Towards Situational Project Management Method Engineering for SMEs

A case study at Nibag B.V.

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NIBAG

UNIVERSITY OF TWENTE.

Towards Situational Project Management Method Engineering for SMEs

A case study at Nibag B.V.

Master thesis Industrial Engineering and Management – IT track

Enschede, July 2011

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“Theories serve to satisfy a very human need:
to order the experienced world.”

- Robert Dubin-

Management Summary

This research is initiated based on the desire at Nibag B.V. to professionalize their project management. This follows from the recognized opportunities for quality optimization and need for standardization by company management in the company year-plan. Based on this desire, a practical as well as theoretical study has been conducted. Despite all research and experiences in project management, failure rate of projects in general remains high and tailoring of project management approaches to the project situation was found in literature as a way to reduce this. Application of Project Contingency Theory (PCT) was identified to be a connection between project management and the project situation and extension of this theory contributes also to the theoretical relevance of this research (Howell, Windahl, & Seidel, 2010).

By means of semi-structured interviews insights were derived on current approaches to project management, problems with these approaches and the relevant contextual factors on project management. By conducting a systematic literature review on contingency factors, a combination could be made based on theoretical as well as practical insights and a list of 28 relevant factors was constructed. In an online workshop with an innovative software tool, the top 10 of these factors was identified as well as the most important project management activities at Nibag. These elements were then combined in a possibility matrix and the data were derived from the practitioners. This process has lead to the construction of the decision tool with the likelihood of activities under certain circumstances. Next to this tool, a consensus matrix was created in order to visualize the diversity of opinions on this subject. Concerning this diversity the tool should serve well in being the foundation for a practitioners meeