doors to new risk types Tungnoil (2005).

Risk is in all project-based activities (Hillson, 2009, pp. 33–39). The very reason project management exists as a field is to manage various elements of risk to attain project objectives. Risk management is vital to minimize the threats and capitalize on the opportunities (Austeng et al., 2005, p. 26). To that end, literature on the topic makes it abundantly clear that the key is to manage risk proactively.

4.2 Risk categories

The Concept report publications Austeng et al. (2005, pp. 23–25); Austeng (Torp and Midt, 2005, pp. 85–100) categorized risk into two groups on a general level: Estimate risk and Event risk. (1) and (2). The subject of interest here is ways to potentially identify and prepare for event risks

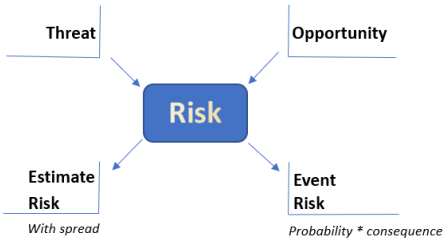
Estimate risk

Estimate risks are predictable risks, of which the risk is linked to estimations regarding cost, duration, and the effect of internal and external influences. Estimate risks are expressions for the accuracy of cost, time, and work scope estimates (Rolstadås, 2020). There are several ways to calculate estimate risk such as Stochastic methods, Logical Framework, Monte-Carlo simulation, etc. to mention a few (Austeng et al., 2005, chap. 2). However, describing the methods is outside the interest of this study.

Event risks

Event risks are mostly discrete and unpredictable (Austeng et al., 2005, pp. 23–25; Austeng, Torp, and Midt, 2005, pp. 85–100). The risk concerns the probability of occurrence and the subsequent consequence. Event risks mostly materialize during the execution phase (Rolstadås, 2020). All estimates and assessments are subject to estimated risk. The estimates can also include the expected effects of event risks. Event risk is expressed by the probability that the event occurs multiplied by the consequence. The figure below illustrates the classification of risk:

Figure 4-2: Risk categories (Austeng, Torp and Midt, 2005, figs 2–12)



Event risks often occur due to external circumstances outside the control of the project organization. Nonetheless, since stakeholders must incur the consequences, provisions must be in place for the chance that it might occur.

Dealing with event risks

It is essential to distinguish between small and large incidents (Austeng et al., 2005). This approach regards filtering and categorizing based on the risks' occurrence probability and the magnitude of impact.

Enhanced knowledge can reduce the impact of event risks. However, more knowledge could also lead to overestimating the risk. There is a detailed guideline on how this can be achieved

(Austeng, Torp, and Midt, 2005, pp. 89–90). But for this study, distinguishing between the different types of event risks that can occur is enough.

Some events can have a direct monetary consequence, while other types of events may have an indirect implication on cost. And it could also be a combination (Austeng, Torp, and Midt, 2005, pp. 90–92). Austeng, Torp and Midt (2005, p. 91) differentiate between three types of event risks:

- Events that happen once (quick clay landslides, block falls, etc.).
- Events that have a "statistical cycle" with a given return period (100-year hurricane, 10-year hurricane flood etc.).
- Events that occur suddenly and that may recur several times (lightning, fire, etc.)

4.3 Risk factors

Risk factors can be categorized into four groups. It is vital to understand what and where the cause of risk lies to influence the outcome.

Conceptual risk

Conceptual risk regards understanding the problem at hand (Austeng et al., 2005, pp. 60–62). It postulates that there are two kinds of risks linked to three aspects. (1) there is risk in the understanding of the problem (2) there is risk in the analysis model used to understand the problem and whether the parameters used are correct.

Operational risk

Operational risk regards the project's execution (Austeng *et al.*, 2005, p. 63). It is focused on risks that the project has control over (the possibility to influence the outcome). Operational risks are present in different phases of the projects. Overall, operational risks concern the internal risks of the executioner's ability to influence the risks. The solution is to have sufficient information.

Contextual risk

Contextual risk concerns the external conditions that affect the project (Austeng *et al.*, 2005, pp. 64–73). It is difficult, if not impossible, to predict these risks. In general, contextual risks are known as event risks. Contextual risks can occur suddenly and affect the project's entire duration. Many factors can constitute contextual risks, such as floods or market shifts.

Scenario risk

Scenario risk relates to risks connected to the relevance and reliability of the scenarios as a decision-making criterion (Austeng *et al.*, 2005, pp. 73–81). External factors can cause changes that affect the project's goals or success criteria. Or there could be factors that affect the decision criteria, leading to decision-maker change. Decision-maker change can also mean different decision-making approaches.

Risk management: perspectives from economic and behavioral theories

This section presents the transaction cost theory, the principal-agent problem, power dynamics theory, and behavioral science theories . It explains the relationship between the project owner and the contractor and how that relationship affects risk management.

4.4 Factors affecting decision-making

4.4.1 Transaction cost theory & decision-making

The purpose of this section is not to delve into transaction cost theory. But give an account of how it affects risk management from a decision-making perspective. The question this section address is whether a risk can and should be outsourced. The answer to the first one seems to be yes, but at a premium. The latter is difficult to answer and affects risk management practices.

Why is transaction cost theory (TCT) relevant in risk management?

One significant question necessitates reviewing risk management in light of TCT. "In a resource-constrained world, seeking the most economical advantageous choice is not only relevant but also common sense (Ketokivi and Mahoney, 2017). Ketokivi and Mahoney (2017) ask: "if there are alternative ways of conducting a transaction, why not choose the one that consumes fewer resources?". The same is true regarding risk management. Risks can be managed through a variety of methods, why not use them?

What is transaction cost theory?

On a general level, TCT regards how business transactions are structured in challenging decision environments (Ketokivi and Mahoney, 2017). Ketokivi and Mahoney (2017) highlight that the theory saw its foundation in the article "The nature of the firm" written by Ronald H. Coase in 1937. He asked two profound questions. If markets are so effective at allocating resources for production, then why are organizations necessary? Coase proposed that organizations and markets differ in their ability to manage the economic exchange. This proposal was later developed further by Oliver Williamson. The key remark regarding risk management is that by Coase's token, project owners and contractors differ in their ability to manage risks. Who should then oversee the risk management for the best outcome?

How behavioral economics theories affect decision-making

Williamson provided the working mechanisms for TCT using two behavioral economics theories i.e., bounded rationality and opportunism. Three factors were developed (Williamson, 1981).

Bounded rationality

Bounded rationality regards how an entity's decision-making is affected by the available information (Wheeler, 2020; Boyce, 2021). In most situations, entities lack enough information to make the optimal decision. Bounded rationality is the idea that the cognitive decision-making capacity of humans cannot be fully rational because of limits linked to lack of information, complexity, time, and brain processing capacity. Consequently, bounded rationality (our limitations) will force us to opt for making satisfying decisions.

In organizational contexts, decision-makers will thus operate in a state of satisfactory mode. Bounded rationality is firmly rooted in the relationship between the project owner and the contractor. None of them possess complete information to make the optimal decision regarding risk management.

Continuing, Williamson argued that had it not been for bounded rationality, economic actors could anticipate every future event and would write complete contracts covering any potential outcome (Williamson, 1981). The very fact that our world does not function this way thus necessitates risk management to improve the outcome of future events. The second theory Williamson used was opportunism.

Opportunism

According to Schnietz and Kachra (2013), opportunism is the deliberate act of exploiting favorable circumstances at the cost of others. Opportunistic actions are guided by the propensity to promote self-interest. Williamson proposed, that without opportunistic behavior, actors could simply agree to amicable solutions for future events.

Williamson, (1985, p. 52, as cited in Ketokivi and Mahoney, 2017) did highlight that bounded rationality and opportunism can make economic transactions adversarial. Based on the two behavioral theories, Williamson developed three observable characteristics of transactions. These factors would indicate whether it is more efficient to organize transactions through the market or an organization. The factors are asset specificity, uncertainty, and frequency.

How asset specificity, uncertainty, and frequency affect decision-making

Asset specificity

Asset specificity is " the degree to which a thing of value, or even a person of value, can be readily adapted for other purposes" (KENTON, 2021). An asset with low specificity is a more flexible resource. There are different forms of specificities in the literature. human specificity, physical specificity, site-specificity, dedicated assets, etc. (Vita, Tekaya and Wang, 2011).

Physical asset specificity is applicable in risk management decision-making. Following Vita, Tekaya, and Wang (2011), one could consider that asset specificity regards the relationship between two or more parties in which one is invested in the other, making everyone shareholders. Being a shareholder can be a vulnerable position. To this end, alliancing models can be mentioned here as a tool to manage risks in the interests of all involved (Klakegg,

2020). This is so because when both the project owner and the contractor are shareholders in the project, there will be little or no basis for opportunistic behavior.

Uncertainty (equivalent to risk in this thesis)

The second characteristic is uncertainty. It amplifies asset specificity issues (Williamson, 1981). In a setting with very low uncertainty, uncertainty in asset specificity may not be a problem. In a setting with high uncertainty, uncertainty in asset specificity becomes a problem.

In a risk management context, if uncertainty is low, the project owner has a reason to trust the contractor. When uncertainty is high, it is difficult to anticipate the events that might affect the project, leading to distrust. Construction is a risky activity. There is no evidence suggesting that future events can be predicted with full certainty. And studies show that the complex and uniqueness nature of construction activities may encourage contractors to become opportunistic (Lau and Rowlinson, 2009; Zhang and Qian, 2016).

Uncertainty also influences costs that affect risk management practice. There are three types of transaction costs in TCT (Burke, 1998). The cost of information, haggling, and policing and enforcement. In risk management, it can translate into the following. The cost of search and information can be considered equivalent to costs related to risk assessment during procurement. Haggling and decision-making relate to contract awarding criteria (price-based, negotiation-based, or value-based). And risk measures and monitoring can be seen in the light of the policing and enforcement aspect of TCE.

Frequency

The third characteristic regards frequency (Williamson, 1981). If a transaction occurs with high frequency, establishing a vertical integration can reduce the cost of a transaction per occurrence. Vertical integration is a strategy that cuts costs related to outsourcing (Hayes, 2021).

Risks occur frequently in construction, and one can wonder whether vertical integration could solve risk management issues (Kvaløy, 2007). The question is what is in the best interest of the project.

Opportunistic behavior is a reality in construction activities and affects risk management practices (Shi et al., 2018). From social science studies, one finds how power dynamics affect opportunistic behaviors (Kovach, 2020). There are six factors constituting power dynamics when addressing mediated power and their influence opportunism. In general, they are known as mediated power.

4.4.2 Power dynamics theory & decision-making

Power dynamics has six bases of power: Legitimate, Reward, Expert, Referent, Coercive, and Informational (Bertram H. and John R. P. Jr., 1959; Kovach, 2020; The Mind Tools, 2022). In organizational management, power dynamics theory applies as mediated power to order employees and increase effectivity. Mediated power in the construction sector, however,

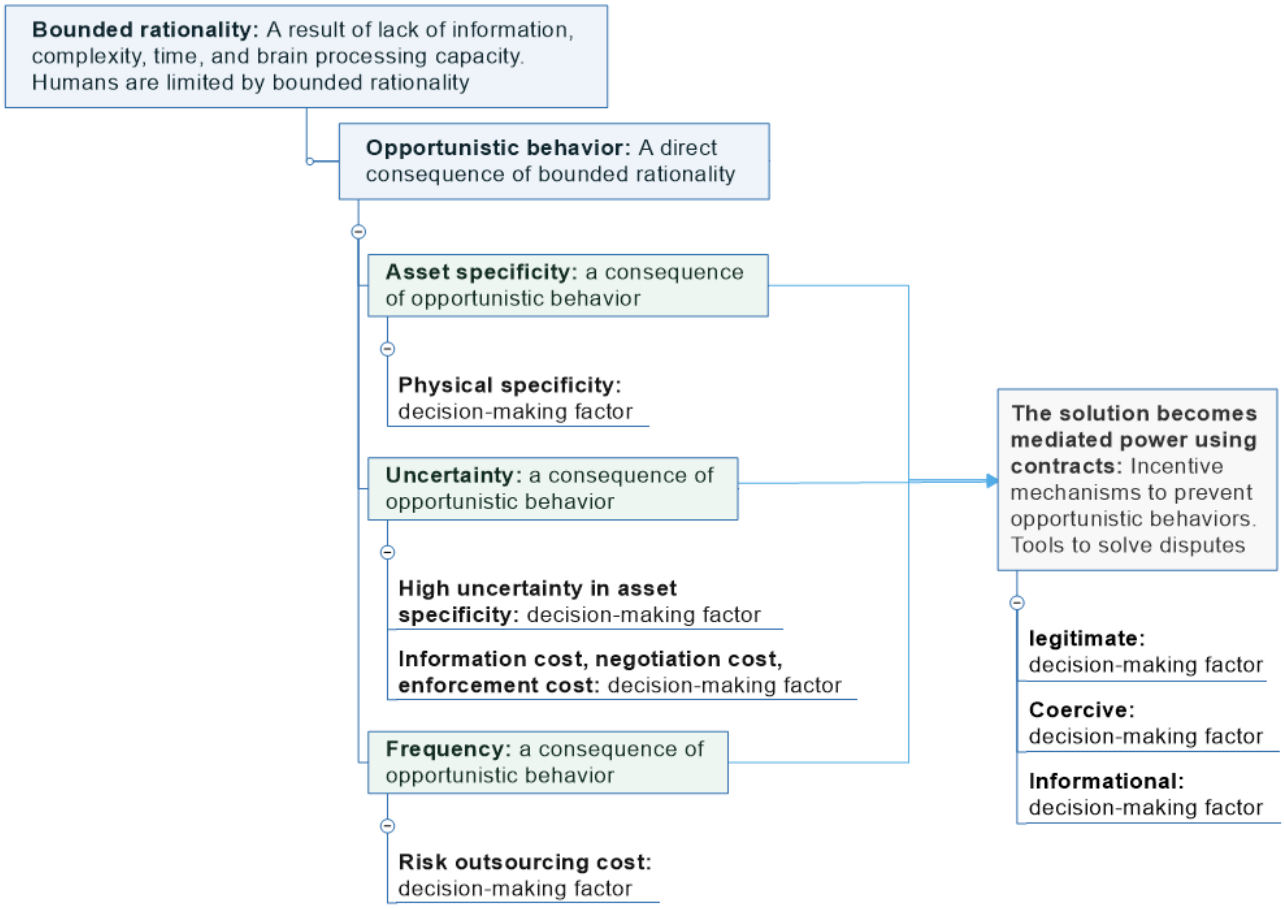
seems to have a negative effect, leading to reactive behavior. It creates unnecessary tension between project owners and contractors and promotes opportunism (Handley and Benton, 2012; Zhang and Qian, 2016).

Findings suggest that organizations may not use mediated power arbitrarily. Organizations rely more on mediated power when they have several qualified and easily accessible alternatives (Handley and Benton, 2012). Conversely, when organizations have limited and unattractive alternatives, they appear to rely more on non-mediated methods that are more cooperative and relational oriented.

An interpretation of how TCT and power dynamics theories affect decision making in risk management

Unifying the theories above, the following pattern is identified.

Figure 4-3: Effects of TCT and Power dynamics on decision-making



Situation

Characterization of current risk management practice and the common solution.

Bounded rationality

Literature indicates that decision-making cannot fully be rational due to information shortage, complexity, time, and brain processing capacity. The significant consequence of limitations

translates into decision-makers opting for satisfactory decision-making. In a management context, bounded rationality explains why complete contracts covering any potential outcome cannot be written. The most concerning aspect of bounded rationality is that it leads to opportunistic behavior.

Problem

Opportunistic behavior, Asset specificity, Uncertainty, and Frequency

Opportunistic behaviors arise mainly due to a lack of information. Opportunistic behavior necessitates contracts to prevent disputes. Literature indicates that opportunistic behaviors are described by asset specificity, uncertainty, and frequency. The following describes how decision-making is affected by the three factors.

From a risk management perspective, physical specificity regards the transaction relationship between two or more parties in which everyone is a shareholder. It prevents one from walking away from the transaction because being a shareholder is a vulnerable position.

From a decision-making standpoint, high uncertainty makes it difficult to anticipate the events that might affect the project. There is no evidence suggesting that future events can be predicted with full certainty.

Risks occur frequently during construction and one can wonder whether vertical integration could resolve decision-making issues. In a manufacturing context, deciding which supply chain or distribution platforms to use is a frequent decision-making issue. The same decision-making issue is encountered in construction regarding whether to outsource the risk responsibility and management or keep it. The question is, what is in the best interest of the project?

Conventional solution

Mediated power

Project owners tend to use contracts to force contractors to abide by agreements. From power dynamics, we learn that coercive thinking justifies punishing for noncompliance. And informational mediated power explains the need to withhold information others might use to gain an advantage.

Project owners rely on mediated power when several qualified and easily accessible alternatives exist. Conversely, when limited and unattractive alternatives are all there is, project owners rely more on non-mediated methods that are cooperative and relational oriented. Using power theory, a key question can be asked. Why does opportunistic behavior exist, and why do project owners persist in relying on mediated power? More can be learned by exploring the principal-agent problem.

4.4.3 The principal-agent problem & decision making

According to Harvard Law School (2022), the principal-agent theory regards a model that describes the relationship between two actors, the principal, and the agent. The principal (the project owner) is the one who owns the resource means necessary for a project to materialize, and the agent (contractor) manages the resources on behalf of the owner (provides expertise on how to build) (Austeng et al., 1998, p. 25). In an ideal situation, the agent should manage the resource in the principal's best interests. However, that is not always the case. The issue here arises due to the existence of asymmetric information leading to opportunistic behaviors.

Asymmetric information

Asymmetric information in the context given here is when the contractor has more information about the cost of various elements than the principal (Austeng et al., 1998, p. 25). The principal may not possess sufficient information about the true cost. The project owner is in a disadvantageous position. This is where the agent may exploit the situation by pricing costs at higher quotes.

Hidden information

There may not be transparency because doing so would incur the agent costs. The agent may intentionally hide information (Austeng et al., 1998, p. 26). The principal-agent theory proposes that a contract can be a solution. However, incorporating incentives to discourage the agent from being opportunistic is essential. However, Austeng et al. (1998, p. 26) highlight that it is not an easy task to create rational incentive mechanisms.

Another way to counter hidden information is for the principal to know about the costs involved on comparable levels to the contractor (Austeng et al., 1998, p. 26). Alliance contracts have been proposed to facilitate transparency and are a current discussion topic.

Austeng et al. (1998, pp. 27–28) identified which factors motivate the agent to enact opportunistic behaviors, see Table 8. The table below shows conditions that facilitate the exploitation of hidden information and conditions that prevent it.

Table 4-1: Factors affecting hidden information level (Austeng et al., 1998, p. 28)

	Hidden information	
Market conditions	**Little**	**A lot**
Expectations of more contract award	X	
Client-centric market power	X	
Competition in both markets	X	
One-time project with low competition		X
Long deliver time		X
Contractor-centric market power		X
Non-ordinary delivery requirements		X

Hidden actions

Hidden actions contribute to the principal-agent problem. According to Austeng et al., 1998 (pp. 30–31), the agent can hide actions taken to manage risks. In situations where the principal has a way of knowing the actions taken, there is less probability of that being an issue.

PIRMS deals with this by using RMPs, WRRs, and KPIs throughout the project. It enables the principal to monitor the risk mitigation, and management conducts. The principal is thus aware of misconduct and the agent can be held responsible for ill-motivated actions or poor conduct.

4.4.4 Behavioral science theories & decision-making

This section examines literature on behavioral science theories of resistance to change and risk culture. Resistance to change is studied using behavioral dimension. Risk culture is explored using risk attitude theory.

Resistance to change

Change resistance is a vast research domain and receives much attention, (Erwin and Garman, 2010; Rehman et al., 2021). Organizations that attempt to implement change, whether it is on an organizational level or on an individual struggle to effectively realize it. Literature indicates that behavioral dimensions are divided into three types based on the behavioral traits observed (Lines et al., 2017). Usually, the traits are active, passive, or neutral behaviors. Change resistance can be exercised in one or more of the three traits.

Resistance to change has been described using cognitive, affective, and behavioral dimensions (Lau and Woodman, 1995; Erwin and Garman, 2010; Altarawneh, Mackee and Gajendran, 2018). Cognitive dimensions regard what an individual thinks about changes whereas affective dimensions concern what an individual feels about change. Cognitive and affective dimensions affect risk perception and constitute the behavioral dimensions (Lines et al., 2017; Altarawneh, Mackee and Gajendran, 2018). As Lau and Woodman (1995) described it, individuals' assertion of change is very much shaped by the cognitive dimensions that ultimately form the risk attitude adopted toward change. It can have implications for an organizational change effort.

The behavioral dimension describes observable traits. Resistance to change is mostly described as a negative trait that hampers organization change efforts towards improvements. Much of the resistance has to do with what individuals expect to benefit or lose because of the change. Resistance to change has been shown to be a natural proclivity of individuals when the change initiated threatens their comfort zone or known routines (Rehman *et al.*, 2021). A sense of unfamiliarity seems to exacerbate the problem. For example, routine seeking and cognitive rigidity to change can hamper change efforts (Oreg, 2003; Oreg, Vakola and Armenakis, 2011).

However, it is not only the difference in change perceptions between an organization and employees that can hamper development. Change resistance can also be exacerbated due to

differences in change perception between employees (Caldwell, Herold and Fedor, 2004). It can have implications for how success the change can be.

Individuals can also engage to positively contribute to the change. A study shows that organizational support and the individual's perceived benefit are critical to maintain for a successful change implementation (Elias, 2009). Kim, Hornung and Rousseau (2011) have demonstrated that with time as a moderator, the expected benefits individuals usually seek in times of change, diminish as the relationship between the organization and them improves. Study shows that this can strengthen a sense of ownership to the change, leading to embracement rather than resentment (Gigliotti et al., 2019). And that employees are more likely to conduct assigned tasks to a better standard. However, the change agent must also be persuasive of the change to foster ownership enticement (Fransen, Smit and Verlegh, 2015).

Overall, studies show that understanding change resistance in times of change efforts is beneficial. It appears to be a critical factor. To that end, the initiation to pursue higher productivity in public procurement by DFØ, and the pilot groups attempting to make the change can be understood by studying factors that influence changes. While chance resistance is caused by a plethora of factors, for this thesis, examining risk attitude closer is chosen.

Risk attitudes

Risk attitudes affect decision-making (Hillson, 2009, chap. 4). It is helpful to define what is meant by attitude to understand factors that affect risk attitude.

What is meant by risk attitude?

According to Hillson and Murray-Webster, a risk attitude is a "chosen response to situations" (Hillson and Murray-Webster, (2005, pp. 20–22). Attitude is a person's or group's state of mind when assessing risks. Hillson and Murray-Webster stipulate that, personal characteristics usually govern risk attitudes since the chosen response to a situation are situational responses rather than natural preferences or traits.

Most individuals have a preferred risk attitude

Individuals or groups have a preferred or default risk attitude (Hillson and Murray-Webster, (2005, pp. 20–22). According to Hilson and Murray-Webster, risk attitudes are decisive decision-making factors because they determine the risk measure. Decision-making is affected by risk attitudes. The authors highlight that it might represent the individual's or the group's natural first response to risk. However, if the individual or the group has sufficient awareness and is emotionally literate, situational factors can change the preferred risk attitude. These situational factors are internal and external. Mostly, there is a greater focus on external factors. However, the internal factors have an equally profound effect on risk attitudes.

Risk attitudes can be influenced by situational factors

A group's or an individual's present situation considerably influences the perceived risk (Hillson and Murray-Webster, 2005, chaps 4–5) Perception, in this case, has to do with the assessment and understanding of a particular risk.

External situational factors

External situational factors can alter the preferred risk attitude. The driving factors include the perception of risk as wanted or unwanted. Six situational factors that influence perception exist.

"Level of relevant skills, knowledge or expertise" (Hillson and Murray-Webster, 2005, pp. 48–49). When prior knowledge or experience is insufficient, an individual or a group often perceives the situation as riskier, leading to a more risk-averse response. If an individual or a group possesses adequate expertise or skills, the risk perception tends to be risk-seeking. However, the perception fallacy can occur when the premises are wrong.

"Perception of probability or frequency of occurrence" (Hillson and Murray-Webster, 2005, pp. 48–49). The higher the perceived probability of the risk occurring, the risk attitude tends to be risk-averse. Conversely, a lower perceived probability of risk occurrence makes the risk attitude risk-seeking. Yet, this perception might contradict the abundance of data that shows actual frequency.

"Perception of impact magnitude, either severity of negative threats or size of positive opportunities" (Hillson and Murray-Webster, 2005, pp. 48–49). If the risk is perceived to have a negative outcome, the risk attitude becomes risk-averse. Meanwhile, risk perceived as an opportunity leads to a risk-seeking inclination.

"Degree of perceived control or choice in the situation" (Hillson and Murray-Webster, 2005, pp. 48–49). If a risk is perceived as unmanageable, the risk attitude becomes risk-averse. If the perceived manageability is high, individuals or a group take risk-seeking measures.

"Closeness of the risk in time" (Hillson and Murray-Webster, 2005, pp. 48–49). For risks perceived to occur soon, a risk-averse position is often assumed.

This can be the case despite objective assessments of probability, impact, and manageability suggesting otherwise.

"Potential for direct consequences" (Hillson and Murray-Webster, 2005, pp. 48–49). Risks that are perceived to have a direct effect on the group or an individual are prioritized over those that affect others.

Internal situational factors (heuristics)

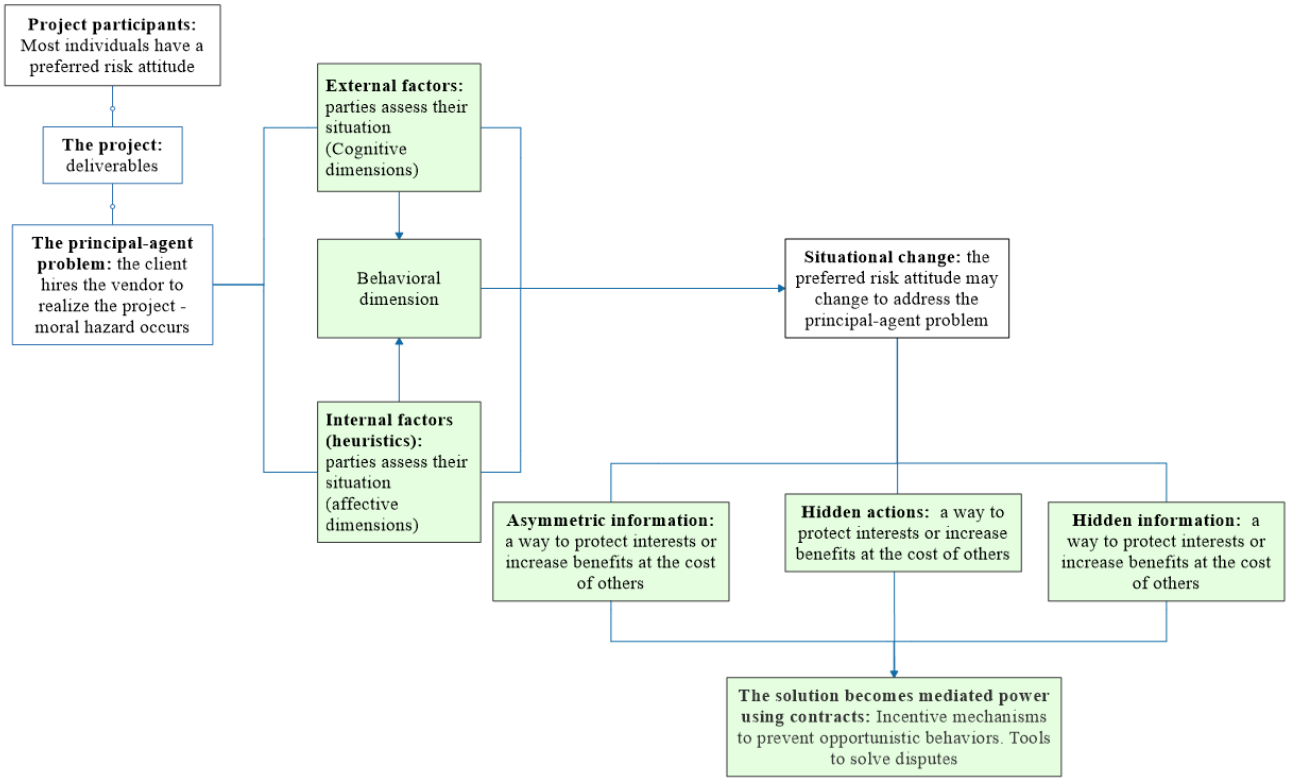
The internal situational factors are believed to be psychological and are known as heuristics. Heuristic behavior refers to "an approach to inferring a solution by reasoning from previous experience when no relevant algorithm or dataset exists" (Hillson and Murray-Webster, 2005, p. 50).

Heuristics are attempts to solve problems related to risk by using previous experiences as a basis. It is believed to occur subconsciously as an integral part of an individual's risk assessment. However, it can also lead to sources of bias. There are several studies supporting the understanding presented by Hillson and Murray-Webster. A few selections are presented below.

An interpretation of how the principal-agent problem and behavioral theories explain decision-making in risk management

Unifying the theories presented above, the following pattern is identified.

Figure 4-4: The principal-agent problem and behavioral science on decision-making



Situation

Project participants

Individuals are a constituent part of any organization. An inherent characteristic of individuals appears to be maintaining an accustomed preferred risk attitude. Mostly, it is based on preceding experience (heuristics).

Problem

The project, the principle-agent problem, and Asymmetric information

For risk management to become an issue, there must be a cause. The project is the cause. A project initiation aims to realize deliverables through a process in which risk is imminent. The project owner hires a contractor to build the concepts from drawings to a standing

building. This transaction in the form of service and compensation causes the principal-agent problem.

The principal entrusts the agent with the resources to manage and realize the deliverables. However, the agent may not act in the principal's best interest hence the problem. This adversarial relationship is not avoidable since realizing deliverables requires two inputs, investment from the project owner and expertise from the contractor. The relationship translates into the various external and internal situational factors that can lead the two parties to change their preferred risks. To best protect their interest, parties begin to examine external and internal factors resulting in a situational change.

Conventional Solutions

Contracts

Contracts that include incentives to discourage the agent from promoting self-interests at the cost of the principal seem to be the preferred solution (Lædre, 2012). The main incentive mechanisms proposed by different project delivery models seem to concentrate on risk-sharing and risk transfer.

Contracts affect decision-making since the project owner must decide whether to transfer the risk or keep it (Lædre, 2012). Literature indicates that the party best suited to influence the outcome and deal with the consequences of risks should be responsible. However, it does not seem to solve the issue much (Lædre, 2009). The PIRMS model proposes that the project owner should keep the risk responsibilities outside the contractor's control.

Risk management & the PIRMS solution

This section presents risk inducing factors through the perspective of the BVA model. The situation that leads to a problem are explained and the solution Kashiwagi proposes is given.

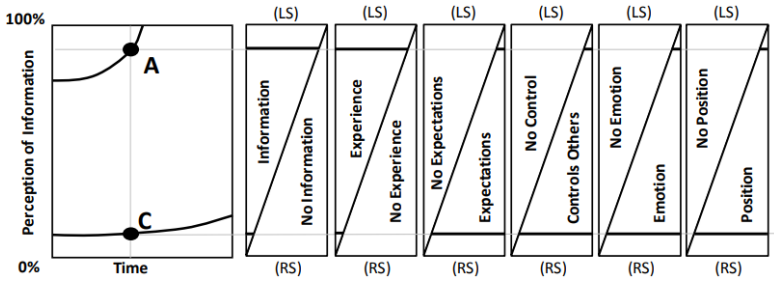
4.5 Risk inducing factors

lack of information leads to decision-making: KSM

Kashiwagi Solution Model (KSM) uses the principles of IMT to show how lack of information causes risks (Kashiwagi, 2016b, chap. 3). KSM describes the characteristics of individuals and entities about their possession or lack of information. The characterization is described using a rectangular box divided into two triangles, labeled left side (LS) and right side (RS). See Figure 4-5. LS characteristics are desirable, and the RS characteristics are not. RS characteristics lead to decision-making. KSM uses the radical extremes to show characteristic traits and does not deal with the slope line that concerns how much information. KSM identifies the prevalence of uniqueness factor and leads to observational conclusions in which the characteristics of individuals are labeled LS or RS.

- When using expectations: LS trait
- When using control: LS trait
- When using emotions: LS trait
- When using positions: LS trait

Figure 4-5: Kashiwagi Solution Model (Kashiwagi, 2016b, fig. 3.6)



KSM works by recognizing that lack of information creates risks. IMT defines decision-making as "when an individual does not know the outcome of an event and therefore believes that there are two or more possible outcomes." Since decision-makers lack sufficient information to predict the event outcome, they default to subjective judgment (heuristics) and make satisfactory decisions. The event is perceived as a risk when the outcome is different from the initial condition.

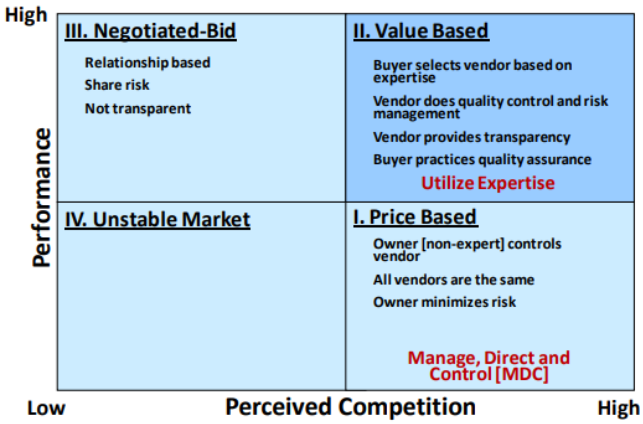
Kashiwagi conceptualized how risks are created based on information level and change rate. The figure below shows the relationships. All traits in decision-making, imposing rules and minimum requirements, and practicing MDC, are characteristics of decision-makers with little information (RS traits).

lack of information creates risks

Price-based procurement

Lack of information leads to the procurement of a non-expert contractor, affecting risk management (Kashiwagi, 2016a, chaps 6–2). Price-based procurement seems to be the main reason procurement of non-expert contractors happens (Kashiwagi, Parmar and Savicky, 2004; Yu and Wang, 2012). The problem with price-based procurement is that the project owner uses subjective assessment, focusing mainly on price (Kashiwagi, Parmar, and Savicky, 2004). What characterizes quadrant 1 in Figure 4-6 provides an answer to how to price-based-procurement results in poor risk management.

Figure 4-6: Industry structure(Kashiwagi, 2016a, chap. 8, p. 2)



The high intervention of project owners describes Quadrant 1 (Kashiwagi, 2002). Project owners practice MDC in this quadrant, creating a reactive response from the contractors. To win the bid and increase profit margins, the contractor will usually compromise on quality and cost of labor (Kashiwagi, Parmar, and Savicky, 2003; Andersen, Samset, and Welde, 2016). The risk of cost overrun, poor quality delivery, and unsatisfied end-users becomes imminent.

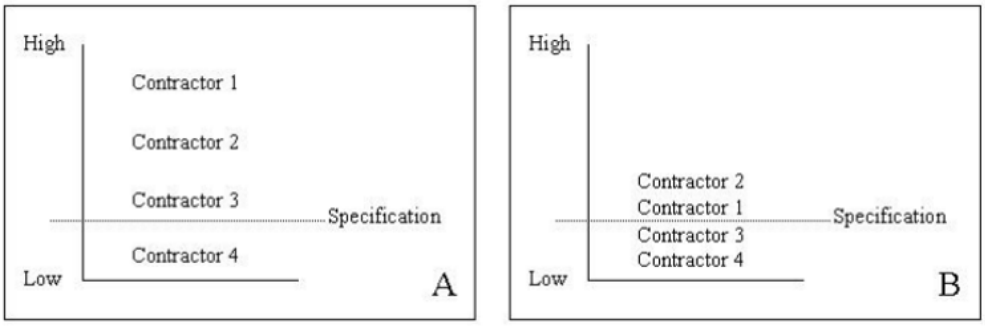
Lack of transparency is also a significant contributor to risks in the price-based environment (Kashiwagi et al., 2012; Andersen, Samset, and Welde, 2016). The contractor is likely to hide risks if being transparent means losing profit margins (hidden information and action).

Specifications and minimum requirements

Specification and minimum requirements become through detailed descriptions of project deliverables (Kashiwagi, 2016a, chaps 2-2, 2–4). When detailed description is used to specify deliverables in a price-based and negotiated-bid environment, all contractors that meet the minimum requirements become equal. Thus, the decisive differentiating factor becomes price.

Project owners use specifications and minimum requirements to reduce the risk of hiring a low-performing contractor. According to Kashiwagi, this is how risk is introduced into the project. The logic as follows.

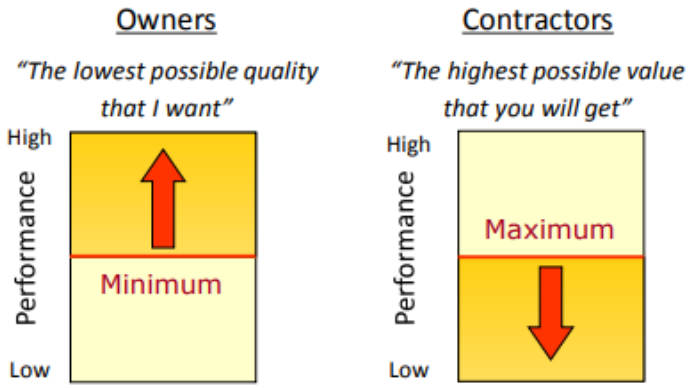
Figure 4-7: Minimum standards & performance (Kashiwagi, Parmar and Savicky, 2004)



As Figure 4-7 illustrates, four contractors. The project owner is forcing the high-performing contractor to lower quality for competitive reasons. The contractors do this by cutting costs in sub-contractors and materials.

Figure 4-8 illustrates the problem further. While project owners consider minimum standards as the solution to procure a high-performing contractor, the opposite effect is achieved (Kashiwagi, 2016a, chaps 2–2). High-performing contractors regard minimum standards as the maximum level of quality they can deliver since anything above the minimum standard will result in the contractor taking a profit loss.

Figure 4-8: Effects of Min/Max standards on performance (Kashiwagi, 2016a, chaps 2–2)



4.5.1 Factors that influence risk measure

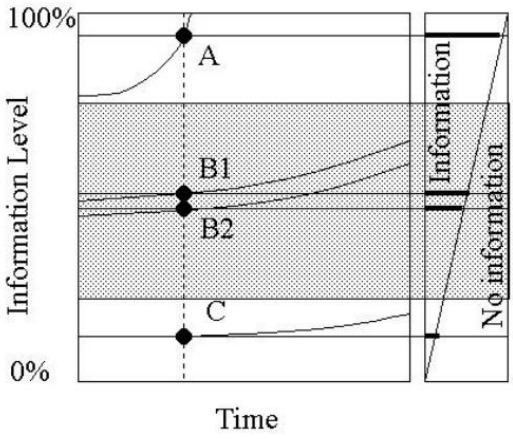
Rate of Change and KSM - how information affects risk response

IMT theory stipulates that change occurs when the amount of information perceived by an individual or entity increases over time (Kashiwagi, 2002). The faster information is perceived, the faster the rate of change.

IMT recognizes that every individual's uniqueness and ability to perceive information differs based on their unique constituents. Uniqueness refers to education, genetic makeup, communication skills, age, culture, etc. Uniqueness affects an individual's ability to perceive and process information and the opportunity to access information. This is further described using KSM.

The figure illustrates the rate of change. It shows the relationship between an individual's level of perceived information and the rate of change. The slope of the curved and horizontal lines represents the trajectory and rate of change. The figure shows four individuals with varying information levels. As time goes by, individual A perceives a high level of information and changes significantly, individual C with little information makes almost no change. Individual A can thus apply suited risk measures.

Figure 4-9: KSM: Relationship between rate of change and perceived information



MDC leads to reactive risk measures

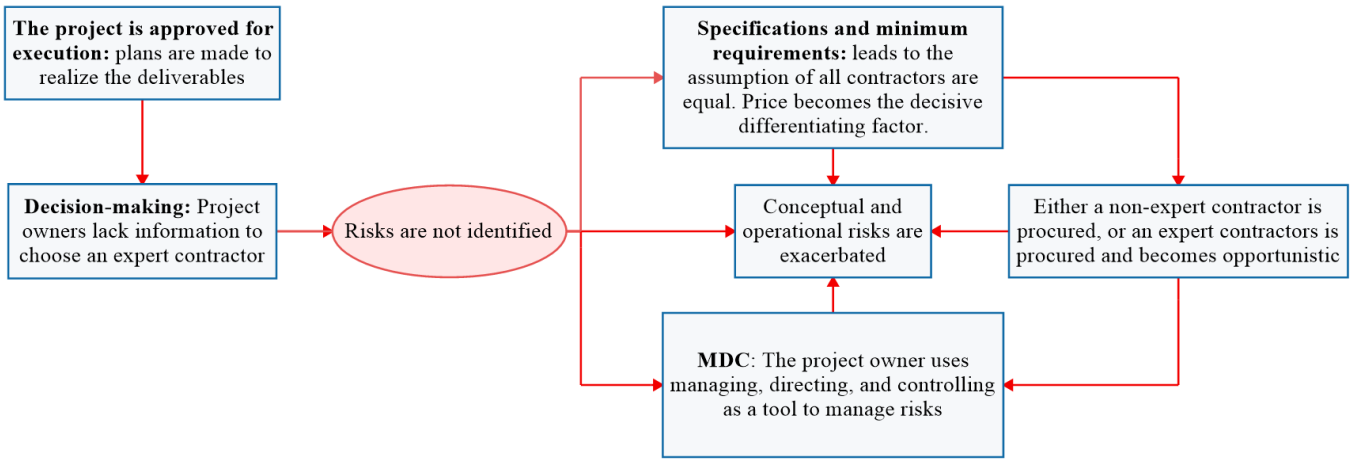
Meyer et al. (2011) has argued that performance-related issues are due to project delivery models failing as a system. The price-based project delivery models fail to limit the practice of MDC, exacerbating risk.

When the project owner manages, directs, and controls the contractor, risk measures become reactive (Kashiwagi, 2016a, chaps 4–2). Contractors are likely to become opportunistic and likely to hide information and actions. Hence, the project owner incurs increased costs and lower performance.

4.5.2 Risk inducing factors in current practice and the PIRMS solution

Unifying the theories presented above, the following pattern is identified. Risk inducing factors and solutions are presented from the KSM. The findings suggest that following relationships affect risk management.

Figure 4-10: Risk inducing factors, an interpretation of Kashiwagi's perspective



Situation

Decision-making

Lack of information causes decision-making. Decision-makers identify that the outcome of an event is multiple, necessitating subjective judgments (heuristics). The project owner does not know who the expert contractor is because the initial condition (enough information about the contractor is lacking) does not allow to predict the performance level of the contractor. Thus, the decisions project owners make rely on specifications and minimum requirements to procure contractors.

Problem

Specifications and minimum requirements lead to price-based procurement

Since the project owner cannot differentiate between contractors, the use of detailed project descriptions (specifications and minimum standards) is prevalent. Consequently, all contractors meeting the specifications and minimum requirements emerge as equal alternatives. Hence price becomes the decisive factor. It introduces risk in two ways. An expert contractor becomes opportunistic, or poor performing contractor compromises quality.

Opportunistic behavior occurs for various reasons. One scenario could be that to win a contract, contractors may offer a bid price that is not sufficiently profitable for the contractor. Consequently, corners are cut to increase profit margins during the construction phase. The expert contractor becomes reactive instead of proactively managing risks. An incompetent contractor causes risks because of in-capabilities. Risks are not mitigated, and usually, there is a reactive response. Cost overruns, delays, and quality issues are common.

Rate of change and risk measures

Every individual's uniqueness (education, genetic makeup, communication skills, age, culture, .etc.) and ability to perceive information differs based on their unique constituents. The rate of change increases in tandem with information increase gained over time. It is the application of new information that causes the change. And that change results in individuals perceiving more information (the cycle of learning). Expert contractors perceive information at a fast rate. It means that they can implement risk mitigation measures. None-expert contractors do not perceive information at the same rate; hence they are reactive.

Solution

Based on KMS, the solution Kashiwagi proposes is PIRMS. Revisit chapter 2 for details.

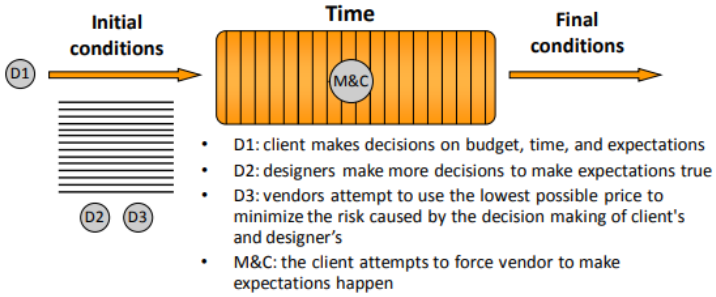
IMT applied to risk management

PIRMS is anchored in IMT. IMT is defined as: "A deductive logical explanation of the structure of an event (Kashiwagi, 2016a, chap. 2). According to Kashiwagi (2016a, chap. 2): "It is the use of the measurement of relative and related data, in terms of ‘information,’ that

defines the conditions of an event or an event object at a specific time and predicts the future outcome of the event". For an in-depth understanding of IMT theory, see (Kashiwagi, 2002, 2016b, chap. 2). The explanation given in this thesis is merely to give an account of what it is and how it forms the PIRMS foundations.

PIRMS is designed to minimize risk by transferring the right information (Kashiwagi, 2016a, chap. 6). Conditions describe the inner functions of PIRMS. Conditions refers to the initial, changing, and final conditions of an event. An event is defined as "anything that happens that takes time" (Kashiwagi, 2016a, p. G-2). The event in this sense is a particular risk. An event does not only describe a risk, it can also be any accomplishment or occurrence during the project planning and execution. There are numerous characteristics of events, however, two of the characteristics are significant to risk management.

Figure 4-11: Event model, traditional RMM (Kashiwagi, 2016a, chap. 6.2)



(1) Every event (risk) has a unique set of initial conditions and a unique set of final conditions (2) an event occurrence is not governed by randomness. Kashiwagi argues that one uses theories of randomness and probability to estimate the final outcome when there is a lack of information about the initial conditions and laws. He further claims that true randomness does not exist, but that it is rather inability to measure it that causes perceived randomness.

My understanding of the logic presented above is as follows. Essentially, sufficient information allows future event prediction, implying that a contractor has no risk given that enough information is available to measure initial and final condition of events i.e., identified risks. That seems to be the reason why Kashiwagi claims that the only risk a contractor has is the risk over which the contractor has no control (insufficient information to measure conditions).

Using the event model, Kashiwagi argues that risk is caused by decision-making when project owners attempt to attain deliverables through MDC (Kashiwagi, 2016a, chap. 6). The project owner often states expectations for deliverables using detailed description rather than functional description. Detailed descriptions manifest minimum requirements. Unless the project owner can accurately identify the initial conditions (contractor's capability to manage risks) and therefore predict the future outcome, decision-making creates risk (expecting a different outcome than what initial conditions will result in). If decision-making is the main source of risk, how can it be reduced or eliminated? The answer to this question rationalizes PIRMS.

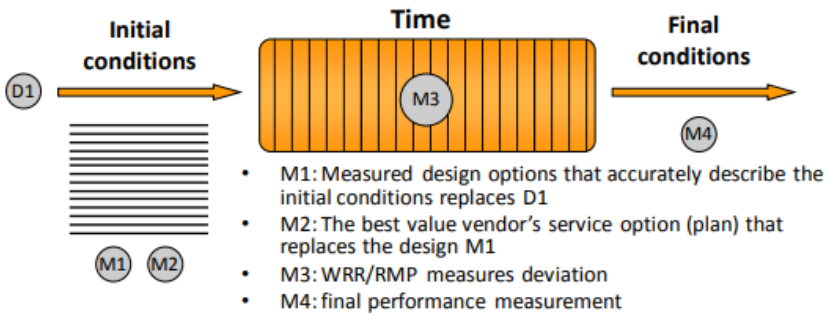
The six mechanisms underlying PIRMS

PIRMS works by eliminating or reducing the need for decision-making (Kashiwagi, 2016a, chaps 5–6). This is achieved through a series of mechanisms during the procurement and execution phases to ensure that (1) the right expert contractor is selected for abilities to mitigate risks (2) using incentive mechanisms throughout the duration of the project. The six mechanisms PIRMS relies on are the following, as interpreted by the author of this thesis.

1. Value-based procurement of contractors
2. Removal of sharing accountability and responsibilities for risks that cause decision-making
3. By giving the contractor incentives to identify risks they do not control and follow-up using the WRR
4. Expert contractors are forced to identify the events which they do not control, i.e., risk
5. Through Identification of who the best suited party is to be responsible for the risks
6. By using dominant information to create transparency for a clear understanding and communication of risks.

The following is a review of the mechanisms in relation to the event model below.

Figure 4-12: The event model in PIRMS (Kashiwagi, 2016a, chapter 6-5)



First mechanism: The BVA model identifies an expert contractor able to predict and handle risks through the BVP model. Using BVP, the project owner can identify the initial conditions meaning that the expectations for the events (expectation of contractor performance) will be realistic and their final condition is better known. Moreover, the contractor is the party setting the expectations for the initial conditions (risks), eliminating, or reducing the need for decision-making.

Second mechanism: Sharing responsibilities or accountability shall not take place. The rational is that if a group is responsible, no one is responsible on an individual basis. Seeing as the project owner is the party causing most of the risks by making decisions, it is unreasonable to share risks which leads to questions and more decision-making. One party should hold all responsibility or risk.

Third mechanism: Contractors are given incentives to identify risks they do not control and follow-up using a RMP and WRRs.

Fourth mechanism: The contractor is forced to identify the events which they do not control, i.e., risk. This is achieved throughout the procurement phase and during the execution phase. Initially in the BVP tender offer, the contractor must identify the risks it

does not have control over, but the contractor must nonetheless give an expert's estimation of what the risk could lead to. Since unpredicted risks can occur during construction, the RMP must be updated with the new risk. This enables the contractor to mitigate the risks by making them known underpinned by dominant information. The project owner can thus avoid making decision based on incomplete information.

Fifth mechanism: PIRMS allocates the work of risk management and risk mitigation to the best suited party. It is important to note that Kashiwagi distinguishes risk management liked to risk mitigation and risk management liked to quality control. Hence, the contractor manages the mitigation of risk using RMP, WRRs, and KPIs. The project owner manages quality control using WRRs and KPIs the contractor submits. And since the project owner is responsible for the risks that the contractor does not control, it enables the contractor to concentrate on mitigating the client's risks.

Sixth mechanism: Dominant information is used to create transparency for a clear understanding and communication of risks. This optimizes risk measures and is a determining factor in how the initial conditions (event risks) through time result in final conditions (risk or opportunity). The two main purposes are (1) to minimize the use of ambiguous and complex data and (2) to minimize decision-making. Dominant information increases accountability, too.

A summary of theory findings

The patterns identified indicate that current risk mismanagement inherently occurs because of three factors. One regards boundaries of what is possible to manage, and the second factor has roots in behavioral responses. A pattern that identifies reasons for opportunistic behavior was derived using transaction cost theory. Literature shows that current risk management practice deals with it using mediated power as described in power dynamics theory. So far, it does not seem to resolve the core issue.

Moreover, the principal-agent problem seems to be an intrinsic part of risk mismanagement. We learn that the problem is a congruent part of project initiation because realizing a project requires the principal and the agent. In current risk management practice, the classic adversarial relationship between the two seems to continue. Contracts containing incentive mechanisms such as risk-sharing and risk transfer have been the preferred choice to discourage opportunistic behaviors. Results do not seem to indicate a high success rate.

Furthermore, the literature review examined results achieved using the PIRMS model. The BVA model outlined observational assumptions claimed to cause risks. A pattern figure illustrating how they occur is developed. The following chapter presents findings from empirical data and explores whether PIRMS was a good solution in the pilot projects. The research questions explore the issues, and an evaluation follows that discusses to what extent PIRMS tackles fundamental issues of malpractice. Also, the chapter gives recommendations to improve PIRMS implementation and a proposal for a potential to increase the utility of PIRMS.

5 Findings and discussions

The findings are based on interviews, literature review, and document analysis. I have chosen to present findings and discussions together for improved readability and greater understanding.

The structure findings and discussions follow a consecutive presentation of findings followed by an analysis/discussion for each research question. The thematic networks developed constitute the main portion of the findings. Throughout this chapter, thematic networks are used to present interlinks between the informant's perspectives. The networks represent five topic groups. See Table 7-6. The thematic networks within each topic groups address the research questions in different ways. The purpose of this chapter is to present findings, analyze, and discuss the following research questions:

1. What are the critical factors needed to optimally apply the PIRMS?

   1 A. How should PIRMS be implemented, and what was practiced?
   1 B. Which situational factors influenced how PIRMS was practiced?
   1 C. Theory of PIRMS and practice discrepancies, why they occur?

2. Which advantages and disadvantages of current practice were observed?
3. What can be done to better apply the PIRMS model and increase its utility?

Research question 1

What are the critical factors needed to optimally apply the PIRMS model?

The critical factors will be explored in questions 1 A, 1 B, and 1 C. A list of critical factors will be provided. The objective of question 1 A is to evaluate how well implementation recommendations of PIRMS were practiced. The objective question 1 B is to describe why the pilot projects implemented PIRMS in a particular way. The objective of question 1 C is to explore what may have caused deviations between recommended PIRMS implementation and what was practiced.

Research question 1 A

5.1 How should PIRMS be implemented, and what was practiced?

5.1.1 Findings and analysis

A proposal for implementation based on the reference books

The PIRMS model is an integral part of the BVA model and must be seen in unison. Part of any solution is to identify the problems first. The findings from the reference books suggest that four steps (I - IV, listed below) must be taken to create ideal conditions for PIMRS to

work properly. It is vital that the implementation follows the recommendations. The recommendations as interpreted by the author of this thesis are the following:

I. Understand the industry structure
II. Make a transition into a value-based procurement using the BVP model
III. Apply PIRMS
IV. Maintain PIRMS

To answer how well PIRMS was implemented, the findings from interviews and document analysis are evaluated based on the five evaluation criteria shown in Table 5-1.

Figure 5-1 was developed to illustrate the proposal for implementation. The prerequisite is to understand the industry structure to establish what causes risk. Next, a transition into a value-based environment must be made. Tying step 1 and 2 is understanding the BVA model (4 in the figure). Step three involves using the PIRMS model. Tying Steps 1, 2, 3, and the intermediary steps, is maintaining the application of PIRMS (7 in the figure).

Figure 5-1: A holistic view of the BVA & PIRMS: a proposal for implementation

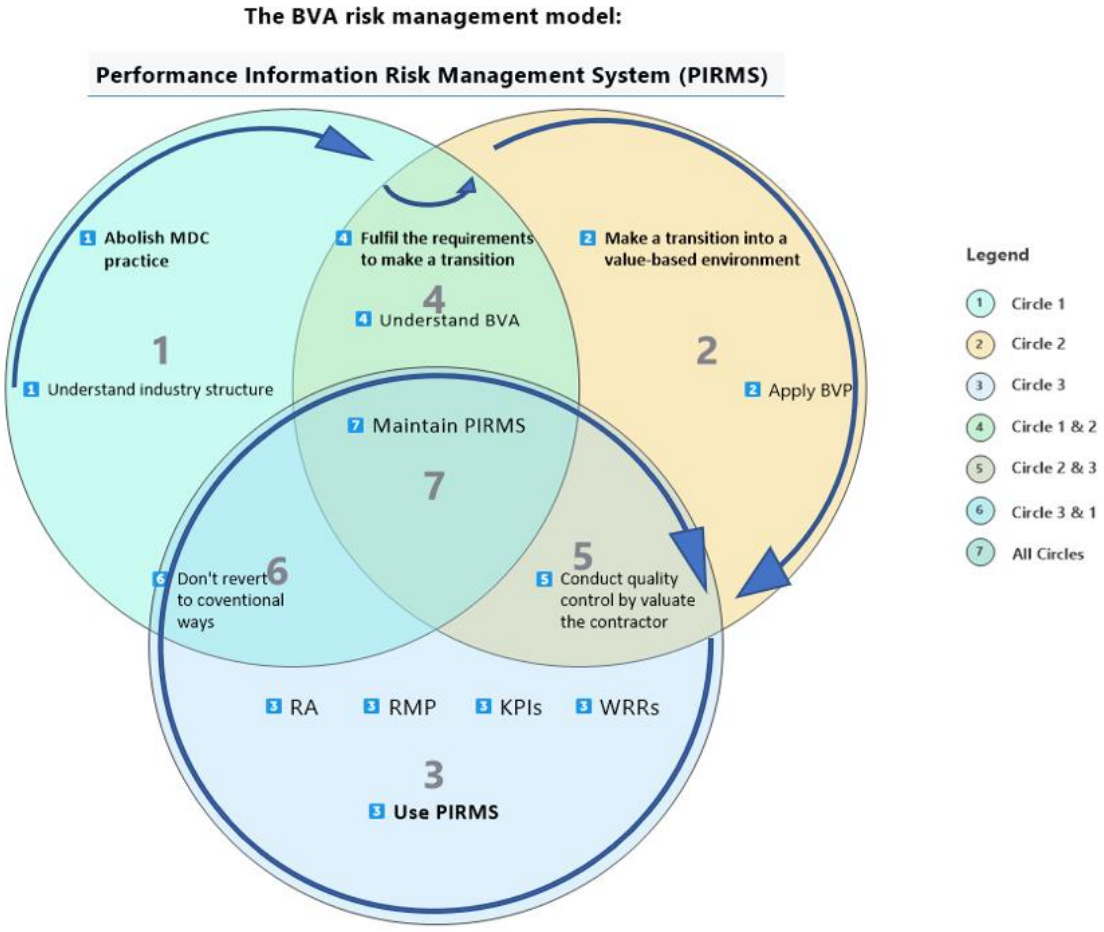


Table 5-1: Framework for what must be done to optimally utilize the PIRMS model

Procurement phase	Execution phase
Understanding the industry structure	
Courses on how to use the BVA model must be taken ▪ Price-based procurement causes risks ▪ Minimum standards and requirements force contractors to perform poorly (detailed project deliverable descriptions)	▪ MDC causes risks ▪ Focus on risk transfer or risk sharing does not solve risk management malpractice
Requirements to make a transition into a value-based environment	
The project owner and contractor must be willing to embrace change ▪ Training on how to use the PIRMS should be taken ▪ Both the project owner and the contractor must be willing to learn ▪ Sufficient resource allocation for training is vital	▪ Both parties must be willing and able to apply theory into practice
Making a transition into a value-based procurement using the BVP	
Identify an expert contractor using the BVP model to differentiate contractors based on capabilities	▪ Do not revert to convention ways
APPLAY PIRMS	
▪ A RA document must be developed ▪ A RMP must be developed ▪ KPIs must be developed	▪ Risks and measures must be resisted in the WRR and submitted to the client ▪ KPIs must be measured and reported to monitor quality and evaluate the contractor's performance ▪ WRRs must be reviewed
	Maintain PIRMS
	▪ Maintain using PIRMS as recommended

The following tables contain an evaluation of how well the four criteria were met. Findings comprise document analysis and interviews.

Findings from the interviews and content analysis of RAs, WRRs and RMPs

I. Understanding the industry structure

Table 5-2: Core team composition

Criteria	Informant 1	Informant 2	Informant 3	Informant 4	Informant 5	Informant 6
BVA course (per Best Value Certification)	B + certified	Only 2 hours of training	Bid personnel took the course	B- certified	A certified	B+ certified
# of participation in BVA projects	3	1	2	2	2	1
Degree of involvement	*Project 1*: Procurement phase *Project 2*: Procurement phase *Project 3*: Start - finish	Start - finish	*Project 1*: Start - finish *Project 2*: Start - finish	*Project 1*: Start - finish *Project 2*: Procurement phase	*Project 1*: Start - finish *Project 2*: Start - finish	Start - finish
Involvement type	As a project manager	s a project manag	As a project manager	As a project manager	As a project manager	As a project manager

Table 5-3: Training and education

Criteria	Project 1	Project 2	Project 3	Project 4	Project 5	Project 6	Average representation out of 6 projects	Average representation in %
Expert mentor from the Netherlands	From the Netherlands	From the Netherlands			From the Netherlands	From the Netherlands	4	67%
Expert mentor from Norway			From Norway	From Norway			2	33%
Expert mentor present during procurement	✓	✓	✓	✓	✓	✓	6	100%
Expert mentor present during execution	✓				✓		2	33%
Project owner was trained	✓	✓	✓	Offered but declined	✓	✓	5	83%
Contractor was trained	✓	✓	✓	✓	✓	✓	6	100%

II. Fulfil the requirements and make a transition into a value-based environment

Table 5-4: Procurement & PIRMS preparation

Criteria	Project 1	Project 2	Project 3	Project 4	Project 5	Project 6	Average representation out of 6 projects	Average representation in %
Procurement model	BVP	BVP	BVP	BVP	BVP	BVP	6	100%
Functional description	Functional	Functional			Functional	Functional	4	67%
Detailed description			Detailed	Detailed			2	33%
Risk allocation	NS 8407	NS 8407	NS 8407	NS 8407	NS 8407	NS 8407	6	100%
Competitive procedure with negotiation procurement	Competitive procedure with negotiation			Competitive procedure with negotiation	Competitive procedure with negotiation		3	50%
Competitive procurement		Competitive	Competitive			Competitive	3	50%
RA was developed	✓	✓	✓	✓	✓	✓	6	100%
RMP was developed	✓	✓	✓	✓	✓	✓	6	100%
KPIs were developed	✓	✓	✓	✓	✓	✓	6	100%

III. Applying PIRMS & maintaining PIRMS

Table 5-5: Applying PIRMS & maintaining PIRMS

Criteria	Project 1	Project 2	Project 3	Project 4	Project 5	Project 6	Average representation out of 6 projects	Average representation in %
RMP was used	✓	✓	✓	✓	✓	✓	6	100%
RMP was updated	✓	✓			✓		3	50%
RMP was not updated			X	X		X	3	50%
WRR was used	✓	✓	✓	✓	✓	✓	6	100%
Followed through with WRRs till the end	✓	✓			✓	✓	4	67%
Did not follow through with WRRs till the end			X	X			2	33%
WRR (weekly submittance)	Weekly	Weekly					2	33%
WRR (inconsistent submittance)			Inconsistent	Inconsistent	Monthly	Weekly	4	67%
WRR content quality (overall good)	Overall good				Overall good		2	33%
WRR content quality (inconsistent)		Inconsistent	Inconsistent	Inconsistent		Inconsistent	3	50%
KPIs were used	✓				✓		2	33%
KPIs were not used		X	X	X		X	4	67%
KPIs comprehensiveness related to the project goals	Overall good	Overall good	Overall good	Overall good	Overall good	Overall good	6	100%
Project owners' rating consistency of WRRs and KPI evaluations	Overall good	Overall good			Overall good	Overall good	4	67%
Project owners' rating consistency of WRRs and KPI evaluations			Inconsistent	Did not know what to do			2	33%

Analysis

Understanding of the industry structure

Most members of the core teams (the team trained to implement the model) on both the project owners' and contractors' sides were trained by certified BVA educators per the recommendations in (Kashiwagi, 2016a, chap. 12). Most of the project managers heading the core teams had participated in 2 BVP projects and their involvement in the project was at least one from procurement until project handover.

Most of the expert mentors used were from the Netherlands. It can be beneficial since the mentors from the Netherlands have the longest experience compared to mentors from Norway for the time being. However, the mentors were not involved in guiding the core team into the execution phase. Given that the projects were pilot projects, it could have been beneficial to maintain guidance until handover time.

Fulfilling the requirements and make a transition into a value-based environment

This criterion concerns adhering to the BVP model recommendations. The documents show that though most of the recommendations were followed, inconsistencies and deviations were part of the implementations. For example, one of the unique factors of BVP is the opportunity it creates for ECI. However, some projects had detailed project deliverable specifications, reducing the benefit of ECI. Studies shows that the benefit of using a value-based procurement model is to capitalize on the contractor's creative and expertise. Detailed deliverable specifications limit contractors' creativity and their ability to improve constructability (Farrell and Sunindijo, 2020; Wondimu, Klakegg and Lædre, 2020). The risk of specifying deliverables in detail could result in cost inefficiency and poor resource optimization (Sødal et al., 2014).

The contract award criteria used in 50 % of the projects examined here was based on negotiation. One of the fundamental recommendations of the BVA is to not negotiate price. According to Kashiwagi (2016a, chap. 5), in a competitive market, contractors are likely to offer a fair bid, and mostly with small profit margins. Negotiation forces the contractor to compromise on quality that to maintain profitability. Kashiwagi explains that it is the reactive response of contractors. Consequently, the deliverables could be exposed to different risks, a common one being cost escalation and poor material choice (Bos, Kashiwagi and Kashiwagi, 2020). A detail explanation of how the problem occurs is provided in sub-chapter 4.5.

The projects were hybrids of BVP and D-B. Project owners transferred the risks based on NS 8407 to protect themselves from incurring risk costs. However, recommendations suggest not to use risk transferring mechanisms as a tool to avoid potential costs. The rational is that it can encourage the contractor to become opportunistic (Kashiwagi, 2016a, chap. 1).

Applying PIRMS & maintaining PIRMS

According to Bos, Kashiwagi and Kashiwagi (2020), efforts needed to sustain a best value environment is to properly apply the model and to maintain applying it. The greatest difference between implementation recommendations and practice appears to be failing to apply the PIRMS model and maintaining it. PIRMS works well when the RA, RMP, WRRs, and KPIs are appropriately applied. All projects did develop a RA, a RMP, KPIs, and a WRR scheme. However, the problem, appears to be not using them as recommended. For example, the documents show that the RMP was not updated as intended, defying the purpose of having it. A previous study had also documented the same conduct (Nygård, Wondimu and Lædre, 2019)

WRRs were submitted inconsistently, and the content quality greatly varied within the same project and between projects. Despite the quality of KPIs being appropriate, they were not applied in most projects. It is noteworthy to highlight that both the project owners and the contractors contributed to the deviation. The contractors expected the project owners to conduct quality control, but some project owners did not fulfil their duties. The contractors' execution and follow up of WRRs were also inconsistent.

5.1.2 Identified similarities and discrepancies

Overall, there are grounds to conclude that practitioners understood the recommendations and the model to varying levels. However, there is no conclusive evidence this study can show to determine whether the understanding level was high or low. The RMP and WRRs show that implementation recommendations were mostly followed. Studies that assessed the implementation of BVP also reported implementation consistencies (Storteboom *et al.*, 2017; Narmo, Wondimu and Lædre, 2018)s. In this study, however, findings also indicate that inconsistencies and deviations did occur. The performance monitoring tools in PIRMS were not used consistently. It compromises the project owner's ability to monitor performance and prompts a relapse to MDC. General, there are differences between recommendations and practice. Mostly, the differences concern the application of PIRMS. The reason for that seems to be a poor procurement execution that did not facilitate the best premise for the optimal effect of PIRMS.

Research question 1 B

5.2 Which situational factors influenced how PIRMS was practiced?

Using literature presented in 4.4.4, factors that can affect risk management practices are identified. The objective is to describe why PIRMS was implemented in a particular way among the pilot projects. This question can help identify which factors were decisive in how implementation recommendations were practiced.

5.2.1 Findings and analysis

The main findings from the theory suggest that risk management is influenced by factors related to decision-making explained by behavioral and economic theories. The theory section 4.4.4 indicates that situational factors can change risk attitudes. This question will identify the situational factors in the. The theories examined in chapter 0 indicate that there is a situation that causes a problem, and the problem propagates a reaction. How these issues are traditionally dealt with is presented in 4.4. Here, the findings from the interviews are examined to explore whether they bare the same characteristics as those provided in the theory chapter.

Findings from the interviews are based on two of the five topic groups of thematic networks: perceptions and motives for ways of implementation. The findings are described, beginning with the contractors' viewpoints and an analysis, followed by the project owners' perspectives and analysis. Finally, the situational factors that could have influenced how PIRMS was practiced will be concretized.

Thematic Networks 1: Perceptions

The contractors' perspective

Two thematic networks were developed. While the first network includes two organizing themes and five basic themes, the second network has one organizing theme and one basic

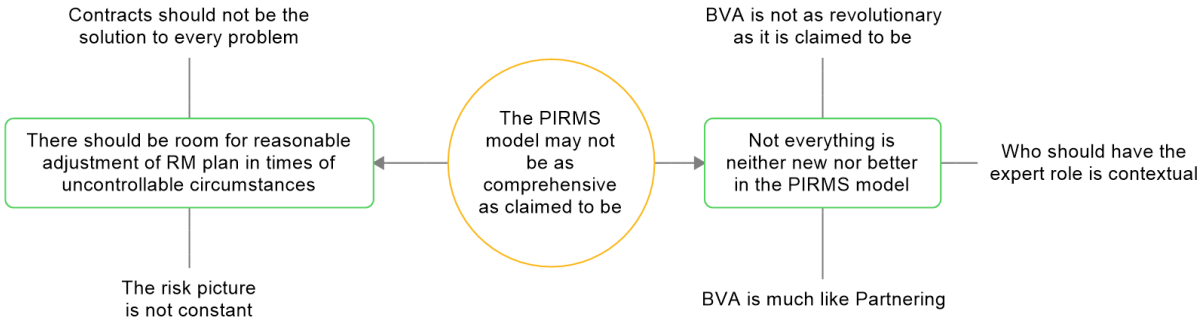
theme. See Figure 5-2 and Figure 5-3 for the thematic network and Table 7-1 for list of themes.

Thematic network 1

Findings

This network explores the contractors' perception of PIRMS relating to lack of comprehensiveness. The informants highlighted two issues. Figure 5-2 shows the key themes on which the global theme is anchored. Issues about lack of comprehensiveness in a general context regarding PIRMS, and conventional RM practice were raised. The perception seemed to be focused on highlighting that there is no significant difference between PIRMS and common practice. The perception, in this case, suggests that contractors were more concerned with solving existing issues than considering a new approach to solve the problem. Based on their perception, PIRMS seems to be perceived as just another model to add to their list.

Figure 5-2: Thematic network 1, the contractors' perceptions



Analysis

Organizing theme: lack of room for reasonable adjustment of RM plan in times of uncontrollable circumstances This organizing theme seems to concern a perception motivated by the need to voice a general issue rather than an issue directed specifically at PIRMS. Two issues were identified as the plausible cause of the perception. There seems to be an understanding among contractors that the model lacks provisions for uncontrollable circumstances, event risks, that gives the contractor adjustment room. Informants highlighted that much of the focus has been on identifying an expert contractor "that can see into the future" and predict the outcome of event risks. Informants stressed that the risk picture can change with no warnings and that predicting the unpredictable is impossible. For example, the Corona pandemic was raised as an example. The conclusion appeared to underline that it is difficult to abide by the contractual agreement in such situations.

Informant 1: *The contracts should not dictate everything*
Informant 3: *The risk picture has changed*

Organizing theme: Not everything is either new or better in the PIRMS model This organizing theme pertains to the understanding that there is no significant difference between PIRMS and common practice. The informants' perception seemed to rather be concerned with, highlighting why common issues affecting contractors from a risk management perspective

persist. For example, a lack of significant uniqueness was described by comparing PIRMS to common practices found in Partnering models and in-house RM practices. Informants also questioned the much-used phrase "expert vendor". Most stressed that the expert role is contextual. It means that there are areas where the contractor has expertise, but there are also areas in which the project owner can have better expertise.

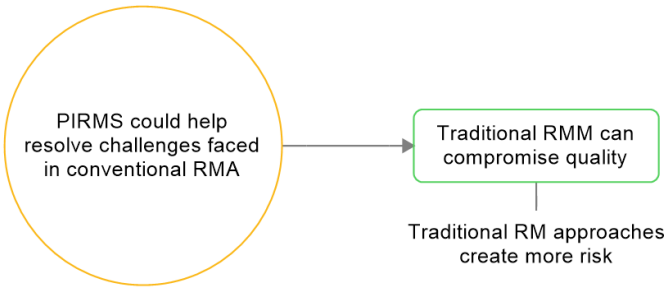
Informant 6: *Comparable to partnering where proactive risk management is centra*
Informant 1: *BVA gives the expert role to the contractor, but the contractor is not an expert in everything*
Informant 6: *Some similarities between WRR and our own RM practice*
Informant 3: *BVA and Partnering are different in how procurement is conducted*
Informant 3: *BVA RMM is just another way of structuring and reporting risks*

Thematic network 2

Findings

Unlike the first network in which perceptions relating to doubts were highlighted, this network explores perceptions from a benefit perspective. The informants seemed to also perceive PIRMS as a solution provider, not just as a model that only creates issues. Contractors seemed to perceive that the model could help resolve challenges hampering conventional risk management approaches.

Figure 5-3 Thematic network 2, contractors' perception



Analysis

Organizing theme: Traditional RMM can compromise quality This organizing theme pertains to one of the most essential aspects of RM i.e., quality assurance. Informants highlighted that conventional RM practice can compromise deliverable qualities. It was identified as one of the fundamental issues that cause more risks during construction and the service life of the building. Project owners were blamed for most of the compromises that can occur regarding quality. Informants seem to blame project owners for regulating by minimum requirements, continual interference to dictate material choice, and not involving the contractor early enough to optimize constructability. These can translate into expenses for the project owner due to increasing maintenance costs and can shorten the service life of the building.

Informant 1: *Buildability is compromised sometimes, leading to redesign*
Informant 3: *didn't use the opportunity to take advantage of early contractor involvement*
Informant 3: *don't come with a finished design to the contractor*

The Project owners' perspective

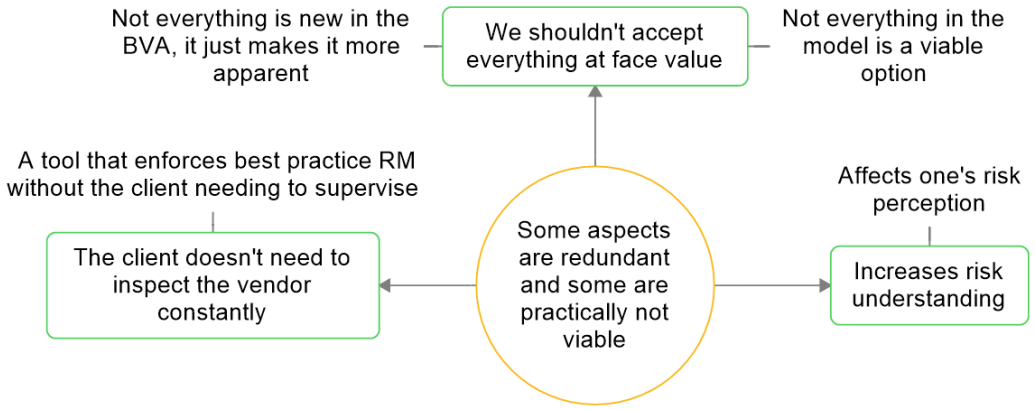
One thematic network was developed. The network includes three organizing themes and five basic themes, while the second global theme includes two organizing themes and five basic themes. See Figure 5-4 for the thematic network and Table 7-1 for list of themes.

Thematic network

Findings

This network explores project owners' perception of how PIRMS can be redundant and how it to some degree proposes unviable options. Three conflicting ideas seem to emerge tied to the perception. Redundancy is perceived to be beneficial since it is a reassuring mechanism. Redundancy is also perceived to be resource-intensive and impractical. Additionally, despite the intent of redundancy built into the model for quality assurance purposes, the project owners perceive the proposal as a nonviable option. Figure 5-4 illustrates the positive and negative attributes of redundancy as described by the project owners' perceptions.

Figure 5-4: Thematic network, project owners' perceptions



Analysis

Organizing theme: We shouldn't accept everything at face value This organizing theme regards the negative perception of the redundancy mechanism in the model. Two significant issues were highlighted: not everything in the model is necessary, and not everything is a discovery. The informants seemed to distinguish between the unique benefits of the model and what is similar to common practice. In that regard, the WRRs was seen as redundant because not much would change in a week. At the same time, WRRs were perceived to make the risks more apparent. Overall, redundancy regarding the frequency of WRRs is perceived to increase workload compared to benefits gained.

Informant 4: *BVA stipulates no need to use contracts to force the other party. It didn't work in practice*
Informant 2: *Not important to update the RMP because it is the same risks that re-occur*

Moreover, the informants clarified that despite risks being more apparent with the WRR, some level of MDC is needed. Their perception has to do with why they regard the need to practice MDC. As an example, they highlighted the proposal of BVA that stipulates "no need to use contracts as an enforcing tool. They worry that the contractor left on its own might lead to cost increases and poor quality of deliverables. Overstating delays as one of the most critical impediments to risk management was also perceived to be improbable. One informant underlined that "delays are only an economical burden". It may suggest that a delay may not be a critical risk mismanagement parameter for the project owner.

Informant 2: *The WRR can be too frequent. It is perhaps better to reduce the reporting frequency.*
Informant 4*:* *Delays are only economic burden*

Organizing theme: The project owner doesn't need to inspect the contractor constantly This organizing theme describes the positive perception of why redundancy is beneficial. Project owners seemed to appreciate the redundancy since they perceive risk reporting as a suitable tool to enforce best-practice risk management. The perceived benefit appeared to regard how the model eases workload. Informants emphasized that the project owners do not need to practice MDC to a high degree because the model allows greater transparency.

Informant 2: *Makes it easier to follow up on risks and to make sure that the measures are implemented*
Informant 4: *The model increases transparency*
Informant 4: *Eases our workload compared to other models*

Organizing theme: Increases risk understanding This organizing theme also indicates another positive perception. It regards a higher-order perceived benefit. The perception seemed to suggest that there might have been a lack of sufficient risk understanding in the past. The perception emerges as a crucial perceived benefit. Informants described that improved risk understanding does affect the risk perception. According to remarks, the change in risk perception is due to increased transparency through the WRR. In that sense, redundancy is likely what translates into improved risk understanding and risk perception change.

Informant 2: *The contractor is forced to increase its risk awareness*
Informant 4: *BVA did affect our risk culture and perception greatly*
Informant 2: *We are forced to dig further*

Thematic Network 2: Motives for ways of implementation

The contractors' perspective

Two inter-linked thematic networks were developed. Both include one organizing theme and three basic themes. See Figure 5-5 for an illustration of the thematic network. The networks are inter-linked because the motives for implementation emerged as common incentives that drive both global networks.

Thematic network in unison

Findings

The network explores two related motives of why contractors chose to implement PIRMS on their terms. The interview analysis suggests two related motives that describe why the contractors were hesitant to implement PIRMS as proposed in the reference books. Figure 5-5 shows the relationship of key theme factors on which advancing self-interest and fearing accountability are anchored. The contractors were perhaps hesitant to follow recommendations due to fear of accountability. In that sense, fearing accountability seemed to regard a need to protect themselves and maintain interests.

Figure 5-5: Contractors' motives for ways of implementation

Analysis

Organizing theme: Failed attempt at reconciling conventional practice with PIRMS This organizing theme pertains to wanting to do good for others, but cannot, due to the need to advance self-serving purposes. In this context, advancing self-interest emerged as a necessity rather than a need to exploit others from the contractors' perspective. The key themes describing this organizing theme seem to suggest that, despite contractors wanting to implement PIRMS to the best of their ability, the project owners did not follow suit. According to accounts from informants, some project owners had other intentions regarding why the project delivery model was selected, to begin with.

Informant 3: *The model was a concept picked up due to marketing from promoters*
Informant 3: *It was More important to have a BVP contract for the project owner than to implement the model appropriately*

The informants highlighted that because the project owners did not seem to match their level of dedication to implementing PIRMS, it forced them to revert to conventional practices. This came across through the description of which factors influenced the development of the RMP. It seems that the factors that would incur costs for them, and not necessarily cost to the project's success were high on the list. Given the interpretation presented, there appears to be

a failed attempt at reconciling conventional practice (a move to protect own interest) with PIRMS (wanting to do well by the recommendations).

Informant 1: *We attempted to do everything by the book to the best of our ability*
Informant 4: *Whether the risk burden is on us or not influences which risks get included in the RMP*
Informant 4: *Where the risk burden is plays a big role in how good RM practice is*

Organizing theme: Failed attempt at reconciling conventional practice with PIRMS This organizing theme regards humans' natural proclivity to avoid dealing with accountability. The choice of the word "fear" in the thematic network was intentional to denote that it may not have been an attempt to avoid accountability. The findings seem to suggest that the contractors were avoiding conditions that would necessitate avoiding accountability. In that sense, fearing accountability influenced how PIRMS was implemented. Overall, the conditions seem to have forced the contractors to focus on guarding their own interests rather than devoting their full capability to optimally implement PIRMS. However, it does not mean that contractors do not try to avoid accountability.

Informant 6: *Closer follow-up of WRR is needed from the project owner's side*
Informant 5: *The project owner did not know what to use WRR for*
Informant 5: *The project owner did not make effort to use the model as intended*

The project owners' perspective

Findings

There is no evidence from the informants suggesting any motives to implement PIRMS in any particular way.

Analysis

The fact that the findings do not indicate any motives for ways of implementation is a finding in itself. Here is an interpretation. In the mathematical world, the number 0 does have a great value. The reason for mentioning zero is because of what zero represents. Among other things, zero represents presence by denoting absence. In that sense, it could be reasoned that project owners lacking motives to implement PIRMS suggests their reluctant attitude. It is not clear that this is the case for every project owner. However, a lack of sufficient interest to motivate a strategic implementation plan seems an attitude worth reconsidering. That said, the few respondent numbers contribute to the outcome of the findings. In that regard, the evidence showing a lack of motives for ways of implementation might not be representative.

5.2.2 Discussion

The contractors' perspective

The contractors' perceptions focused more on the downsides than the positive attributes. Interestingly, their perceptions seem to be guided by their beliefs on whether PIRMS exposes or protects them from risks. Risks to themselves, not risks to the project. According to

Weinstein, Rothman and Nicolich (1998), behavioral science does confirm a correlation between risk perception and precautions taken to reduce the perceived risks.

Precautions lead one to believe that the perceived negative risk is reduced (Weinstein, Rothman and Nicolich, 1998; Kanter, 2012). The one perceived benefit also seems to be advanced since they can control constructability. A sense of controllability is one of the main reasons people might embrace or reject new approaches. A study that examined the effects of perceived controllability and risk attitudes on risk ratings, has demonstrated the significance of a sense of controllability (Dikmen et al., 2018). It could be hypothesized that the positive perception has to do with protecting own interests. If the contractors are not part of the designing phase, constructability might not be optimal. If contractors are involved during the designing phase, they can influence the degree of constructability, material choice, etc. Research shows that both cognitive (factors linked to estimate risks) and affective (factors regarding heuristics) are major predictors of precautionary risk measures (Altarawneh, Mackee and Gajendran, 2018) When contractors refer to a "lack of comprehensiveness", they seem to be saying "we are not sure to what extent our interests are protected". In that sense, they seem to regard PIRMS as just another model to add to their list. Their concern seems valid. They highlighted that some of the focus with PIRMS was on aspects outside the realm of what is possible, like predicting future event risks. In that sense, regarding PIRMS as just another model, to take precautionary measures that reduce their exposure to risks emerges reasonable.

The lack of uniqueness from conventional risk management was described by comparing PIRMS to conventional practices in Partnering models and in-house risk management practices. The perception seems to regard resistance to change. Organizational behavior theories indicate that resistance to change is one of the drivers of organizational behavior (Dent and Goldberg, 1999; Rehman et al., 2021). Within the behavioral science academics, resistance to change has been a major contributor of why change efforts often fail. Employees of an organization are likely to contribute to realize the change when they perceive value on an individual and toa a lesser extent on an organizational level (Rehman et al., 2021). Within the framework of organizational behavior, the contractors do not seem to see much value in PIRMS. It could be the reason why they were hesitant put more effort into applying it properly. However, thematic networks on motives for ways of implementation indicate other reasons on why the contractors might have perceived the model with a self-centered attitude.

Findings suggest that contractors hesitantly implemented PIRMS because of fear of accountability and to protect self-interests. As discussed in (Dent and Goldberg, 1999), fear of poor outcomes and emotional side-effects are significant predictors of resistance to accept conditions in new situations. Conditions in a new situation refer to perceived present benefits and familiar conduct. In other words, in conventional project execution, contractors and project manager would have their ways of maintaining their interests. In that context, advancing self-interest emerged as a necessity rather than a need to exploit others from the contractors' perspective. However, the characterization does resonate with findings in (Fransen, Smit and Verlegh, 2015) that examined resistance strategies related to different motives, one of which was a concern for deception. The contractors highlighted that because

the project owners did not seem to match their dedication level to implementing PIRMS, it forced them to revert to conventional practices. Thus, fearing accountability became a factor in how PIRMS was implemented. Overall, Conditions seem to have forced the contractors to guard their interests rather than devoting their full capability to optimally implement PIRMS.

The project owners' perspective

The project owners' perspectives provide one clue describing factors that influenced how implementation recommendation was practiced. It appears that PIRMS has shortcomings, too.

The frequency of WRRs was seen as redundant and perceived to increase workload compared to benefits gained. Research has shown that an organization's structure is a factor that influences the perceived understanding of a new model and own self-interest (Dent and Goldberg, 1999; Kanter, 2012). The project owners seemed critical of what they described as an unnecessary WRR frequency. They seem to regard the condition as an unnecessary burden. According to Lines et al. (2017), passive forms of resistance to change are the highest factor in the behavioral dimension to change. The study remarks that passive resistance may be overt or understated but that the effect is noticeable. Perceiving the frequency of WRRs as a factor that unnecessarily increases workload could be linked to a way of resisting change.

There is no evidence suggesting that the project owners had any motives to implement the PIRMS in any particular way. It can only be speculated that lacking motives might suggest a reluctant change attitude. Studies on attitude formation show that cognitive biases can, for example, lead to assuming unfamiliar approaches as negative (Fazio, Eiser and Shook, 2004).

5.2.3 Identified situational factors

The objective was to describe why PIRMS was implemented in a particular way. The situational factors were identified by exploring organizational behavior theories that describe the findings from the analysis section. The situational factors that emerge can be described by the external and internal situations that affect risk attitude as described in (Hillson and Murray-Webster, 2005, pp. 55–60). Figure 4-4 developed in this thesis shows a pattern of how situational changes may occur that could alter the preferred risk attitude. In this case, the risk is not in its conventional sense a risk to the project, but a perceived usage risk to the contractors and project owners. Nonetheless, the figure provides clues of what is involved in the issue.

From the contractors' perspectives, the situational factors identified were two of the six external situational risk attitude factors described by (Hillson and Murray-Webster, 2005, pp. 55–60): *(1) Level of relevant skills, knowledge, or expertise*, and (2) *Potential for direct consequences.*

The analysis indicated that the situational factor motivating a change in perception was linked to insufficient experience. Giving clues to the conclusion is the overemphasized focus on the negative attributes of PIRMS. It might have been a factor in why contractors did not optimally implement the model.

The contractors also seem to perceive that the direct consequence of using PIRMS could be a risk for themselves. Their doubts as to whether PIRMS exposes or protects them from risks informs the conclusion that the situational factor is likely a potential for direct consequences. The findings had indicated that fear of accountability to protect self-interests could have impaired optimal implementation. And findings also indicated that the contractors were forced to revert to conventional practices rather than devoting their full capability to optimally implement PIRMS. Possibly, they might have perceived PIRMS with hesitance. As the discussion part indicates, the cumulative effect was likely resistance to change.

From the project owners' perspectives, the keyword informing which situational factor affects how recommendations were practiced appears to be perceived workload increase. This is a situational change described by one of the six external risk attitude factors, "Potential for direct consequences." (Hillson and Murray-Webster, 2005, p. 61). As discussed in the discussion, the perceived increase in workload seems to be a form of passive resistance to change.

Research question 1 C

5.3 Theory of PIRMS and practice discrepancies, why they occur?

The answer to question 1 A has indicated differences between implementation recommendations and practices. The answer to question 1 B provides clues regarding which situational factors could have influenced how the recommendations were practiced. This part focuses on why discrepancies between recommendations and practice occur. The topic groups of thematic networks that will be used are *influencing factors from conventional practice, implementation challenges*, and *Unique risk factors observed.* The objective is to explore what may have caused differences.

5.3.1 Findings and analysis

Thematic Network 3: Influencing factors from conventional practice

The contractors' perspective

Thematic network

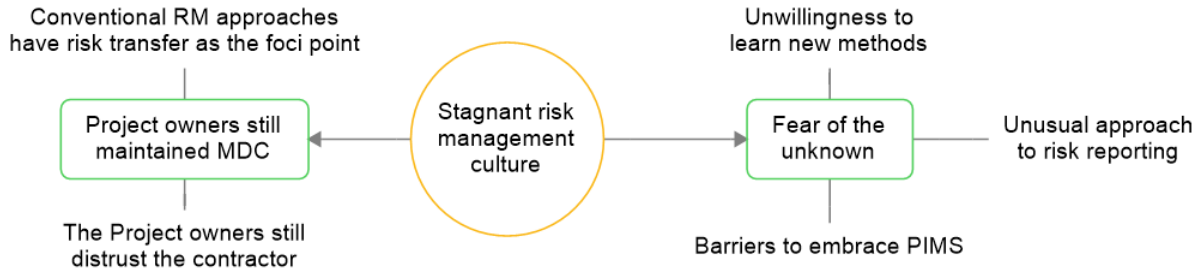
One thematic network was developed. The network includes three organizing themes connected to five basic themes in total. See Figure 5-6.

Findings

The influencing factors from conventional risk management seem to relate to three conflicting but highly related issues. The thematic network explores influencing factors from conventional practice linked to stagnant risk management culture. There appears to be a risk culture adamant to change, due to fear of the unknown. It indicates different ways of resistance to change. Also, contractors emphasized that project owners applied MDC because

they believe were determined that risks could be managed through the practice of MDC. Both factors appear to describe a stagnant risk management culture. Such a risk management culture can weaken the ability to embrace a new approach. However, it is equally vital that any new approach is a workable model to initiate change.

Figure 5-6: Influencing factors from conventional practice, contractors' perspective



Analysis

Organizing theme: project owners still maintained MDC This organizing theme relates perhaps to humans' struggle to trust in other people, entities, and systems. In this context, project owners practicing MDC appears as a natural proclivity to protect their own interests. Informants highlighted two factors that describe why MDC was practiced in the pilot projects. The contractors seemed to be confused by why the project owners still distrusted them despite choosing them on merits. Moreover, risk transferring practice was highlighted to have been used. It is a trait known from conventional practice. The question here is then why is it difficult to trust the PIRMS system and the contractors? It may not be unreasonable to assume that a lack of trust could be due to PIRMS not being convincing enough to let go of traditional conduct. However, that also raises the question of why.

Informant 1: *A lot of focus on risk transfer on the project owner's part*
Informant 3: *The project owner controlled us using frameworks*
Informant 1: *The project owner manages and controls the contractor in detail at the same time as the risk responsibility falls on contractor*

Organizing theme: fear of the unknown This organizing theme has stark ties to the organizing theme above. However, it differs since fearing the unknown seems to be motivated by factors beyond distrust. The issues raised by contractors also indicate the shortcomings of themselves and the supporting institutions that introduced the model in Norway. In that context, fear of the unknown seems to be linked to resistance to change. Most informants highlighted notions like "the concept of WRR is new to us, we do not see the value of WRRs, etc.". Though resisting change can be motivated by distrustful attitudes to protect self-interest, it could also be motivated by knowledge ignorance. The contractors highlighted that some project owners lacked the willingness to learn.

Informant 5: *The project owner rejected help from then mentor organization*
Informant 6: *Many contractors are now used to D-B project delivery models*
Informant 1: *Traditionally, it is common to use monthly reporting and WRR is new to us*

The Project owners' perspective

Thematic network

One thematic network was developed. There are two organizing themes connected to four basic themes in total. See Figure 5-7

Findings

This network represents an understanding of what causes conventional poor risk management and how it influenced the pilot projects. The informants highlighted two fundamentally related issues: self-centered risk management practice and late risk response. The latter can be considered a consequence of the former. The network below shows the key themes that describe conventional poor risk management.

Figure 5-7: Influencing factors from conventional practice, project owners' perspective

Analysis

Organizing theme: self-centered RM practice This organizing theme relates to what seems to be an inherent inclination towards opportunism. In that context, informants seem to conceive self-centered risk management practice as part of the poor risk management conducts the contractors brought over into the pilot projects. The project owners explained that they did not face new challenges different from those encountered in conventional projects. In that respect, they seem to imply that, since much of the risk management in that regard is motivated by self-interest, the same poor risk management continued in the pilot projects, too. For instance, project owners highlighted that the contractors would avoid accommodating the user-generated changes, especially if it meant incurring costs. However, it is fundamental to understand that for contractors to survive, their business must be profitable. It necessitates guarding self-interest for a survival purpose. In that regard, self-interest becomes a problem when advancing opportunistic behaviors to excessively profit. Therefore, questioning opportunistic behavior is appropriate when the motives driving self-centered risk management practices are ill-guided.

Informant 4: *Contractors have a tendency to revert to D-B ways during the building phase*
Informant 2: *In a D-B project, the contractor is more concerned with its own risks and this practice was observed in our project*
Informant 2: *Ground conditions are risky. We had unpredicted outcome*

Organizing theme: late response to risks Though highly related to the organizing theme above, it differs in other ways. Perhaps the highest purpose of risk management is to implement risk measures. The project owners highlighted that the same reactive risk response often observed in most conventional risk management practices was also observed in the pilot projects to some extent. However, it was underlined that being new at practicing PIRMS also contributes to the problem. Despite that, the remark gives an insight into the motives behind a reactive risk management practice. The apparent reason might be opportunistic behavior. However, the issue is far more complex. It is vital to understand factors that motivate opportunistic behavior. It seems reasonable to question whether opportunism is only a behavior exercised to gain excessive benefits.

Informant 4: *Contractors speculate that it is difficult to stope extra costs and prevent them*
Informant 4: *Traditionally the focus of the contractors has been on changes rather than engaging in a proactive risk management*
Informant 7 (informal unrecorded discussion): *In D-B projects, risks are dealt with after risk occurrence and the same mentality exists across different project delivery models*

Thematic Networks 4: Implementation challenges

The contractors' perspectives

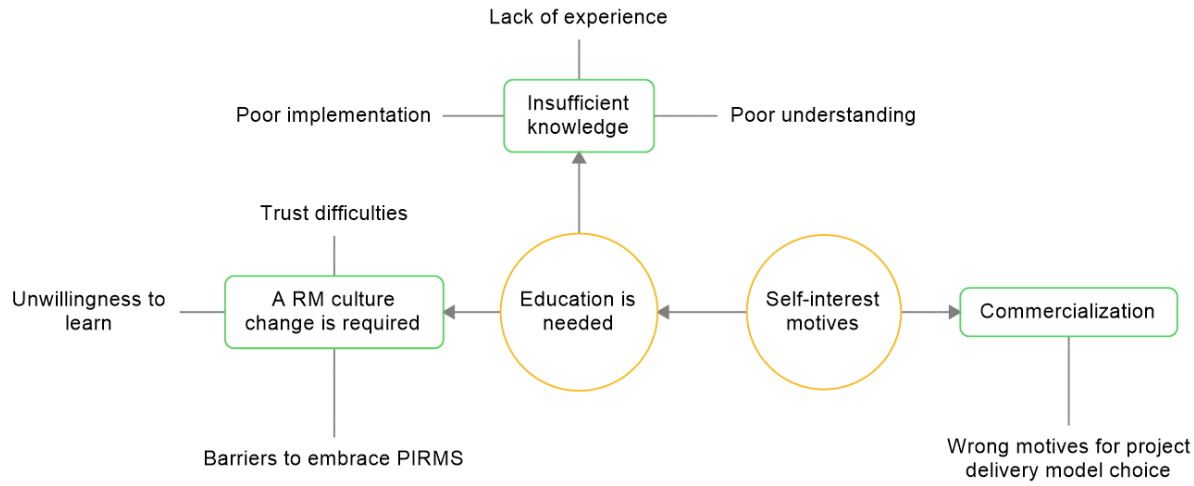
Two thematic networks were developed. While the first network includes two organizing themes and eight basic themes, the second network has one organizing theme and one basic theme. The second network is linked to the first network because self-interest motives could be motivated due to lack of education. See Figure 5-8

Thematic network 1

Findings

The first network explores the need for education regarding insufficient knowledge and a risk management culture that is adamant to change. The interviews indicate fundamental issues linked to excuses for not trying new challenges and a lack of support system for guidance. The left side of the network in Figure 5-8 shows key themes on which the need for education is anchored. It indicates that contractors perceive that the lack of education is driven by resistance to change and because of lacking support systems (barriers to embracing PIRMS). In this sense, lack of education emerged as a result of somewhere between being unmotivated to embrace new thinking and being willing to try it.

Figure 5-8: Implementation challenges, contractors' perspectives



Analysis

Organizing theme: A RM change is required This organizing theme is connected to the very nature of human behavior to resist change. The contractors had interestingly focused on conveying the message that, despite their attempts to try the PIRMS, the project owners did not respond with the same level of enthusiasm. They were keen to point out that there was an unwillingness to learn the model and trust difficulties from the project owners' side. In that sense, when the contractors indicate a need to change RM culture, they mean from the client's side. This gives reason to suspect that their perception of what a risk management culture change entails, is based on looking for a syndicate rather than looking inwards.

Informant 5: *The project owner rejected help from the mentor organization*
Informant 3: *The project owner just contracted us to do the job as planned by them without us having no say in terms of solutions*
Informant 1: *Project managers still managed and controlled us in detail, and at the same time transferred the risk responsibility to us*
Informant 1: *The project owner still struggles to trust us despite having contracted the best contractor for the job*

However, the contractors did not only blame the project owners. Most informants gave a recount of barriers to embracing PIRMS. The barriers had to do with lack of support systems to improve the implementation. Also, the barriers seemed to be linked to project owners not applying PIRMS correctly.

Informant 6: *When Project owners dictate detail specific solutions, it promotes backward thinking*
Informant 6 *Project owners do not like to take more risk than obliged to by the standards*

Organizing theme: Insufficient knowledge This organizing theme pertains to humans' general tendency to rush into things with little knowledge. The informants highlighted that poor understanding, lack of experience, and poor implementation contributed to implementation challenges. Poor implementations seem to arise from flawed understanding, and the issue propagates with a lack of experience. According to the informants' remarks, the poor

understanding was described by two characterizations of poor implementation. (1) Poor implementation was discussed in terms of not using the full potential of PIRMS due to assertions, and (2) poor implementation was discussed relating to the lack of willingness to understand and implement PIRMS.

The term "the full potential due to assertions" describes the pre-assumed attitudes of the contractors and project owners. It seemed that some contractors had the notion of "this is no different than existing models, why try PIRMS". The project owners did not educate themselves sufficiently on the model. For example, some projects designed the building completely before implementing the BVP model, failing to attain the benefits of ECI.

Overall, it seems that the implementation challenges faced were beyond a simple diagnosis of a lack of knowledge. The issue appears to be more profound because it regards humans' behavioral constituents. Examining the root factors seems reasonable before tackling the relatively simple task of training people on new models. It is an individual issue and an organizational issue at the same time.

Informant 6: *We didn't see the value in WRR for each week*
Informant 5: *We didn't feel the need to use WRR since the risks had been handled*
Informant 3: *There was no condition to use the full potential of the model*
Informant 3: *WRR was new for us*

Thematic network 2

Findings

The second network concerns self-interest motives that resulted in poor implementation and confusion. The issue is linked to why the BVP model was selected by the project owners in the first place. The choice of BVP seems to have evolved out of a wish to showcase that it is a better model, and to prove that project owners are willing to try new approaches.

Analysis

Organizing theme: self-interest motives This organizing theme relates to humans' general tendency to be guided by self-serving motives. Self-serving in the sense that "I will do what is best for me, but it is good if others benefit in the process, too". An informant highlighted that the project owners had selected the BVP model to convey that they are trying alternative methods. Thus, they attempted to apply the model without understanding it. Whether the model is appropriate for the project seemed a secondary concern. Moreover, the BVA mentors that the project owners partnered with were more concerned with promoting the model than improving the project owners' understanding.

Informant 2: *BVP was a concept picked up due to marketing from promoters*
Informant 5: *It was more important to have a BVP contract than to implement the model appropriately*

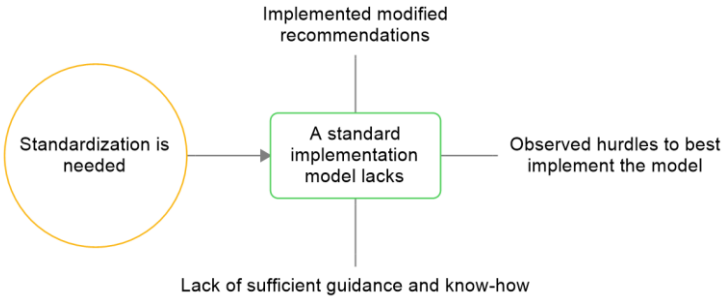
The project owners' perspective

One thematic network was developed. Is has one organizing theme and three basic themes. See Figure 5-9

Findings

The network represents the need for a standardized implementation guideline, calling for a lack of a standardized implementation model. Figure 5-9 shows the relationship between key themes. It appears that the need for standardization is driven by two factors. There seems to be a lack of sufficient guidance on implementing PIRMS. Testament to that is the abundance of incomplete WRRs. Additionally, the informants have highlighted hurdles that hinder the proper implementation of PIRMS. PIRMS disregards sub-contractors. It was considered to be one of the biggest hurdles.

Figure 5-9: Implementation challenges, project owners' perspective



Analysis

Organizing theme: *A standard implementation model lacks* This organizing theme appears to regard the need for sufficient time to understand new approaches. The fundamental issues describing the call for a standard implementation model seem to be rooted in issues related to lack of experience and regression. Regression seems to be used as a coping mechanism when conditions get too confusing, or the workload too much. Informants have highlighted that the contractors tended to manage risks the usual way. The regression to conventional ways is connected to a lack of experience and know-how. To this end, informants have raised a lack of sufficient know-how as a major contributing factor to the fragmented ways of the RM conducted. However, despite the challenges, it should be noted that these are pilot projects, and that failure is what is needed to improve successive attempts. Another significant factor was that the sub-contractors were disregarded throughout the projects. Given that the actual work is done by them in many cases, it is surprising to remark the absence of sub-contractor inclusion in the model.

Informant 2: *We were inexperienced, so we implemented modifications*
Informant 4: *The contractors have a tendency to revert to D-B ways during the building phase*
Informant 2: *The RMP was updated but the contractor wasn't updating as proposed in the book*
Informant 4: *Sub-contractors are disregarded*

Thematic Networks 5: Unique risk factors observed?

The objective here is to explore whether there were unique risk factors observed in the pilot projects that could explain implementation deviations.

The contractors' perspective

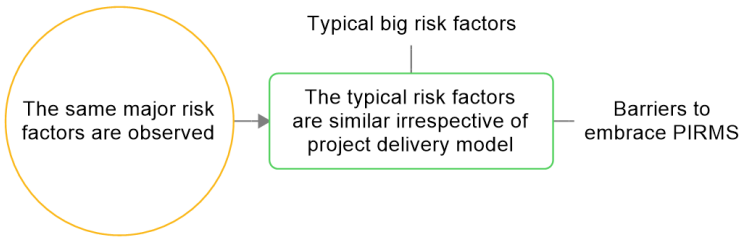
One thematic network was developed. The network has one organizing theme and two basic themes. See Figure 5-10

Thematic network

Findings

This network explores whether unique risk factors contributed to deviations from implementation recommendations. Findings indicate that the same major risk factors observed in projects with other project delivery models are encountered in the pilot projects. There is no difference to speak of regarding risk factor uniqueness causing a deviation. However, in seeking possible unique factors, other factors that could have contributed to widening the discrepancy between recommendations and practice were identified. While many informants highlighted that the typical risk factors are the same in the pilot projects, one informant emphasized that there were barriers causing discrepancies. Figure 5-10 shows the relationship between key themes.

Figure 5-10: Unique risk factors observed



Analysis

Organizing theme: typical risk factors are similar irrespective of project delivery model There were no risk factors that were seen as unique. All the informants highlighted the same common major risk factors:

Informant 1: *Ground conditions are possibly the biggest risk*
Informant 3: *ground conditions are always risky*
Informant 4 *Approval of documents pose risk tom time*

However, one informant highlighted that there were barriers to embracing PIRMS. It seems that in referring to "barriers to embracing" the underlying message appears to be an issue of resistance to change. In that respect, it does not seem to be the risk factors causing discrepancies, but that change resistance was. One informant highlighted the following.

Informant 6: *Many contractors are are now used to the D-B project delivery model*

The remark suggests, since the risks observed were similar to typical risk factors, the same poor risk management was likely practiced in the pilot projects too.

The Project owners' perspective

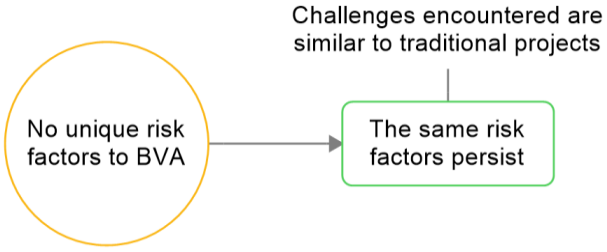
One thematic network was developed. The network comprises one organizing theme and one basic theme. See Figure 5-11

Thematic network

Findings

The project owners had the same answer as the contractor regarding no unique risks being observed. Like the contractors, ground conditions and designing risks were reoccurring themes during the interview sessions. Also, self-centered risk management practice was mentioned.

Figure 5-11: Unique risk factors observed, project owners' perspective



Analysis

Organizing theme: the same risk factors persist What differentiated the project owners' remark was, risks caused because of lack of support from the institutions that introduced the BVP model. The lack of sufficient guidance on how to use the WRR and RMP did cause challenges.

Informant 2: *Ground conditions are risky*
Informant 2: *User participation poses risk regarding risks unforeseen on their behalf, causing change requirements during construction*
Informant 5: *Risks linked to ground conditions are common*

5.3.2 Discussion

The contractors' perspectives

The analysis parts explored why the practical implementation of PIRMS differed from the recommendations. The main findings revealed that there were implementation challenges resulting in inability to fully attain the benefits of PIRMS. Plausible reasons as to why are explored using theory presented in chapter 4.4.4.

Findings suggest that the project owners tried to protect their own interest by employing MDC. They seemed to resort to heuristics. Perhaps it relates to humans' struggle to put faith in others, entities, and systems. In this context, persistence on using MDC emerges as a natural proclivity to protect interest. The relapse to MDC seems to be motivated by three

factors: ignorant knowledge, distrust and change resistance A study that examined barriers to implement the BVA model has identified that mistrust and traditional mindset as the main cause of failed implementation, supporting findings in this thesis (Ying, Zhao and Tookey, 2021).

Both the contractors and project owners had a pre-assumed attitude towards the PIRMS model. For example, some contractors had the "this is no different than existing models, why give this a try" attitude. According to Hillson and Murray-Webster (2005), most individual have a pre-established risk attitude. It might explain some of the reasons why there were discrepancies. The new model might have been perceived to challenge established beliefs and conducts, resulting in a poor implementation.

It was identified that the nature of change resistance in organizations was likely a contributing factor to implementation challenges. According to kreitner (1993, as cited in Dent and Goldberg, 1999), poor training is one of the main drivers of resistance to change. The contractors perceived that resistance to change drives knowledge ignorance. In that sense, knowledge ignorance emerged as a result of poor training, promoting change resistance.

As discussed in Gigliotti et al. (2019); Rehman et al. (2021), the connection between perceived organizational support and readiness for Change is high. The authors indicate that organizational support is key to the success of change implementation. When organization support is high, the resistance to change decreases and, readiness to embrace the change increases. The supporting organizations that introduced the model could initiate more engagement between practitioners and supportive organizations.

The reason why project owners reverted to MDC seems to be motivated by factors beyond distrust, too. It appears that MDC could be a manifestation of change resistance. In other words, hesitating to let go of conventional practice. In this context, MDC practice comes across as a natural proclivity to protect interest using a familiar conduct. Research shows that there are numerous factors that affect reluctance to change. For example, Kim, Hornung and Rousseau (2011) investigated the effects of change-supportive behavior in an organization. Their findings indicate that expected benefits of the change were critical factors that influence how perceptive organizations can be towards new conducts. Dogmatism is another factor that affects how receptive organizations are to new models. Often organizations with dogmatic structures tend to resist change (Lau and Woodman, 1995; Oreg, 2003). Other studies have shown that resistance to change can be related to uncertainty avoidance (Bordia et al., 2004; Caldwell, Herold and Fedor, 2004). In this context, avoidance regards project owners not knowing whether PIRMS is a model that can replace MDC. The Norwegian society is characterized as a high uncertainty avoiding society. Thus, most may seek to reduce the likelihood of unfamiliar conditions that could affect an organization's familiar conduct (Warner-Søderholm, 2012). Perhaps the need to practice MDC is engrained in the culture. In that case, it may take more than a new approach to motivate a risk culture change. however, studies show that resistance to chance could be a simple case of unwillingness to vacate a comfort zone out of fear of the unknown (Rehman *et al.*, 2021). A good starting point to address the issue, is acknowledging that there is a risk culture that is adamant to change.

Though no unique risk factors were found, when contractors refer to "barriers to embrace BVA", it emerges as an underlying message that regards change resistance on their part. A study in done by Sherman and Cohen (2002) has shown that resistance to change becomes strong when the change affects established beliefs that are held to promote self-interests. In that respect, it does not seem to be the risk factors causing discrepancies between recommendations and practice, but that resistance to change was. Additionally, it can be assumed that because of similarities in typical risk factors, the same neglectful risk management practice has likely transferred to the pilot projects, too. Ying, Zhao and Tookey, (2021) recommended that organizations should adopt progressive procurement and effective communication and collaboration to foster a change in mindset. It could be a solution to narrow the discrepancy between implementation and practice for future projects.

Project owners' perspective

Reactive risk measures common to conventional RM practices were observed in the pilot projects to some degree. The observations relate to what seems to be an inherit inclination towards opportunistic behavior. Project owners consider self-centered RM practice as part of the challenges carried over into the pilot project by the contractors. The obvious reason might be opportunistic behavior to make excessive profits. However, it could also be a question of survivability to their business. It is vital to understand which factors that motivate the opportunistic behavior. From Transaction cost theory, we can assert that a high asset specificity with high uncertainty prompts opportunism (Wang et al., 2019; Wang, Fang and Li, 2019). Studies show that contracts do not curb opportunism as well as one might assume. Rather relational governance has been suggested to reduce opportunism.

The need for a standardized implementation guideline was raised as an implementation challenge. It appears that the need is driven by two factors. Lack of sufficient guidance on how to use the PIRMS model. The fundamental issues describing the call for a standard implementation model seem to be rooted in issues related to lack of experience and regression. Regression is a topic much discussed within the psychology field. Studies show that regression is a coping mechanism in which current issues are dealt with by reverting to old mindset, habit, or conduct (Sisgold, 2014; Lokko and Stern, 2015). In risk management context, Hillson and Murray-Webster, (2005) term the phenomenon heuristics. In that sense, regression in the form of heuristics appears to have been used as a coping mechanism when conditions get too confusing. Finding in this study indicate that the use of heuristics is likely connected to a lack of experience and know-how.

The second factor regards the model's lack of comprehensiveness. Sub-contractors are disregarded. Given that the actual work is done by them, disregarding sub-contractors overlooks a significant part of the transaction between agents and principal in an effort of project realization.

5.3.3 Identified factors leading to discrepancies

From the perspectives of contractors

It appears that the implementation challenges faced were beyond a simple diagnosis of lack of knowledge or distrust. The issue is deeper because it regards humans' behavioral constituents. The root cause of why the implementations were not that successful must be addressed. It is an individual issue and an organizational issue at the same time. Overall, findings from the contractors' perspectives seem to point to discrepancies caused by a relapse to MDC.

From the perspectives of project owners

The conclusion that can be drawn her is described by the principal-agent problem. As theory reads, the principal is usually the victim of asymmetric information and hidden information and actions. Assuming that the contractors' opportunistic behaviors were aimed at bilateral benefits, the project owners' observation seem to be in tandem with theory. From TCT, we can understand that opportunistic behavior between firms pose a challenge, in this case as reactive risk measures.

Why differences between implementation recommendations and practice occurred

The objective was to describe why discrepancies between implementation recommendations and practice occur. The findings indicate that the root causes could be the following two factors. (1) The differences are due to behavioral attitude described by TCT and the principal-agent problem. Findings seem to indicate that change resistance and opportunism was observed. This issue is probably not an isolated case for the study here but will likely apply to any other RM model. (2) The ideal premise (as outlined in question 1 A) for the PIRMS model to optimally function was not created. Meaning there was a lack of sufficient standardized guidance on implementation. More importantly, the willingness and readiness to embrace the model was low. Moreover, the differences had to do with the model's lack of comprehensiveness.

The critical factors needed to optimally apply the PIRMS

1. Sufficient understanding of the BVA model to convert recommendations into practice is key
2. The willingness and readiness of practitioners is a critical factor that can influence whether PIRMS is applied appropriately
3. The PIRMS model itself must be improved. It lacks comprehensiveness, undermining its potential. Most critically, the model must include sub-contractors as part of the solution.

Research question 2

5.4 Which advantages and disadvantages of current practice were observed?

The main advantages and disadvantages are identified. A discussion follows evaluating whether the advantages attained reflect the six mechanisms underlying PIRMS (Kashiwagi, 2016a, chaps 6–7), as presented in 4.5 here. The six mechanisms are an interpretation of what Kashiwagi constitutes as fundamental issues to resolve poor risk management. In other words, they represent what the model promises to deliver. An evaluation of whether the advantages agree with benefits remarked in other studies that explored BVP will also be examined. Finally, an evaluation of evaluate what did and did not work well in the Norwegian market will be provided.

5.4.1 Findings and discussion

Advantages

Table 5-6: Advanteges of PIRMS

Contractors	Project owners
Advantages	Advantages
1. Greater risk understanding	1. Well-informed decision-making
2. Improved RM processes	2. Improved risk process and measures
3. Better risk measures	

The contractors' perspective

Three broad advantage aspects were identified: Greater risk understanding, improved risk management processes, and better risk measures. The three aspects are interlinked since one is either a consequence of the other, or it enhances the other. Greater risk understanding will improve the risk management processes. Conversely, an improved risk management process can facilitate a greater risk understanding. The relationship is two sides of one coin. Improved risk understanding and improved risk management process lead to better risk measures.

Improved risk understanding

Two benefits were highlighted linked to understanding improvement. Each informant emphasized that PIRMS forces parties to plan in greater detail. The contractors were motivated to proactively manage risk. The benefits realized are consistent with the fourth, third, and fifth mechanisms underpinning PIRMS (Kashiwagi, 2016a, chaps 6–7). Findings in Perrenoud (et al., 2017) indicate a correlation between high average RMP scores and high levels of risk communication, increasing risk understanding. It substantiates the finding of this study.

The second benefit regards the improvement of risk understanding and its consequences. The benefits are a structured overview of risks and the ability to have a clear picture of risks early. As pointed out in 4.5 in this thesis, it increases the likelihood of influencing the risk outcome. The advantage gained reflects the sixth mechanism underpinning PIRMS.

Improved risk understanding was also perceived to motivate improvement in risk management expertise. Informants highlighted that it enhances in-house expertise. According to J. Perrenoud, C. Lines and T. Sullivan (2014), an improved ability to understand risks could lead to enhanced risk expertise. For example, because the RMP provides a clear picture of risks, contractors were able to prepare preventive and corrective measures with higher effects. Using a RMP, WRRs, and KPIs is a repetitive process, improving contractors' ability to understand risks. Perhaps the significant benefit of improved risk understanding might translate to a risk attitude change. As argued by Hillson and Murray-Webster (2005, chap. 2), individuals have a pre-assumed risk attitude, but it can change due to external and internal situational factors. It could lead to better outcomes. Improved risk understanding could facilitate that.

Improved risk management process

The risk management process was found to be streamlined and effective. There are two reasons for this. For one, the improved process was due to a reduction in motives to become opportunistic. It seems to be because transparency was increased, decreasing the opportunity to exploit a favorable situation. Also, it appears to be because of a mutual understanding of what is included in the RMP regarding risk allocation and risk measure responsibilities. In short, the interests of both parties seemed to be protected. The attribute reflects the sixth mechanism underpinning PIRMS. Narmo, Wondimu, and Lædre (2018) seem to agree with the finding of this research. They highlighted that the project owners and contractors perceived the risk management approach as amicable. Amicable in the sense that it maintained the interests of both parties, improving risk management conduct.

The second significant reason for improvement seems to be linked to incentives. The contractor had incentives to be effective at managing the risks. Contractors want to get good evaluations from the project owner to show high-performance levels for future competition. Consequently, cost-effective solutions, better risk mitigation plans, and increased productivity were observed. The advantage reflects the third mechanism underpinning PIRMS.

Better risk measures

Improved risk understanding and improved risk management process lead to better risk measures. One profound advantage was highlighted. The risk measures were characterized as having a focus on effective risk mitigation. It meant that higher productivity and cost efficiency were achieved. The benefit reflects the third mechanism underpinning PIRMS. Additionally, if the perceived risk measures are optimal, it may discourage project owners from practicing MDC.

The Project owners' perspective

Well-informed decision-making and improved risk process and measures were two significant and related benefits identified. Well-informed decisions will improve risk measures and the risk management process. Similarly, an effective risk management process and good risk measures will influence future decision-making (heuristic). The perceived benefits are similar to the contractors.

Well-informed decision-making

The benefits identified concern what well-informed decision-making and improved risk management process and measures have meant to the projects. PIRMS was described to facilitate a better understanding of risks and a better alternative to traditional ways. For instance, improved risk communication was, for instance. Nygård, Wondimu, and Lædre (2019) underlined that the WRRs were observed as one of the variables that allow effective communication during the execution phase. The benefits observed are linked to the sixth mechanism underpinning PIRMS.

Improved risk management process & risk measures

Improved ability to implement measures was perceived to counter opportunism and to increase deliverable qualities. Improvement in the risk management process was linked to reduced decision-making time. Contractors had a better freedom to implement measures without having to go through a chain of command. The benefits observed are linked to increased transparency and convenience for efficiency. Those reflect the fifth and sixth mechanisms underpinning PIRMS.

Another benefit highlighted was that the project owners had eased their workload by not having to manage risks the usual way. Monitoring the performance of contractors using WRR was found to be convenient. Narmo, Wondimu and Lædre (2018) had in their study identified similar benefits.

Disadvantages

	Contractors	**Project owners**
	Disadvantages	Disadvantages
1.	Too simplistic for complex projects	
2.	May not be well-suited to function in Norway compared to existing models	

The contractors' perspective

The contractors highlighted that the disadvantages were linked to how well the model can be integrated into established conduct in Norway. Informants seemed to imply that the model needs to be adjusted to suit the Norwegian market. Two fundamental issues were raised that describe the need for adjustment Too simplistic for complex projects and suitability issues.

Too simplistic for complex projects

Some informants stressed that PIRMS is perhaps too simplistic to be applied in a complex project. They indicated the prevalence of high levels of disputes encountered in complex projects. Some informants had interestingly highlighted that there is an established and different opinion on what trust entails in the Norwegian culture. Though they do not mean that trust is blindly established, they also seemed to question to what extent dominant information would translate into transparency and trust. They seem to have an understanding that, for parties involved in construction activities, trust in common sense is important. Others highlighted that it is better to incorporate some of the PIRMS philosophies into established approaches rather than introducing a whole new system. A study that discussed the topic of trust relating to the issues here is Snippert et al. (2015). The discussion highlighted that the relationship distrust between project owners and contractors can inhibit the optimal implementation of the BVA model and could compromise stewardship.

Suitability issues

The other disadvantage was described by comparing PIRMS to existing approaches. Informants expressed that the model was resource-intensive in practice for two reasons. Risk had to be registered twice, using the WRR and per NS 8407. The second reason had to do with the preparation of WRR. Reporting risks weekly was experienced to be unnecessary since not much would change in a week. One informant had even said that it is difficult to see the value in reporting risks weekly. Though this may not have been said bluntly by other informants, they seem to infer the same meaning indirectly. The risk reporting issue was also remarked in (Narmo, Wondimu, and Lædre, 2018; Högnason, Wondimu, and Lædre, 2019), urging a way to accommodate the WRRs into NS 8407.

Moreover, most informants highlighted that the principles in the model are not as revolutionary as they are claimed to be. The claim was substantiated by comparing PIRMS to own RMM and Partnering models. According to remarks, the only distinguishing feature of PIRMS was that it makes the obvious more apparent, but at a cost of more workload.

The project owners' perspective

There is no direct suggestion from the informants that they experienced a disadvantage with PIRMS. However, as an implementation challenge, an issue was raised that regarded how the BVA model disregards sub-contractors. This can be considered a major disadvantage. Considering that most of the actual work is done by sub-contractors, it appears surprising that the model lacks comprehensiveness in such a way. Their competence is of great importance, and, unfortunately, their expertise is neglected. The BA model is claimed to be a paradigm shift. How can the shift be realized when a major player in the supply chain is not part of the shift?

5.4.2 Identified advantages and disadvantages

The advantages identified by both contractors and project owners were similar and reflect that the benefits achieved reflect the six mechanisms underpinning PIRMS well. However,

disadvantages were indicating that not everything claimed may be true. Whereas enhanced risk understanding, improved RM processes, and better risk measures have resulted in a promising result, market suitability issues and lack of comprehensiveness paint an opposite picture. Critics were raised on whether dominant information leads to transparency and trust. And perhaps the greatest critique was how neglectful the model is of sub-contractors. To a lesser extent, findings show that the PIRMS was resource-intensive, defeating one of the purposes of the model.

Research question 3

5.5 What can be done to better apply the PIRMS model and increase its utility?

The recommendations from the contractors and the project owners are concretized. The question seeks to address (1) what is needed to implement the model effectively and (2) how the utility of PIRMS can be improved. The latter is my recommendation based on findings from the study and assumptions. It is meant to hopefully spark a quarry for further research.

5.5.1 Needed improvements to better implement PIRMS

knowledge enhancement is needed

The WRR and RMP documents show that participants in the pilot project may not have had sufficient knowledge. Some had a better understanding than others. However, there seems to be a lack of sufficient understanding. It was confirmed by the informants, too. As Wondimu et al. (2020) highlight, most of the challenges faced during implementation are due to a lack of understanding or experience. The same observation was made by Witteveen and Rijt (2013); Narmo, Wondimu and Lædre (2018). Informants have urged a knowledge enhancement program to improve implementations. The counter-intuitive nature of the model was highlighted as an example. It seems appropriate since the model formulates guidelines in a criticizing manner and defies what most practitioners are used to. That may lead practitioners to assume a defensive position. Research has consistently shown that knowledge enhancement is what fosters the right attitude to embrace new methods, and will also likely increase the willingness to accept changes (Armenakis, Harris and Mossholder, 1993; Elias, 2009)

A standardized implementation model was also recommended. It can decrease confusion as to how to use PIRMS. More importantly, standardization means that the implementation will be similar across a project which can align the efforts the sector is making toward improved risk management practice. Further, knowledge sharing was recommended as a tool to enhance understanding.

Knowledge sharing is significant because it is key to fostering a standardized implementation model. Standardization does not happen overnight but develops over time. The development is dependent on the accumulated experiences to devise an optimal implementation model. Project owners and contractors across disciplines should exchange experiences on what has

worked and what did not. The same recommendation was given in Narmo, Wondimu, and Lædre (2018), indicating the significance of the issue. A possible solution is to facilitate a workshop where relevant stakeholders gather to discuss development. Concerned stakeholders should take greater initiatives to aid the model's maturity.

Collaborative efforts are essential

The informants raised several recommendations linked to increasing efforts to collaborate more. Informants stressed the importance of inter-disciplinarity in the core team developing the RMP. It is significant because individuals with different backgrounds can enhance the thoroughness of identified risks and the types. Moreover, it means that the risks' impact can be better predicted.

The second recommendation regards increased collaboration between the contractor and the project owner during the concretization phase in which the RMP is expanded. Simply suggesting enhanced collaboration is not enough. The factors that enrich the result of that collaboration must be in focus. For this, the project owner must meet the contractor well prepared and should have thought thoroughly though risks that the contractor did not include. Informants highlighted that project owners identified only some risks. Establishing an inter-disciplinary core team could increase the likelihood of identifying more risks. Wondimu et al. (2020) had found that early risk identification can lead to improved risk controllability.

Just as identifying ways to increase collaborative efforts is vital, it is equally important to understand what not to do. Contractors did raise concerns regarding project owners using contracts as a tool to dictate terms. It seems to suggest that not everything is solvable by contracts. It appears a reasonable proposition given the hostile environment contracts can create between the project owners and contractors. The purpose of contracts is to reduce disputes. However, it is not uncommon for ambiguous and biased contracts to exacerbate disputes (Wang, Fu and Fang, 2019).

A structured working practice can enhance implementation

PIRMS is a model that functions in a structured manner. It requires a structured working manner from contractors and project owners alike. Practitioners have disclosed that the Norwegian construction sector lacks a structured working manner. The recommendation was to adopt a structured working practice to better implement PIRMS. For example, delay when obtaining local approvals was mentioned. The WRR confirms this trend in which much of the complaints from the contractors were on project owners missing the deadline to obtain approvals. It has implications for performance.

The project deliverable descriptions should be functional, not detailed

Although most of the projects examined here were functional, some were detailed. One of the ideal conditions PIRMS relies on to function properly is using BVP to procure a contractor on merits. When project owners specify deliverables in a detailed manner, the advantage of ECI is lost. The direct consequence is that risks might not be identified. Findings did reveal that some project owners had a complete design before involving the contractor. Project owners

should strive for a functional-based description and utilize the contractors' ability to identify risks.

Implementing the BVA model could eliminate the drawbacks of hybrids

The pilot projects were a hybrid of BVP during the procurement phase and D-B in the execution phase. Although PIRMS was used throughout the project, elements of D-B features have interfered. The informants' evaluation was conclusive that it created confusion and nullified the value of PIRMS to some degree. The reason introducers of the piloting effort might have chosen to do so could be for ease of introduction. Besides, the reference books stipulate that BVP can be used in combination with other project delivery models. However, the problems seem to be that the combination of PIRMS and conventional practice in D-B do not agree well. Informants had highlighted that hybrid neither encourager nor gives incentives, rather they increase workload. There were instances of double risk reporting through the WRRs and another reporting per NS 8407. Both parties urged a way to fix the situation. The same finding was highlighted in Narmo, Wondimu, and Lædre (2018), recommending to make WRRs contractual.

Is not possible to conclude based on findings here whether having a fully BVA piloting conduct would have resolved the issue. However, the findings at least indicate that the attempt should be reconsidered. It appears that implementing hybrids might have prevented the full utility of PIRMS. moreover, hybrids seem to encourage a relapse to old ways. Perhaps most importantly, the condition might foster resentment towards the model and the paradigm change the BVA pushes for. users of PIRMS might Also, hybrids may work against maturity development in the Norwegian market. The findings indicate that it is worth giving the full implementation of BVA a try.

5.5.2 A recommendation to increase the utility of PIRMS

PIRMS does not address the core issue of why opportunistic risk management exists

There is no doubt that PIRMS resolves poor risk management issues. The pilot projects examined here demonstrate the effects. While recognizing the innovativeness of the model, I am not sure whether PIRMS can resolve the risk management issues at the core. My evaluation is that PIRMS does indeed promote a proactive risk management practice. However, the root cause of factors that motivate deliberate poor risk management (opportunistic risk management) go beyond addressing poor risk management due to lack of know how or experience.

Overall, risk management seems to be of a human behavior issue. PIRMS can be an effective tool that can address the question of how to manage operational risks. However, it does not provide solutions to questions regarding why opportunistic risk management exists. Granted, the umbrella model BVA provides rational that attempt to explain why. My reading, however, is that the base assumption is predicated on there being a problem in the first place. I.e., it does not address predictors opportunism in risk management, other than attributing lack of information as a factor. Despite the assumption being an accepted fact, it only partially explains why opportunistic risk management persists.

The utility function area of PIRMS should be expanded

To possibly get to the bottom of the root cause, the question should be why opportunistic risk management occurs. The BVA model aims to foster/create a new risk culture. As indicated in

Figure 5-12 below, the utility function area of PIRMS is limited. It implies that PIRMS does not cover the full magnitude of opportunistic risk management factors. It does not encompass a significant utility area as indicated in the figure marked with red color. I propose that expansion of the utility function area of PIRMS is necessary to tackle the core issue. Conditions seem to indicate that there is still a need for a holistic risk management model.

Figure 5-12 illustrates where I understand the focus area of PIRMS is currently, and what I propose should be in focus to fundamentally resolve the issue.

Figure 5-12: The utility function area of PIRMS and the area not covered

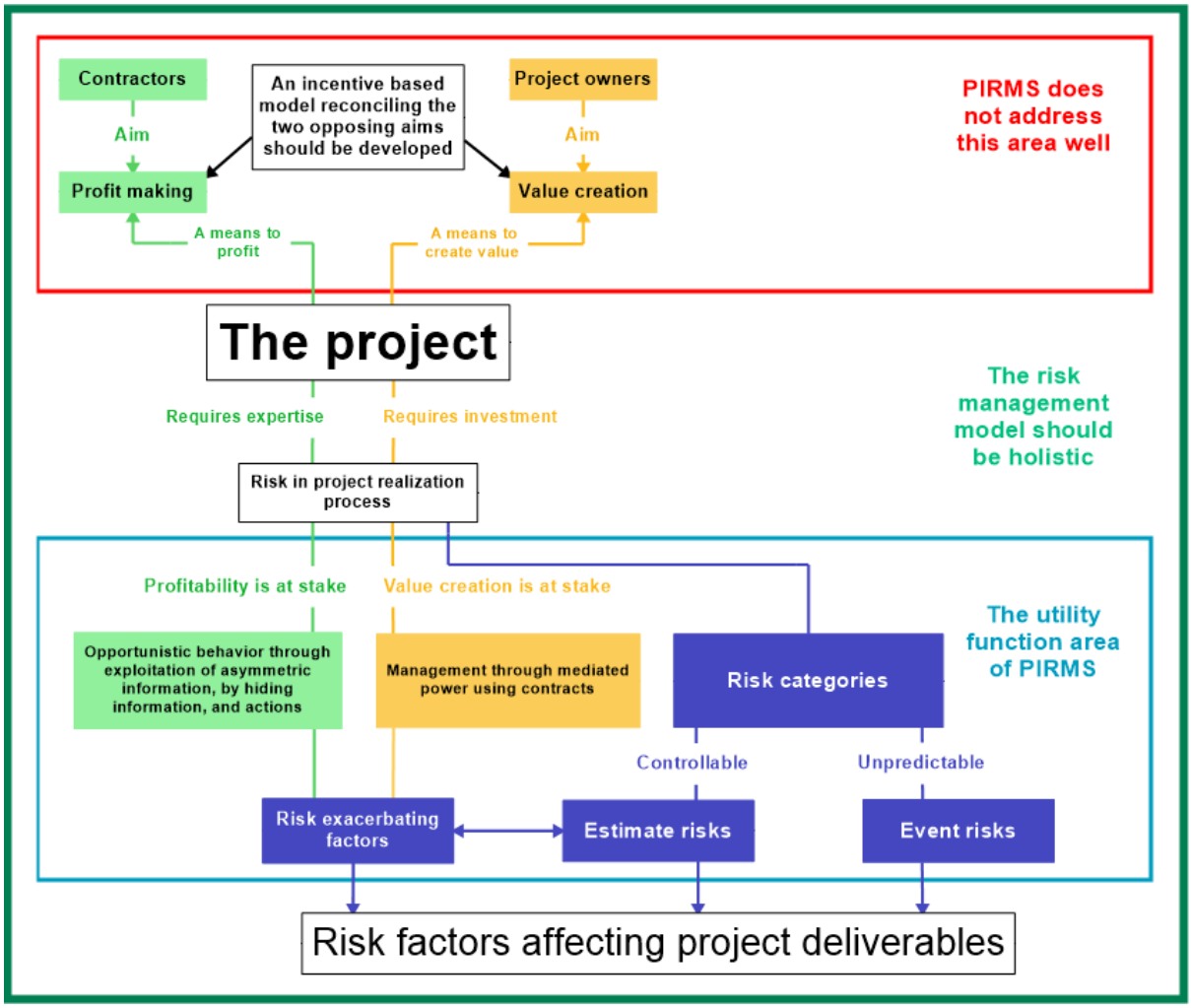


Figure description:

The figure is color coded to show connections. The term "the utility function area" is borrowed from utility theory and is used to show the constraints preventing risk management

maximization efforts. In this study, utility function area is used to roughly indicate which aspects PIRMS can handle and maximize. However, the figure does not say anything about how well PIRMS can handle the aspects. For example, PIRMS does not prevent event risks, but it recommends effect reducing actions. The figure is not a precise illustration of the risk picture involved in a project. The purpose is to merely provide a clue as to which aspect PIRMS does not deal with, thereof showing what is needed to maximize its utility.

Outlining a possible solution

Based on findings from the analysis and understanding from expected utility theory, the following is proposed to increase the utility of PIRMS.

expected utility theory

Expected utility theory is a well-known economic theory that predicts the expected utility that an individual or an organization is expected to reach under constraints (Briggs, 2019; Expected Utility, 2021). In economics, utility theory predicts consumers' decision-making using the principle of utility maximization. However, maximization is not without constraints. The model measures consumers' preferences (what they want) and constraints (their budget limit). Using a utility function, the model maximizes what consumers desire, subject to what they can afford. By applying the same token in risk management, the logic is as follows. The idea is to accept the reality that there are organizational aims (like what consumers desire), and there is opportunistic behavior functioning as constraints (like budget constraints). This calls for a solution to deal with factors that motivate opportunistic behaviors.

Applying expected utility theory to increase the utility of PIRMS

Realizing a project initiation requires two inputs, expertise, and an investment. The contractor possesses expertise (know-how of how to build), and the project owner funds the project. It is vital to acknowledge the aim of both organizations. Contractors aim to profit, and project owners aim to maximize value. My understanding is that the risk management model needs to enable an optimization of the organizations' aims by dealing with the constraints that inhibit optimizations. As it stands today, the constraints are opportunistic behaviors, to either protect interests (aims) or to exploit the other party. The risk management model must include incentive mechanisms that reconcile the aims of both organizations. That way, the interests of each party are kept, leading to a reduction or an absence of opportunistic enactment. The following paragraphs explain my assumptions further.

Bad risk culture could be a consequence of change resistance, not the core issue as it may seem to be

Most informants have proposed a risk culture change as a solution, though no one is sure how to achieve that. Implicitly, however, they indicated what could potentially be helpful. Contractors highlight incentives as crucial factors to discourage opportunistic risk

management. The project owners were more concerned with highlighting bad risk culture as the main problem.

Bad risk culture due to a lack of knowledge can be fixed through a set of correctional mechanisms. But bad risk culture caused by underlying problems requires another approach. Risk management in the construction field seems to be challenged by the latter. As stated, informants in this study have urged for risk culture. However, the kind of change they refer to is curing bad risk culture that stems from a lack of know-how. For example, being unable to implement the PIRMS appropriately. It might also be linked to unwillingness to embrace a new approach. In that sense, bad risk culture seems to be the surface symptom. The underlying factors encouraging bad risk culture must be examined.

Change resistance seems to be a tool used to protect interests

Change resistance appears to discourage risk culture change. It seems appropriate to examine why change resistance occurs. As indicated in (Dent and Goldberg, 1999), change resistance in an organizational context refers to fearing loss of status, loss of pay, or loss of comfort. In that sense, the resistance to applying PIRMS could be due to fear of losing current benefits or the unknown. Informants indicate that various factors could motivate change resistance. But change leading to a loss of present benefits is highly concerning to project owners and contractors alike. Therefore, distinguishing what is at stake for them is important. In that sense, change resistance emerges as a tool used to protect interests. Establishing some assumptions is necessary to further the idea.

It must be acknowledged that project owners and contractors depend on each other to achieve their goals. It also must be accepted that avoiding bounded rationality is an impossibility currently, which leaves room for opportunistic behavior. And due to bounded rationality, event risks cannot be predicted. Given the assumptions, one must distinguish factors motivating changing resistance.

Change resistance factors and a proposal to deal with them

Two contesting aims seem to exist between project owners and contractors. While project owners seek value creation, contractors seek profitability, except for nonprofit works. This reality is significant since it defines what is at stake. On the project owners' side, maximizing value creation for the invested capital is at stake. For contractors, their ability to survive as a firm depends on profitability, and their obligation to increase the shareholder's share value necessitates them to be profit-oriented.

It seems that the solution lies in recognizing the aims as stated and devising a model that reconciles the two propositions. My understanding is that a model that uses incentives to reconcile the aims of both could be su

6 Conclusion

This chapter summarizes key findings by answering the research questions and evaluates the study's quality. This study explored the core problems that motivate risk management malpractice by studying the effects of PIRMS on the BVP pilot projects in Norway. The study has identified the advantages and disadvantages of PIRMS. Ways to improve future implementation of PIRMS are recommended, and a proposal to increase the utility of PIRMS is forwarded. This thesis explored the following research questions.

1. What are the critical factors needed to optimally apply the PIRMS model?

    1 A. How should PIRMS be implemented, and what was practiced?
    1 B. Which situational factors influenced how PIRMS was practiced?
    1 C. Theory of PIRMS and practice discrepancies, why they occur?

2. Which advantages and disadvantages of current practice were observed?
3. What can be done to better apply the PIRMS model and increase its utility?

6.1 Critical factors needed to optimally apply PIRMS

Research question 1A was explored by examining discrepancies between recommended PIRMS implementation & practice. The objective was to evaluate how well implementation recommendations of PIRMS were practiced. Generally, there is reason to conclude that practitioners understood the recommendations and the model to varying levels. Findings indicate that inconsistencies and deviations did occur. The performance monitoring tools in PIRMS were not used consistently, prompting a relapse to MDC. The reason for that seems to be a poor procurement execution that did not facilitate the best premise for the optimal effect of PIRMS. Though the projects mostly followed the recommendation, the quality of implementations was fragmented. Overall, the recommendations were not satisfactorily converted into practice, urging improved implementation in the future.

The situational factors influencing how PIRMS is practiced were identified. The objective was to explore why the pilot projects implemented PIRMS in a particular way. Situational factors were identified by exploring aspects contributing to situational change factors that influence how implementation recommendations were practiced. The situational factors that emerged appear to be the external and internal situations that affect risk attitude: (l) Level of relevant skills, knowledge, or expertise, and (2) Potential for direct consequences. In this case, the risk is not in its conventional sense a risk to the project, but a perceived usage risk to the contractors and project owners. The analysis indicated that the situational factor motivating a change changes in perception seem to be due to inexperience and a perceived consequence of using PIRMS as a risk by itself, Overall, the descriptions that emerged in the analysis indicate that the characteristics that could be passive resistance forms to change.

Why discrepancies between implementation recommendations and practice occur were studied. The objective was to explore what may have caused deviations between recommended PIRMS implementation. Two significant reasons explaining why discrepancies occurred were identified. (l) The ideal premise (as outlined in question l A) for the PIRMS model to optimally function was not created. lack of sufficient standardized guidance on implementation the low willingness and readiness to embrace the model were contributing factors, suggesting change resistance. Moreover, the differences had to do with the model lacking comprehensiveness. (2) it appears that the implementation challenges faced were beyond a simple diagnosis of lack of knowledge or distrust. The issue seems to regard behavioral constituents. It appears to be an issue of change resistance, bad risk culture, and opportunism. From TCT, we can understand that opportunistic behavior poses a challenge. In this case, it was observed through reactive risk measures, indicating opportunism and bad risk culture. Change resistance to protect self-interest seems to motivate bad risk culture and opportunism. In that sense, resistance to change does not seem to be an issue in its traditional sense. In other words, change resistance seems to be a tool used to protect interests, leading to discrepancies among other outcomes.

The critical factors needed to optimally apply PIRMS are the following

1. Sufficient understanding of the BVA model to convert recommendations into practice is key
2. The willingness and readiness of practitioners is a critical factor that can influence whether PIRMS is applied to attain a higher effect
3. The PIRMS model itself must be improved. It lacks comprehensiveness, undermining its potential. Most critically, the model must include sub-contractors as part of the solution.

6.2 Advantages and disadvantages of PIRMS

The objective was to evaluate whether the advantages attained reflect the six mechanisms underlying PIRMS as stipulated in Kashiwagi (2016a, chaps 6–7). An evaluation of whether the advantages agree with the advantages remarked in other studies was also given. It could enable us to identify which aspects did and did not work well in the Norwegian market. The following advantages and disadvantages were identified.

Advantages	Disadvantages
Greater risk understanding	Perceived market suitability issues
Improved RM processes	Lack of comprehensiveness
Better risk measures	

The advantages identified by both contractors and project owners were similar. Overall, the advantages identified reflect the six mechanisms underpinning PIRMS developed from the reference books. However, there were disadvantages. Whereas enhanced risk understanding, improved risk management processes, and better risk measures have resulted in a promising

result, market suitability issues and lack of comprehensiveness undermine the benefits. paint an opposite picture.

The question of what did and did not work well could not be established. There were, however, doubts regarding whether dominant information leads to transparency. Perhaps that might indicate the perceived low value of dominant information in the Norwegian market. Possibly, the greatest critique concerned why sub-contractors are not considered part of the solution. . It was not perceived to work well in the Norwegian market demography. Contrary to the second mechanism underpinning PIRMS, the model was also observed to be resource-intensive to some degree.

6.3 Recommendations to better apply the PIRMS model and increase its utility

Recommendations to better apply PIRMS

The objective was to address what is needed to effectively implement the model. Five recommendations are given to improve future implementations of PIRMS.

Recommendations
1. knowledge enhancement is needed
2. Collaborative efforts are essential
3. Adopt a structured working practice
4. The project deliverable descriptions should be functional, not detailed
5. Implement the BVA model to eliminate the drawbacks of hybrids

knowledge enhancement is needed: A standardized implementation model is needed to reduce confusion and increase consistency during implementation. Moreover, knowledge sharing is key to fostering a standardized implementation model.

Collaborative efforts are essential: The core team should comprise inter-disciplinary members when developing the RMP. Individuals with different backgrounds can enhance the thoroughness of identified risks, and the risks' impact can be better predicted. Increased collaboration between the contractor and project owner is vital when developing the RMP during the concretization phase. for further development of the RMP in the concretization phase is vital. Project owners must meet contractors being well prepared by thoroughly identifying risks that the contractor did not include. Literature and informants indicated that using contracts to exercise mediated power does not improve risk mismanagement. A contract can create a hostile environment between the project owners and contractor when used to change one's behavior through mediated power.

Adopt a structured working practice : PIRMS requires structured working manners. Informants have disclosed that the Norwegian construction sector lacks development in terms

of working in a structured discipline. A structured working practice should be devised to better implements PIRMS. This has implications for the performance.

The project deliverable descriptions should be functional not detailed: PIRMS uses BVP to procure the ideal contractor on merits. When the descriptions are functional, contractors emphasize that they are likely to identify the project owners' risk. When project owners specify deliverables in a detailed manner, the advantage to utilize ECI is lost.

Implement the BVA model to eliminate the drawbacks of hybrids: The informants' evaluation conclusively indicated that hybrids created confusion and decreased the benefit of PIRMS. It is not possible to conclude based on finding here whether having a fully BVA piloting conduct would have resolved the issue. However, the findings indicate that implementing hybrids might have prevented the full utility of PIRMS. Moreover, hybrids seem to encourage a relapse to old ways. It could be a better alternative to implement the BVA model.

A recommendation to increase the utility of PIRMS

The study has identified that PIRMS does not fundamentally solve risk management malpractice issues. Though informants recognize the innovativeness of the model, they seem to perceive the solution as incomplete. From what can be assumed, it appears that the utility function area of PIRMS is limited. A recommendation calling for an expansion of the utility function is outlined. Findings seem to indicate that the core issues motivating malpractice are linked to a lack of incentive mechanisms that discourage opportunistic behavior.

Factors encouraging opportunistic behaviors were explored. Findings show that, ultimately, the same factors motivating change resistance are what propagate into opportunistic behavior. Informants have highlighted that bad risk culture and lack of incentives are crucial factors of risk culture change resistance. It appears that bad risk culture could be a consequence of change resistance, not the core issue as it may seem to be. Change resistance also emerges as a tool used to protect interests. Overall, findings suggest that an incentive-based risk management model that maintains the aims of both organizations is needed. For this, it is recommended to expand the utility function area of PIRMS. It could address the fundamental malpractice issues with a better impact factor.

6.4 Are the findings transferable?

The criterion set to evaluate the study's transferability was a thick description of findings. The study's qualitative design approach does not provide grounds to generalize the findings of this study. Some of the findings can, however, have transferable value. The following paragraphs distinguish conditions that could enable or that prevent transferability. The study has two significant findings with a transferability potential. (1) Ways to improve the future implementation of PIRMS, and (2) a proposal to increase the utility of PIRMS.

1: The improvement recommendations could be transferable to other risk management models, especially recommendations 1-4. Literature indicates that most risk management models could benefit from an improved implementation. Yet, since geographical limitations

apply (informants only from Norway), the findings reflect risk management practice in Norway. The recommendations might thus not be transferable outside Norway.

2: Much of the mismanagement issues that emerged from the analysis agree with the literature included in this thesis. Malpractice appears to occur for reasons intrinsically tied to lacking incentive mechanisms that protect owners' and constructions' interests. It suggests that the utility of PIRMS can likely expand by shifting the focus area to focus on incentive mechanisms. Proposing a possible way to increase the utility of PIRMS is not geographically limited. The proposal is an idea draft to spark further research. Promoters of the model reading this thesis in Norway or other countries can further build on the proposal. However, since the proposal stems from a personal appraisal of the issues and model, the reader may have a differing understanding. It might lead to a low transferability value.

6.5 Final remark

Findings suggest that the PIRMS model leads to a better risk management process and counters some of the fundamental mismanagement issues. However, it does not seem to solve the core issues of risk management. Recommendations for ways to enhance current implementation methods are given. Part of the solution to advance toward a holistic risk management model is, to correctly implement existing models. A recommendation for a possible way to increase the utility of PIRMS is forwarded. The journey to a holistic model must continue to evolve by improving current models. Doing so will improve the model's effectiveness. Perhaps a perfect holistic risk management model may not be achievable. However, it seems possible to at least enhance current models.

6.6 Further research

The following recommendation for further research is based on the findings of this research. The recommendation could validate the findings in this study.

This thesis has proposed to increase the utility of PIRMS by using incentive mechanisms that reduce opportunism. In this study, opportunism appeared to be the instrument in which change resistance materializes from the contractors' side. It emerged as a need to maintain business survivability. Studies examined have shown that the effect of risk transferring contracts to prevent opportunism is limited. An emerging body of literature indicates that alliancing contracts that foster relational collaboration could discourage opportunistic behavior. Overall, findings suggest that further examination of how opportunism factors affect risk management could be beneficial.

Informants in this study have highlighted that using PIRMS improves risk understanding and mitigation. From theory, high risk maturity is known to be a key factor to improve risk managing ability. Since a high incentive mechanism is recommended to solve opportunism, it could be useful to examine how risk maturity levels of contractors correlate with the degree of opportunism? Specifically, a correlation test between opportunism and risk maturity, with

incentive mechanisms as moderators, could inform whether high incentive mechanism can reduce opportunism. Since there are multiple dependent and independent variables, multivariate regression or MANOVA tests could be used to test hypotheses. As a point of departure, three assumptions for hypotheses are forwarded below.

The phrase (a need) in this recommendation is contextually used. A need for opportunism refers to (1) contractors' lack of sufficient risk managing ability (low or moderate risk maturity level), enticing opportunistic behavior, or (2) contractors with a high risk managing ability (high risk maturity level) but that choose to unilaterally exploit favorable conditions for excessive profit.

Assumptions regarding risk maturity and opportunism, the moderating factors are not provided

- Highly risk mature contractors do not need to be opportunistic (they perceive risks as manageable due to having the will and ability to manage risks),
- Moderately risk mature contractors need to be opportunistic (they perceive risks unmanageable due to lack of risk managing ability),
- Low-risk mature contractors need to be opportunistic (they perceive risks unmanageable due to lack of risk managing ability)

7 Reference list

Altarawneh, L., Mackee, J. and Gajendran, T. (2018) 'The influence of cognitive and affective risk perceptions on flood preparedness intentions: A dual-process approach', *Procedia Engineering*, 212, pp. 1203–1210. doi:10.1016/j.proeng.2018.01.155.

Armenakis, A., Harris, S. and Mossholder, K. (1993) 'Creating Readiness for Organizational Change', *Human Relations*, 46, pp. 681–704. doi:10.1177/001872679304600601.

Attride-Stirling, J. (2001) 'Thematic networks: an analytic tool for qualitative research', *Qualitative Research*, 1(3), pp. 385–405. doi:10.1177/146879410100100307.

Austeng, K. *et al.* (1998) *Gjennomføringsmodeller og Kontraktstrategier. Prosjektstyring år Juli Gjennomføringsmodeller og kontraktstrategier* -. Available at: https://www.prosjektnorge.no/wp-content/uploads/2017/12/43-Gjennomforingsmodeller-og-kontraktstrategier.pdf (Accessed: 26 February 2022).

Austeng, K. *et al.* (2005) *Usikkerhetsanalyse: Metoder*. 12. Norwegian University of Science and Technology: Department of Civil and Environmental Engineering. Available at: https://ntnuopen.ntnu.no/ntnu-xmlui/handle/11250/228073 (Accessed: 26 February 2022).

Austeng, K., Midtbø, J.T. and Jordanger, I. (2005) 'Usikkerhetsanalyse - Kontekst og grunnlag', *Concept rapport* [Preprint], (Nr. 10).

Aven, T. and Renn, O. (2009) 'On risk defined as an event where the outcome is uncertain', *Journal of Risk Research*, 12(1), pp. 1–11. doi:10.1080/13669870802488883.

Beatham, S. *et al.* (2004) 'KPIs: a critical appraisal of their use in construction', 11(1), pp. 93–117. doi:10.1108/14635770410520320.

Bertram H., R. and John R. P. Jr., F. (1959) 'The bases of social power', *Studies in Social Power Publication Title: Studies in Social Power*, 6.

Bordia, P. *et al.* (2004) 'Uncertainty during organizational change: Is it all about control?', *European Journal of Work & Organizational Psychology*, 13. doi:10.1080/13594320444000128.

Bos, A., Kashiwagi, D. and Kashiwagi, I. (2020) 'Changes Required to Sustain a Best Value Environment', *Journal for the Advancement of Performance Information and Value*, 7(1), p. 26. doi:10.37265/japiv.v7i1.52.

Boyce, P. (2021) 'Bounded Rationality (Definition and 3 Examples)', *BoyceWire*, 16 February. Available at: https://boycewire.com/bounded-rationality-definition/ (Accessed: 26 February 2022).

Braun, V. and Clarke, V. (2006) 'Using thematic analysis in psychology', *Qualitative Research in Psychology*, 3(2), pp. 77–101. doi:10.1191/1478088706qp063oa.

Burke, T. (1998) 'Risks and reputations: the economics of transaction costs', *Corporate Communications: An International Journal*, 3(1), pp. 5–10. doi:10.1108/eb046547.

Caldwell, S.D., Herold, D.M. and Fedor, D.B. (2004) 'Toward an Understanding of the Relationships Among Organizational Change, Individual Differences, and Changes in Person-Environment Fit: A Cross-Level Study', *Journal of Applied Psychology*, 89(5), pp. 868–882. doi:10.1037/0021-9010.89.5.868.

Creswell, J.W. and Creswell, J.D. (2018) *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*. Fifth edition. SAGE Publications, Inc.

De Groot, K. and Thurik, R. (2018) 'Disentangling Risk and Uncertainty: When Risk-Taking Measures Are Not About Risk', 9. doi:10.3389/fpsyg.2018.02194.

Dent, E. and Goldberg, S. (1999) 'Challenging "Resistance to Change"', *The Journal of Applied Behavioral Science*, 35, pp. 25–41. doi:10.1177/0021886399351003.

DFØ (2020a) *Beskrivelse av pilotering BVP i Norge*, *Anskaffelser.no*. Available at: https://anskaffelser.d7.prod.dfo-dev.no/verktoy/veiledere/beskrivelse-av-pilotering-bvp-i-norge (Accessed: 25 January 2022).

DFØ (2020b) *Veileder i prestasjonsinnkjøp – Best Value Procurement (BVP) | Anskaffelser.no*. Available at: https://www.anskaffelser.no/verktoy/veiledere/veileder-i-prestasjonsinnkjop-best-value-procurement-bvp (Accessed: 12 September 2021).

Dikmen, I. *et al.* (2018) 'Effects of Risk Attitude and Controllability Assumption on Risk Ratings: Observational Study on International Construction Project Risk Assessment', *Journal of Management in Engineering*, 34(6), p. 04018037. doi:10.1061/(ASCE)ME.1943-5479.0000643.

Elias, S.M. (2009) 'Employee Commitment in Times of Change: Assessing the Importance of Attitudes Toward Organizational Change †', *Journal of Management*, 35(1), pp. 37–55. doi:10.1177/0149206307308910.

Erwin, D.G. and Garman, A.N. (2010) 'Resistance to organizational change: linking research and practice', *Leadership & Organization Development Journal*, 31(1), pp. 39–56. doi:10.1108/01437731011010371.

Farrell, A. and Sunindijo, R. (2020) 'Overcoming challenges of early contractor involvement in local government projects', *International Journal of Construction Management* [Preprint]. doi:10.1080/15623599.2020.1744216.

Fazio, R.H., Eiser, J.R. and Shook, N.J. (2004) 'Attitude formation through exploration: Valence asymmetries', *Journal of Personality and Social Psychology*, 87(3), pp. 293–311. doi:10.1037/0022-3514.87.3.293.

Fransen, M.L., Smit, E.G. and Verlegh, P.W.J. (2015) 'Strategies and motives for resistance to persuasion: an integrative framework', *Frontiers in Psychology*, 6. doi:10.3389/fpsyg.2015.01201.

Gigliotti, R. *et al.* (2019) 'The Role of Perceived Organizational Support in Individual Change Readiness', *Journal of Change Management*, 19(2), pp. 86–100. doi:10.1080/14697017.2018.1459784.

Guest, G., Namey, E.E. and Mitchell, M.L. (2013) *Collecting Qualitative Data: A Field Manual for Applied Research*. 1 Oliver's Yard, 55 City Road London EC1Y 1SP: SAGE Publications, Ltd. doi:10.4135/9781506374680.

Handley, S.M. and Benton, W.C. (2012) 'Mediated power and outsourcing relationships', *Journal of Operations Management*, 30(3), pp. 253–267. doi:10.1016/j.jom.2011.11.004.

Harvard Law School (2022) 'What is Principal Agent Theory?' Available at: https://www.pon.harvard.edu/tag/principal-agent-theory/ (Accessed: 24 February 2022).

Hayes, A. (2021) *What Is Vertical Integration?*, *Investopedia*. Available at: https://www.investopedia.com/terms/v/verticalintegration.asp.

Hillson, D. (2009) *Managing risk in projects*. Farnham, England : Burlington, VT: Gower (Fundamentals of project management).

Hillson, D. (2019) *Capturing upside risk: finding and managing opportunities in projects*. 1st edn. CRC Press, Taylor & Francis Group.

Hillson, D. and Murray-Webster, R. (2005) *Understanding and Managing Risk Attitude*. 1st edn. Aldershot, England: Gower Publishing Limited.

J. Perrenoud, A., C. Lines, B. and T. Sullivan, K. (2014) 'Measuring risk management performance within a capital program', *Journal of Facilities Management*, 12(2), pp. 158–171. doi:10.1108/JFM-03-2013-0018.

Kanter, R.M. (2012) 'Ten Reasons People Resist Change', *Harvard Business Review*, 25 September. Available at: https://hbr.org/2012/09/ten-reasons-people-resist-chang (Accessed: 4 November 2022).

Kashiwagi, D. (2002) 'APPLICATION OF INFORMATION MEASUREMENT THEORY (IMT) TO CONSTRUCTION', in *18th Annual ARCOM Conference*. *Association of Researchers in Construction Management*, Northumbria, UK, pp. 511–21.

Kashiwagi, D. *et al.* (2015) 'The Development of the Best Value Approach in the State of Minnesota', *Journal for the Advancement of Performance Information & Value*, 7, p. 116. doi:10.37265/japiv.v7i1.58.

Kashiwagi, D., Parmar, D. and Savicky, J. (2004) 'Traditional low-bid procurement system versus performance information procurement system (pips) in construction industry', in. Edinburgh, UK: ARCOM, pp. 703–9.

Kashiwagi, D. and Scholar, F. (2011) 'Case Study: Best Value Procurement/Performance Information Procurement System Development', 3(1), p. 36. doi:10.37265/japiv.v3i1.104.

Kashiwagi, D.T., Ph.D. (2016a) *2016 Best Value Approach*. Mesa, Arizona: Kashiwagi Solution Model (KSM).

Kashiwagi, D.T., Ph.D. (2016b) *2016 Information Measurement Theory with the "Kashiwagi Story"*. Mesa, Arizona: Kashiwagi Solution Model (KSM).

KENTON, W. (2021) *What Is Asset Specificity?*, *Investopedia*. Available at: https://www.investopedia.com/terms/a/asset-specificity.asp (Accessed: 13 April 2022).

Ketokivi, M. and Mahoney, J.T. (2017) *Transaction Cost Economics as a Theory of the Firm, Management, and Governance*, *Oxford Research Encyclopedia of Business and Management*. doi:10.1093/acrefore/9780190224851.013.6.

Kim, T.G., Hornung, S. and Rousseau, D.M. (2011) 'Change-Supportive Employee Behavior: Antecedents and the Moderating Role of Time', *Journal of Management*, 37(6), pp. 1664–1693. doi:10.1177/0149206310364243.

Klakegg, O.J. (2020) *Er Norge klar for alliansemodeller for infrastrukturprosjekt?* Available at: https://www.bygg.no/article/1439003!/ (Accessed: 14 March 2022).

Kovach, M. (2020) 'Leader Influence: A Research Review of French & Raven's (1959) Power Dynamics', *The Journal of Values-Based Leadership*, 13(2). doi:10.22543/0733.132.1312.

Kvaløy, O. (2007) 'Asset Specificity and Vertical Integration', *The Scandinavian Journal of Economics*, 109(3), pp. 551–572. doi:10.1111/j..1467-9442.2007.0050.7.x.

Lædre, O. (2009) *Er det noen sak? Forebygging og håndtering av tvister i bygg- og anleggsprosjekter*. Tapir Akademisk Forlag.

Lædre, O. (2012) *Gjøre det selv eller betale andre for jobben: byggherrens valg av kontraktstrategi i bygg- og anleggsprosjekt*. Monograph 3. Norwegian University of Science and Technology. Available at: https://www.ntnu.no/documents/1261860271/1262010610/Temahefte_Kontraktstrategi_webutgave.pdf/4854197e-6f54-408c-a5bf-5b86d720307a (Accessed: 28 January 2022).

Lau, C.-M. and Woodman, R.W. (1995) 'Understanding organizational change: A schematic perspective', *Academy of Management Journal*, 38(2), pp. 537–554. doi:10.2307/256692.

Lau, E. and Rowlinson, S. (2009) 'Interpersonal trust and inter-firm trust in construction projects', *Construction Management and Economics*, 27(6), pp. 539–554. doi:10.1080/01446190903003886.

Lincoln, Y.S. and Guba, E.G. (1985) *Naturalistic inquiry*. Beverly Hills, Calif: Sage Publications.

Lines, B.C. *et al.* (2017) 'Implementing Project Delivery Process Improvements: Identification of Resistance Types and Frequencies', *Journal of Management in Engineering*, 33(1). doi:10.1061/(ASCE)ME.1943-5479.0000480.

Lokko, H.N. and Stern, T.A. (2015) 'Regression: Diagnosis, Evaluation, and Management', *The Primary Care Companion for CNS Disorders*, 17(3), p. 10.4088/PCC.14f01761. doi:10.4088/PCC.14f01761.

Luo, L. *et al.* (2017) 'Construction Project Complexity: Research Trends and Implications', 143(7), p. 04017019. doi:10.1061/(ASCE)CO.1943-7862.0001306.

Mahamid, I. (2016) 'Factors contributing to poor performance in construction projects: studies of Saudi Arabia', *Australian Journal of Multi-Disciplinary Engineering*, 12(1), pp. 27–38. doi:10.1080/14488388.2016.1243034.

McKinsey Global Institute (2017) *Reinventing construction through a productivity revolution | McKinsey*. Available at: https://www.mckinsey.com/~/media/mckinsey/business%20functions/operations/our%20insights/reinventing%20construction%20through%20a%20productivity%20revolution/mgi-reinventing-construction-executive-summary.pdf (Accessed: 17 February 2022).

Meyer, J. *et al.* (2011) 'General services administration tests the best value pips paradigm', *Malaysian Construction Research Journal*, 8(1), pp. 18–34.

MIT Libraries (2022) *MIT Libraries: Database Search Tips*. Available at: https://libguides.mit.edu/c.php?g=175963&p=1158679 (Accessed: 13 September 2021).

Narmo, M., Wondimu, P.A. and Lædre, O. (2018) 'Best Value Procurement (BVP) in a Mega Infrastructure Project', in. *26th Annual Conference of the International Group for Lean Construction*, pp. 23–33. Available at: https://iglc.net/Papers/Details/1545 (Accessed: 23 April 2022).

NTNU Universitetsbiblioteket (2020) *Finne kilder - Kunnskapsbasen - NTNU*. Available at: https://i.ntnu.no/wiki/-/wiki/norsk/finne+kilder (Accessed: 13 September 2021).

NTNU Universitetsbiblioteket (2022) *Avanserte litteratursøk - Kunnskapsbasen - NTNU*. Available at: https://i.ntnu.no/wiki/-/wiki/Norsk/Avanserte+litteraturs%C3%B8k (Accessed: 13 September 2021).

Nygård, E.F., Wondimu, P. and Lædre, O. (2019) 'Best Value Procurement – Experiences From the Execution Phase', in. *27th Annual Conference of the International Group for Lean Construction (IGLC)*, Dublin, Ireland, pp. 109–120. Available at: http://iglc.net/Papers/Details/1627 (Accessed: 30 September 2021).

Ogunsanmi, O., Salako, O. and Ajayi, O. (2011) 'Risk Classification Model for Design and Build Projects', *Journal of Engineering, Project, and Production Management*, 1, p. 1(1), 46–60. doi:10.32738/JEPPM.201107.0006.

Oreg, S. (2003) 'Resistance to change: developing an individual differences measure', *The Journal of Applied Psychology*, 88(4), pp. 680–693. doi:10.1037/0021-9010.88.4.680.

Oreg, S., Vakola, M. and Armenakis, A. (2011) 'Change Recipients' Reactions to Organizational Change: A 60-Year Review of Quantitative Studies', *The Journal of Applied Behavioral Science*, 47(4), pp. 461–524. doi:10.1177/0021886310396550.

Patten, M.L. and Newhart, M. (2018) *Understanding Research Methods: An Overview of the Essentials*. 10th edn. New York and London: Routledge.

Perrenoud, A. *et al.* (2017) 'Using Best-Value Procurement to Measure the Impact of Initial Risk-Management Capability on Qualitative Construction Performance', *Journal of Management in Engineering*, 33(5), p. 04017019. doi:10.1061/(ASCE)ME.1943-5479.0000535.

Project Management Institute (2017) *PMBOK Guide*. 6th edn. Inc. 14 Campus Boulevard Newtown Square, Pennsylvania: Project Management Institute. Available at: https://www.pmi.org/pmbok-guide-standards/foundational/pmbok.

Rehman, N. *et al.* (2021) 'The Psychology of Resistance to Change: The Antidotal Effect of Organizational Justice, Support and Leader-Member Exchange', *Frontiers in Psychology*, 12, p. 678952. doi:10.3389/fpsyg.2021.678952.

Rivera, A. *et al.* (2016) 'Identifying the Global Performance of the Construction Industry', *Journal for the Advancement of Performance Information and Value*, 8(2), pp. 7–7. doi:10.37265/japiv.v8i2.61.

Rolstadås, A. (2020) 'usikkerhet – prosjektledelse'. Available at: http://snl.no/usikkerhet_-_prosjektledelse (Accessed: 17 March 2022).

Schnietz, K. and Kachra, A. (2013) *opportunism | economics | Britannica*. Available at: https://www.britannica.com/topic/opportunism (Accessed: 16 April 2022).

Sherman, D.K. and Cohen, G.L. (2002) 'Accepting threatening information: Self-affirmation and the reduction of defensive biases', *Current Directions in Psychological Science*, 11(4), pp. 119–123. doi:10.1111/1467-8721.00182.

Shi, C. *et al.* (2018) 'Asset Specificity and Contractors' Opportunistic Behavior: Moderating Roles of Contract and Trust', *Journal of Management in Engineering*, 34(5), p. 04018026. doi:10.1061/(ASCE)ME.1943-5479.0000632.

Sisgold, S. (2014) *Conscious and Unconscious Regression | Psychology Today*. Available at: https://www.psychologytoday.com/us/blog/life-in-body/201409/conscious-and-unconscious-regression (Accessed: 14 April 2022).

Snippert, T. *et al.* (2015) 'Barriers to realizing a stewardship relation between client and vendor: the Best Value approach', *Construction Management and Economics*, 33(7), pp. 569–586. doi:10.1080/01446193.2015.1078902.

Sødal, A.H. *et al.* (2014) 'Early Contractor Involvement :Advantages and Disadvantages for the Design Team', in. *22nd Annual Conference of the International Group for Lean Construction*, pp. 519–531. Available at: https://iglc.net/papers/Details/1003 (Accessed: 10 March 2021).

Spikin, I.J.C. (2013) *Developing a risk management maturity model: a comprehensive risk maturity model for Dutch municipalities*. PHD. University of Twente.

Storteboom, A. *et al.* (2017) 'Best Value Procurement - The Practical Approach In The Netherlands', in *Procedia Computer Science*, pp. 398–406. Available at: https://www.sciencedirect.com/science/article/pii/S1877050917322470 (Accessed: 13 May 2022).

Taroun, A. (2014) 'Towards a better modelling and assessment of construction risk: Insights from a literature review', *International Journal of Project Management*, 32(1), pp. 101–115. doi:10.1016/j.ijproman.2013.03.004.

Taroun, A., Yang, J. and Lowe, D. (2011) 'Construction Risk Modelling and Assessment: Insights from a Literature Review', *Journal of the Built and Human Environment Review* [Preprint].

The Mind Tools (2022) *French and Raven's Five Forms of Power: Understanding Where Power Comes From in the Workplace*. Available at: http://www.mindtools.com/pages/article/newLDR_56.htm (Accessed: 28 February 2022).

TODSEN, S. (2018) *Produktivitetsfall i bygg og anlegg*. Available at: https://www.ssb.no/bygg-bolig-og-eiendom/artikler-og-publikasjoner/produktivitsfall-i-bygg-og-anlegg (Accessed: 4 February 2022).

Vita, G., Tekaya, A. and Wang, C. (2011) 'The Many Faces of Asset Specificity: A Critical Review of Key Theoretical Perspectives', *International Journal of Management Reviews*, 13. doi:10.1111/j.1468-2370.2010.00294.x.

Wang, D., Fang, S. and Li, K. (2019) 'Dynamic changes of governance mechanisms in mega construction projects in China: The mediating role of opportunism', *Engineering, Construction and Architectural Management*, 26(4), pp. 723–735. doi:10.1108/ECAM-03-2018-0137.

Wang, D., Fu, H. and Fang, S. (2019) 'The efficacy of trust for the governance of uncertainty and opportunism in megaprojects: The moderating role of contractual control', *Engineering, Construction and Architectural Management*, 27(1), pp. 150–167. doi:10.1108/ECAM-09-2018-0409.

Wang, Y. *et al.* (2019) 'Revisiting the Relationship Between Contract Governance and Contractors' Opportunistic Behavior in Construction Projects', *IEEE Transactions on Engineering Management* [Preprint]. doi:10.1109/tem.2019.2945551.

Warner-Søderholm, G. (2012) 'Culture Matters: Norwegian cultural identity within a scandinavian context', *SAGE Open*, 2(4), p. 2158244012471350. doi:10.1177/2158244012471350.

Weaver, P. (2008) 'The meaning of risk in an uncertain world', in. *PMI Global Congress 2008 - Malta*, St. Julian's, Malta: Project Management Institute (PMI).

Weinstein, N.D., Rothman, A.J. and Nicolich, M. (1998) 'Use of correlational data to examine the effects of risk perceptions on precautionary behavior', *Psychology & Health*, 13(3), pp. 479–501. doi:10.1080/08870449808407305.

Welde, M. (2017) *Cost performance in large government investment projects that have been subjected to external quality assurance*. 51. Norwegian University of Science and Technology, p. 12. Available at: https://www.ntnu.no/documents/1261860271/1262010703/Concept_reeport_51_eng_web.pdf/4e9e286f-03f7-491a-810d-aabcdfa28aee?version=1.0 (Accessed: 1 March 2022).

Wheeler, G. (2020) ‘Bounded Rationality’, in Zalta, E.N. (ed.) *The Stanford Encyclopedia of Philosophy*. Fall 2020. Metaphysics Research Lab, Stanford University. Available at: https://plato.stanford.edu/archives/fall2020/entries/bounded-rationality/ (Accessed: 17 March 2022).

Williams, T.M. (1999) ‘The need for new paradigms for complex projects’, 17(5), pp. 269–273. doi:10.1016/S0263-7863(98)00047-7.

Williamson, O.E. (1981) ‘The Economics of Organization: The Transaction Cost Approach’, *American Journal of Sociology*, 87(3), pp. 548–577.

Witteveen, W. and Rijt, J. (2013) ‘Possible Barriers to a Successful Further Diffusion of the Best Value Approach in the Netherlands Possible Barriers to a Successful Further Diffusion of the Best Value Approach in the Netherlands: Observations of Major Misunderstandings on the Concept and Theory’, *Journal for the Advancement of Performance Information and Value*, 5. doi:10.37265/japiv.v5i2.75.

Wondimu, P.A., Klakegg, O.J. and Lædre, O. (2020) ‘Early contractor involvement (ECI): ways to do it in public projects’, *Journal of Public Procurement*, 20(1), pp. 62–87. doi:10.1108/JOPP-03-2019-0015.

Ying, F.J., Zhao, N. and Tookey, J. (2021) ‘Achieving construction innovation in best value procurement projects: New Zealand mega projects study’, *Construction Innovation*, 22(2), pp. 388–403. doi:10.1108/CI-11-2020-0182.

Yu, W. and Wang, K.-W. (2012) ‘Best Value or Lowest Bid? A Quantitative Perspective’, *Journal of Construction Engineering and Management*, 138(1), pp. 128–134. doi:10.1061/(ASCE)CO.1943-7862.0000414.

Zhang, L. and Qian, Q. (2016) ‘How mediated power affects opportunism in owner–contractor relationships: The role of risk perceptions’, *International Journal of Project Management*, 35. doi:10.1016/j.ijproman.2016.12.003.

Zou, P.X.W., Chen, Y. and Chan, T.-Y. (2010) ‘Understanding and Improving Your Risk Management Capability: Assessment Model for Construction Organizations’, *Journal of Construction Engineering and Management*, 136(8), pp. 854–863. doi:10.1061/(ASCE)CO.1943-7862.0000175.

Appendix

Appendix A: Interview background sent to informants

Appendix B: Approval from the Norwegian Center for Research Data

Appendix C: Interview guide

Appendix D: Codes, basic themes, organizing themes, and global themes

Appendix E: Five topic groups & global themes of the thematic networks developed

Appendix A: Interview background sent to informants

NTNU
Det skapende universitet

Intervjuguide for *Assessing the Best Value Approach risk management practice in Norwegian building projects*

Litt om meg og studiets formål:

Mitt navn er Yimrhane Abebe og skriver en masteroppgave om risiko styringsmodellen Performance Information Risk Management System (PIRMS) til Best Value Approach (BVA). Oppgaven skrives ved NTNU Trondheim, institutt for bygg- og miljøteknikk. Dette intervjuet har til hensikt å samle data for oppgaven som skal ferdigstilles våren juni 2022.

Direktoratet for forvaltning og økonomistyring (DFØ) har anbefalt Best Value Procurement (BVP) for å øke profesjonalitet og effektivitet i offentlige anskaffelser. Siden 2016 har BVP vært pilotert i over 20 prosjekter i Norge. Performance Information Risk Management System (PIRMS) har blitt brukt som en del av (BVP) pilotinitiativet. Formålet med forskningen er å undersøke fordelene og ulempene erfart med modellen, og foreslå forbedrings tiltak. I tillegg vil kjerneproblemene som motiverte mangelfull risikostyring utforskes ved å analysere effekten av PIRMS på pilotprosjektene. Følgende forskningsspørsmål er stilt:

1. Hva er de kritiske faktorene for å gunstig iverksette PIRMS-modellen?

   1A. Hvordan bør PIRMS iverksettes, og hva ble praktisert?
   1B. Hvilke situasjonelle faktorer påvirker hvordan PIRMS praktiseres?
   1C. Teori om PIRMS og praksisavvik, hvorfor oppstår de?

2. Hvilke fordeler og ulemper praksis ble observert ved dagens?
3. Hva kan gjøres for å bedre anvendelse av PIRMS-modellen og øke nytten?

Intervjuet er planlagt å ta 45 minutter - 1 time. Det blir lydopptak dersom du samtykker. I tillegg vil Microsoft Word Dictate funksjonen brukes som transkriberer underveis. Dette for å lette mengden arbeid med transkribering i etterkant. Intervjuet inneholder forhåndsbestemte åpnespørsmål med etterfølgende spørsmål. Men avvik kan i noen grad forekomme underveis. Strukturen på intervjuet vil omfatte innledendespørsmål, hovedspørsmål og avsluttendespørsmål.

Takk for at du setter av tid til intervjuet!

Appendix B: Approval from the Norwegian Center for Research Data

NSD NORSK SENTER FOR FORSKNINGSDATA

Vurdering

Referansenummer

684711
Prosjekttittel

Assessing the Best Value Approach uncertainty management practice in Norwegian building projects

Behandlingsansvarlig institusjon

Norges teknisk-naturvitenskapelige universitet / Fakultet for ingeniørvitenskap / Institutt for bygg- og miljøteknikk

Prosjektansvarlig (vitenskapelig ansatt/veileder eller stipendiat)

Ole Jonny Klakegg
Ole.jonny.klakegg@ntnu.no

Type prosjekt
Studentprosjekt, masterstudium

Kontaktinformasjon, student

Yimrhane Abebe
yimrhana@ntnu.no

Prosjektperiode

20.01.2022 - 11.06.2022

Vurdering (1)

07.04.2022 - Vurdert

OM VURDERINGEN
Personverntjenester har en avtale med institusjonen du forsker eller studerer ved. Denne avtalen innebærer at vi skal gi deg råd slik at behandlingen av personopplysninger i prosjektet ditt er lovlig etter personvernregelverket.

Personverntjenester har nå vurdert den planlagte behandlingen av personopplysninger. Vår vurdering er at behandlingen er lovlig, hvis den gjennomføres slik den er beskrevet i meldeskjemaet med dialog og vedlegg.

DEL PROSJEKTET MED PROSJEKTANSVARLIG
For studenter er det obligatorisk å dele prosjektet med prosjektansvarlig (veileder). Del ved å trykke på knappen
«Del prosjekt» i menylinjen øverst i meldeskjemaet. Prosjektansvarlig bes akseptere invitasjonen innen en uke. Om invitasjonen utløper, må han/hun inviteres på nytt.

Appendix C: Interview Guide

Interview guide for contractors

Innledende spørsmål:

1. Hva er din bransjeerfaring?
2. Har du tatt kurs som omhandler risikohåndtering?
3. Har du tatt BVA-kurs?
4. Hvor mange BVA-prosjekter har du jobbet på?
5. Hvem ble leid inn som ekspert mentor i BVA?
6. Hvor lenge har du jobbet med temaer direkte eller indirekte knyttet til risikostyring?

Hoved spørsmål:

1. Fulgte dere gjennom med ukentlige risikorapportering hele veien? Hvorfor/ hvorfor ikke?
    a. Hva fungerte bra og hva fungert ikke bra?
    b. Hvor godt fulgte dere DFØs veiledning for bruk av de ukentlige risikorapportene?
2. I risikovurderingsplanen har man identifisert risikoer som kan få konsekvenser for økonomi, fremdrift og prosjektmålene.
    a. Hvilke faktorer ble vurdert ved valg av de spesifikke risikoene?
    b. Hvilken type risiko anses vanligvis å ha store konsekvenser for økonomi, fremdrift og prosjektmålene?
    c. Hvilke faktorer påvirket rekkefølgen på risikoene i risikostyringsplanen?
    d. Hvor mange personer jobbet med utviklingen av RSP? (en gruppe (hvor mange deltakere?) eller en person?)
3. Hvordan påvirket bruken av ukentlige risikorapporteringsregister risikotiltakene?
    a. Gjør prosedyren konsekvensene av risikotiltak tydeligere
4. BVA modellen understreker at RVP og URR skal brukes som hovedverktøy for risikostyring i gjennomføringsfasen og skal dermed være kontraktfestet. Det har kommet frem i masteroppgaver at RVP og URR ikke er kontraktfestet. (NS8407)
    a. Hvordan påvirket det risikotiltakene?
    b. Hva mener du er en god løsning på det?
5. BVA-metoden tilsier at både negative og positive risikoer med konsekvenser for økonomi, fremdrift og prosjektmålene skal registreres i RVP.
    a. Hvilke fordeler får man av praksisen?
6. For forutsette og uforutsette risikoer som forekommer, hva mener du om følgende?
    a. Gjør BVA risikostyrings modellen det lettere å vurdere forebyggende tiltak? Hvorfor/hvorfor ikke?
    b. Hvor åpenbart er valget av forebyggende tiltak når man sammenligner BVA-prosjekter med andre gjennomføringsmodeller? Hvorfor/hvorfor ikke?
    c. Er det mer eller mindre behov for korrigerende tiltak i BVA-prosjekter sammenlignet med andre gjennomføringsmodeller? Hvorfor/hvorfor ikke?
7. BVA-modellen sier at når uforutsette risikoer inntrer, bør entreprenøren vurdere forebyggende og korrigerende risikotiltak.
    a. Hvordan er det nyttig for å håndtere uventede risikoer og iverksette tiltak?
    b. Hvordan sammenligner du dette med konvensjonell praksis, f.eks. totalentreprise?
8. BVA understreker at modellen ikke handler om risiko overføring, men at hensikten er å tydeliggjøre ansvarsfordeling
    a. Hvordan påvirker det forebyggede og korrigerende risikotiltakene som tas?

9. Et av hovedformålene med BVA er å øke transparens ved å bruke dominerende informasjon.
    a. Øker BVA-modellen transparens? Hvorfor / hvorfor ikke?
    b. Hvilken betydning har dette hatt for risikotiltakene som ble iverksatt

10. I følge BVA-filosofien er en av hovedårsakene til risiko at prosjekteiere detalj styrer og kontrollerer eksperperten (MDC). Modellen fraråder prosjekt eiere fra å gjøre nettopp det.
    a. Hvordan har det å ha friheten til å gjøre det dere er gode på, nemlig bygge og styre risiko bidratt til å ta fornuftige risikotiltak?
11. I BVA prosjekter skal forebyggendetiltak være en del av leverandørs pristilbud mens korrigerende tiltak må prises etter avtal ihht. kontraktbestemmelsene.
    a. Hvordan påvirker dette risikotiltak?
12. Hvordan påvirket BVA-modellen risikostyringskulturen, særlig prosessen med å identifisere og iverksette risikotiltak?

Avsluttende spørsmål

Hva er dine generelle inntrykket ditt om BVA risikostyrings modellen?
Hva kan gjøres for å dra mer nytte av BVA usikkerhetsstyringsmodellen for fremtidige prosjekter?

- Hva kan entreprenøren gjøre
- Hva kan byggherrer gjøre
- Andre samarbeidspartnere d.
- Andre aktører (Difi eller andre)

Har du forslag til problemområder knyttet til BVA risiko styrings modellen som kan bedres for fremtidige BVA prosjekter?
Hvordan det kan dras mer mytte av risikotiltak realisert gjennom BVA
Hva er ditt inntrykk av intervjuforløpet, spørsmålene og hvordan min deltakelse har vært?

Interview guide for project owners

Innledende spørsmål:

1. Hva er din arbeidserfaring?
2. Har du tatt kurs eller studie som omhandler risikohåndtering?
3. Har du tatt BVA-kurs?
4. Hvor mange BVA-prosjekter har du jobbet på?
5. Hvem ble leid inn som ekspert mentor i BVA?
6. Hvor lenge har du jobbet med temaer direkte eller indirekte knyttet til risikostyring?

Hoved spørsmål:

1. Fulgte dere gjennom med ukentlige risikorapportering hele veien? Hvorfor/ hvorfor ikke?
    a. Hva fungerte bra og hva fungert ikke bra?
    b. Hvor godt fulgte dere DFØs veiledning for bruk av de ukentlige risikorapportene?
2. I risikovurderingsplanen har man identifisert risikoer som kan få konsekvenser for økonomi, fremdrift og prosjektmålene.
    a. Hvilke faktorer ble vurdert ved valg av de spesifikke risikoene?
    b. Hvilken type risiko anses vanligvis å ha betydelige konsekvenser for økonomi, fremdrift og prosjektmålene?
    c. Hvilke faktorer påvirket rekkefølgen på risikoene i risikostyringsplanen?
    d. Hvor mange personer jobbet med videreutvikling av RVP i konkritiseringsfasen utviklingen? (en gruppe (hvor mange deltakere?) eller en person?
3. Hvordan påvirket bruken av ukentlige risikorapporter risikotiltakene?
    a. Gjør prosedyren konsekvensene av risikotiltak tydeligere?
4. BVA modellen understreker at RVP og URR skal brukes som hovedverktøy for risikostyring i gjennomføringsfasen og skal dermed være kontraktfestet. Det har kommet frem i masteroppgaver at RVP og URR ikke er kontraktfestet. (NS8407)
    a. Hvordan påvirket det risikotiltaket?
    b. Hva mener du er en god løsning for å fikse dette?
5. Det kommer frem i litteraturen at byggherre ikke påtar seg konsekvensene av risikoer som entreprenøren ikke har varslet byggherre om ihht. Kontraktbestemmelsen for risiko rapportering. Det har vært mange hybrid pilotprosjekter med BVP og

totalentreprise.

   a. Har dette vært et problem for dere?
   b. Hva har det hatt å si for prosjektet?

6. VA-metoden tilsier at risikoer som kan gi negative konsekvenser og positive muligheter for økonomi, fremdrift og prosjektmålene skal registreres i RVP.
   a. Hvilke fordeler får man av praksisen?
   b. Hvilken betydning har det for risikotiltak?
7. For forutsette og uforutsette risikoer som forekommer, hva mener du om følgende?
   a. Gjør BVA risikostyrings modellen det lettere å vurdere forebyggende tiltak og hvordan? Hvorfor/hvorfor ikke?
   b. Hvor åpenbart er valget av forebyggende tiltak når man sammenligner BVA-prosjekter med andre gjennomføringsmodeller? Hvorfor/hvorfor ikke?
   c. Er det mer eller mindre behov for korrigerende tiltak i BVA-prosjekter sammenlignet med andre gjennomføringsmodeller? Hvorfor/hvorfor ikke?
8. BVA-modellen sier at når uforutsette risikoer oppdages, bør entreprenøren vurdere forebyggende og korrigerende risikotiltak.
   a. Hvordan er det nyttig for å håndtere uventede risikoer?
   b. Hvordan sammenligner du dette med konvensjonell praksis før du jobbet med et BVA- prosjekt?
9. BVA understreker at modellen ikke handler om risikooverføring, men at hensikten er å tydeliggjøre ansvarsfordeling.
   a. Hvordan påvirker det risikostyringen og risikotiltakene som tas?
10. Et av hovedformålene med BVA er å øke transparens ved å bruke dominant informasjon.
   a. Øker BVA-modellen transparens? Hvorfor / hvorfor ikke?
   b. Hvilken betydning har dette hatt for risikotiltakene?
11. BVA mener at hovedårsakene til risiko forekommer når byggherre detalj styrer og kontrollerer eksperperten (MDC).
   a. Hvordan har det å gi entreprenøren førersetet til å styre risiko bidratt til fornuftige risikotiltak?
12. I BVA prosjekter skal forebyggendetiltak være en del av leverandørs pristilbud mens korrigerende tiltak må prises etter avtal ihht. kontraktbestemmelsene.
   a. Har dette vært praksisen i en totalentreprise?
   b. Hvordan påvirker dette risikohåndteringen?
13. Hvordan påvirket BVA-modellen risikostyringskulturen, særlig prosessen med å identifisere risiko og iverksette risikotiltak?

<u>Avsluttendespørsmål</u>

Hva er dine generelle inntrykket ditt om BVA risikostyrings modellen?
Har du forslag til problemområder knyttet til BVA risiko styrings modellen som kan bedres for fremtidige BVA prosjekter?
I BVA prosjekter skal forebyggendetiltak være en del av leverandørs pristilbud mens korrigerende tiltak må prises etter avtal ihht. kontraktbestemmelsene.
Har dette vært praksisen i en totalentreprise? Hvordan påvirker dette risikohåndteringen? Hva er ditt inntrykk av intervjuforløpet, spørsmålene og hvordan min deltakelse har vært?

Appendix D: From codes to global themes

Table 7-1: Topic group 1: Perceptions

Informant	Codes	Themes
Informant 1	▪ In DBB projects, the Po assumes the expert role ▪ The Po can come up with solutions that are not cost-effective or are too complicated ▪ Constructability is compromised sometimes, leading to redesign ▪ The contracts should not dictate everything we do and report ▪ The Po manages and controls the C in detail at the same time as the risk responsibility falls on C	1. Traditional RM approaches create more risk
	▪ The contracts should not dictate everything we do and report ▪ Contracts dictate the reporting to varying degree	2. The contracts should not be viewed as alfa and omega
	▪ BVA gives the expert role to the C but the C is not an expert in everything ▪ The Po possesses knowledge in other areas that are essential to the project	3. Who should have the expert role is contextual
Informant 3	▪ The risk picture has changed ▪ Shortage of supplies	4. The risk picture is not constant
Informant 6	▪ Didn't see the value in WRR for each week ▪ Some similarities between WRR and our own RM practice ▪ Not sure if using dominant information improves transparency ▪ BVP is practically resource intensive ▪ Not easy to compensate lost time ▪ Comparable to partnering where proactive risk management is central ▪ BVA RMM is just another way of structuring and reporting risks	5. BVA is not as revolutionary as it is claimed to be
Informant 4	▪ BVA and Partnering are different in how procurement is conducted ▪ Not easy to say whether BVP or Partnering is easiest to win	6. BVA is much like Partnering
Informant 5	▪ Not important to update the RMP because it is the same risks that re-occur ▪ Delays are only economic burden ▪ BVA stipulates no need to use contracts to force the other party. It didn't work in practice ▪ May be some Pos understand the value of dominant information intuitively	7. Not all BVA preaches is necessary 8. Not everything is new discovery in BVA, it just makes it more apparent
Informant 2	▪ We have become more aware of what risk entails ▪ The BVA RMM is useful irrespective of project type ▪ Makes it easier to follow up on risks and to make sure that the measures are implemented ▪ Forces the C to come up with measures ▪ The C is forced to increase its risk awareness ▪ We are forced to dig further	9. Affects one's risk perception 10. BVA RMM is a tool that enforces best practice RM without the PO needing to supervision

	Basic themes	Organizing themes	Global themes
Contractors	▪ BVA is not as revolutionary as it is claimed to be ▪ Who should have the expert role is contextual ▪ BVA is not as revolutionary as it is claimed to be	1. Not everything is neither new nor better within the BVA RMM	1. The BVA RMM may not be as comprehensive as claimed to be
	▪ The contracts should not be viewed as alfa and omega ▪ Risk picture is not constant	2. There should be room for reasonable adjustment of RM schedule in times of uncontrollable circumstances	
	▪ Traditional RM approaches create more risk	3. Traditional RMM compromise quality	2. The BVA RMM could alleviate most of the challenges faced in conventional RMA
Project owners	▪ Not all BVA preaches is necessary	4. We shouldn't accept everything at face value	3. Some aspects are redundant, and some are practically not viable
	▪ BVA RMM is a tool that enforces best practice RM without the PO needing to supervision ▪ Not everything is new discovery in BVA, it just makes it more apparent ▪ Affects one's risk perception	5. The Po doesn't need to inspect the C constantly	4. The BVA RMM alleviates the workload of the PS and gives a reason to trust the C
	▪ Not everything is new discovery in BVA, it just makes it more apparent ▪ Affects one's risk perception	6. Increases risk understanding	

Table 7-2: Topic group 2: Motives for ways of implementation

Informant	Codes	Themes
Informant 1	▪ We had more risks on our list ▪ The biggest risks were listed in the RMP ▪ The project goals are decisive when developing the RMP ▪ Cost and progress mean a lot for the risk ranking in the RMP ▪ Environmental factors are also accounted for when ranking the risks	1. The RMP is developed in a way that accounts for the Pg and our ability to influence the risks
Informant 3	▪ BVP was a concept picked up due to marketing from promoters ▪ Expert mentor wasn't impartial ▪ BVP was a concept picked up due to marketing from promoters ▪ More important to have a BVP contract than to implement the model ▪ Focus on quick delivery rather than risk ▪ Commercialization ▪ POs still controlled us using frameworks	2. Self-interest motives
Informant 4	▪ Whether the risk burden is on us or not influences which risks get included in the RMP ▪ Cost and time factors were mostly regarded when developing the RMP ▪ Ability to influence the risk affects how high the risk is ranked ▪ Whether or not we own the risk affect the ranking	3. Factors affecting the development of the RMP

	Basic themes	Organizing themes	Global themes
Contractors	▪ The RMP is developed in a way that accounts for the Pg and our ability to influence the risks ▪ Self-interest motives ▪ Factors affecting the development of the RMP	1. Inadequate attempt at reconciling conventional practice with BVA philosophies	1. Advancing own interest first
	▪ The RMP is developed in a way that accounts for the Pg and our ability to influence the risks ▪ Self-interest motives ▪ Factors affecting the development of the RMP	2. Reconciling conventional practice with BVA philosophies	2. Fearing accountability

Table 7-3: Topic group 3: Influencing factors from conventional practice

Informant	Codes	Themes
Informant 1	▪ Historically no need for WRR in the infrastructure sector ▪ Traditionally common with monthly reporting ▪ We do not normally use WRR but we do use common risk register	1. Unusual approach to risk reporting
	▪ Responsibility for risk in DB at the C or PO ▪ Contracts dictate the reporting to varying degree ▪ Risks out of the C's control are typically Po's risks ▪ A lot of focus on risk transfer on the Po's part	2. Conventional RM approaches have risk transfer as the foci point
	▪ Contracts dictate the reporting to varying degree ▪ In DBB projects, the Po assumes the expert role ▪ A lot of focus on risk transfer on the Po's part ▪ The Po manages and controls the C in detail at the same time as the risk responsibility falls on C	3. The Po still struggles to trust the C despite having contracted the best C for the job
Informant 3	▪ Pricing risk measures is not important, but listing Corrective and Preventive measures gives the Pos a bigger risk picture ▪ The tender document demonstrates a detail specific request from Pos in Trondheim municipality rather than describing needed function ▪ Don't come with a finished concept to Cs ▪ POs still controlled us using frameworks ▪ Little possibility to make changes	4. The client still practices a high degree of control
Informant 6	▪ Pos do not like to take more risk than obliged to by the standards ▪ Many Cs are now used to DB ▪ When Pos dictate detail specific solutions, it promotes backward thinking ▪ BVP is practically resource intensive	5. Barriers to embrace the BVA risk management model
Informant 4	▪ PO rejected help from mentor organization ▪ PO didn't make effort to use the model as intended	6. Unwillingness to learn new methods
Informant 6	▪ Within DB projects, risks are dealt with after occurrence ▪ Traditionally the focus has been on changes ▪ We wouldn't have foreseen the risks in DB projects ▪ Cs speculate that it is difficult to stope extra costs and prevent them	7. Conventional issues with the RM practice
Informant 2	▪ Ground conditions are risky. We had unpredicted outcome ▪ Designing can be risky ▪ Realizing environmental goals we set is uncertain ▪ Land dispute could result in uncertainties ▪ User participation poses uncertainty regarding risks unforeseen on their behalf, causing change requirements during construction ▪ We lack sufficient guidance on how to implement specific aspects ▪ In a DB project, the C is more concerned with its own risks	8. Challenges encountered similar to traditional projects

	Basic themes	Organizing themes	Global themes
Contractors	▪ Unusual approach to risk reporting ▪ Unwillingness to learn new methods ▪ Barriers to embrace the BVA risk management model	1. Fear of the unknown	1. Stagnant risk management culture
	▪ The client still practices a high degree of control ▪ The Po still struggles to trust the C despite having contracted the best C for the job ▪ Conventional RM approaches have risk transfer as the foci point	2. Project owners persist to highly control the vendor	
	▪ Unwillingness to learn new methods ▪ Unusual approach to risk reporting ▪ Barriers to embrace the BVA risk management model ▪	3. Lacking interest	
	▪ Conventional RM approaches have risk transfer as the foci point ▪ The client still practices a high degree of control ▪ The Po still struggles to trust the C despite having contracted the best C for the job	4. Project owners persist to highly control the vendor	2. Sector actors are not sufficiently persuaded by the BMA philosophy
Project owners	▪ Conventional issues with the RM practice ▪ Challenges encountered similar to traditional projects	5. Late response to risks	3. Conventional bad conducts must be abolished
	▪ Conventional issues with the RM practice ▪ Challenges encountered similar to traditional projects	6. Self-centered RM practice	

Table 7-4: Topic group 3: Implementation challenges

Informant	Codes	Themes
Informant 1	▪ Mentor in BVA ▪ We attempted to do everything by the book to the best of our ability ▪ Used a modified version of DFØ's template ▪ The RMP was developed by a group	1. Followed recommended procedures when implementing the model
	▪ Contracts dictate the reporting to varying degree ▪ In DBB projects, the Po assumes the expert role ▪ A lot of focus on risk transfer on the Po's part ▪ The Po manages and controls the C in detail at the same time as the risk responsibility falls on C	2. The Po still struggles to trust the C despite having contracted the best C for the job
Informant 3	▪ Didn't use BVP's full potential ▪ WRR was new for us ▪ Some Cs don't do early RMP ▪ Model maturity issues	3. Poor understanding of the model
	▪ BVP was a concept picked up due to marketing from promoters ▪ Expert mentor wasn't impartial ▪ BVP was a concept picked up due to marketing from promoters ▪ More important to have a BVP contract than to implement the model ▪ Focus on quick delivery rather than risk ▪ Commercialization ▪ POs still controlled us using frameworks	4. Self-interest motives
Informant 6	▪ Didn't follow through with WRR ▪ Used a modified version of DFØ WRR template ▪ Not that different from NS8407 ▪ Couldn't deliver WRR each week ▪ PO and C didn't manage to follow the BVA WRR ▪ Didn't see the value in WRR for each week	5. Lacking understanding
	▪ Didn't have prior experience of developing RMP before winning the contract ▪ The BVP tender lacked clarity regarding how opportunities would be divided between Pos and Cs	6. Lacking experience
Informant 4	▪ C had mentor until contract signing ▪ C followed dfø's guidance for WRR ▪ A group developed the RMP	7. Not our fault that the implementation was poor
	▪ PO rejected help from mentor organization ▪ PO didn't make effort to use the model as intended	8. Unwillingness to learn new methods
Informant 5	▪ Monthly WRR ▪ Po didn't require the WRR to be weekly ▪ The Pilot group lacked a standardized way to conduct WRR	9. Implemented modified recommendations
	▪ Cs tend to revert to TE ways during the building phase ▪ Lacking formal BVA contract creates confusion regarding maintaining own interests ▪ Few function-based description ▪ Sub-contractors are disregarded	10. Observed hurdles to best implement the model
Informant 2	▪ Course ▪ Followed through with WRR ▪ Didn't use the RMP and WRR as proposed in the book. ▪ We were inexperienced so we implemented modifications	11. Lack of sufficient guidance and know-how

	Basic themes	Organizing themes	Global themes
Contractors	▪ Poor understanding of the model ▪ Lacking understanding	1. Insufficient knowledge	1. Education is needed
	▪ Lacking experience ▪ Not our fault that the implementation was poor ▪ Followed recommended procedures when implementing the model	2. Sector actors need more education	
	▪ The Po still struggles to trust the C despite having contracted the best C for the job ▪ Unwillingness to learn new methods ▪ Barriers to embrace the BVA risk management model	3. A risk culture change is required	
Project owners	▪ Wrong basis for project delivery model choice	a. 4. Self-interest motives	2. Commercialization
	▪ Implemented modified recommendations ▪ Observed hurdles to best implement the model ▪ Lack of sufficient guidance and know-how	5. A standard implementation model lacks	3. Standardization is needed

Table 7-5: Topic group 5: Unique risk factors?

Informant	Codes	Themes
Informant 3	▪ Biggest cost drivers dictate the risk factors ▪ Building capacity is imperative for time and cost ▪ Governments and local authority approvals must be obtained on time ▪ No contract, could lead to sloppy risk reporting ▪ Cs can do a better job of solutions ▪ Some Cs don't do early RMP ▪ Contradiction ▪ Soil conditions are always risky ▪ HMS and quality delivery are also risk factors ▪ POs still controlled us using frameworks ▪ The hybrid version limited flexibility regarding solutions	1. Risk factors
Informant 6	▪ Pos do not like to take more risk than obliged to by the standards ▪ Many Cs are now used to DB ▪ When Pos dictate detail specific solutions, it promotes backward thinking ▪ BVP is practically resource intensive ▪ Hybrid BVA projects impair realizing the full potential of BVA	2. Barriers to embrace the BVA risk management model
Informant 4	▪ Soile condition pose a great risk ▪ Approval of documents pose risk tom time ▪ Uncertain availability of building materials pose financial and time risk	3. Typical big risk factors
Informant 2	▪ Ground conditions are risky. We had unpredicted outcome ▪ Designing can be risky ▪ Realizing environmental goals we sat is uncertain ▪ Land dispute could result in uncertainties ▪ User participation poses uncertainty regarding risks unforeseen on their behalf, causing change requirements during construction ▪ We lack sufficient guidance on how to implement specific aspects ▪ In a DB project, the C is more concerned with its own risks	4. Challenges encountered similar to traditional projects

	Basic themes	Organizing themes	Global themes
Contractors	▪ Risk factors ▪ Barriers to embrace the BVA risk management model ▪ Typical big risk factors	1. The typical risk factors are similar irrespective of project delivery model	1. The same major risk factors are observed in BVA projects too
Project owners	▪ Challenges encountered similar to traditional projects	2. The same risk factors persist	2. No unique risk factors in BVA

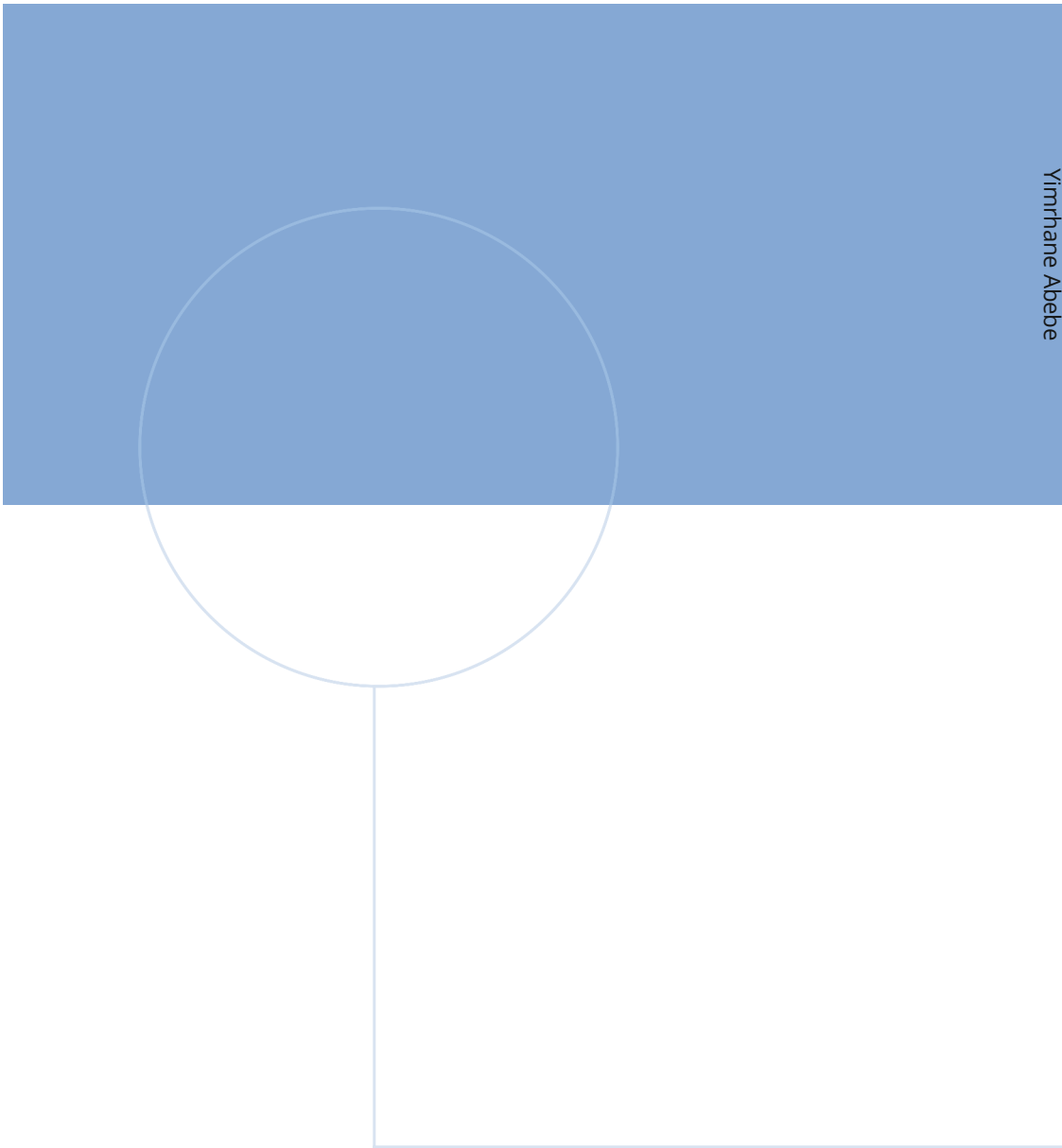
Appendix E: Five topic groups & global themes of the thematic networks developed

Table 7-6: Five topic groups identified from the thematic analysis

Findings from the thematic networks				
Perception	**Motives for ways of implementation**	**Influencing factors from conventional practice**	**Implementation challenges**	**Unique risk factors observed?**
Perceived lack of model comprehensiveness	Fear of accountability creates precautionary actions (protection of self-interests)	Bad risk culture that is adamant to change due to fear of the unknown (new model)	Lack of knowledge might lead to a stagnant risk culture	The same risks are observed in the pilot projects as in any other project, a sense of no difference to speak of
PIRMS creates more workload and could be a risk to our benefit	Lack of motives might suggest a reluctant attitude	Bad risk culture could weaken the ability to embrace new approaches	Lack of education seems to be driven by change resistance	Lack of uniqueness in risks encountered could have contributed common malpractice to continue in the pilot projects, too
No significant difference between PIRMS and common practice		Low perceived value of PIRMS might not motivate a risk culture change		
More concerned with highlighting existing issues with current RM than focusing on using new approaches		Self-centered risk management practice		
Regarding PIRMS as just another model among many other that offer the same solution		Late risk response to protect self-interest, or to exploit favorable conditions		
A sense of PIRMS "could help solve some of the problems"				

Table 7-7: Topics explored in phase two of the literature review

Literature topics reviewed (literature review phase 2) based on the topic groups identified above		
Bad risk culture factors	**Change resistance factors**	**Opportunistic behavior factors**
Factors regarding a continuation of present conduct	Factor motivated by necessity to further present benefits	Factors explaining why opportunistic behavior exists
Factors concerning resentment of new approached	Factors regarding low innovativeness and creativity	
Factors linked to reluctancy		



Yimrhane Abebe

NTNU
Norwegian University of
Science and Technology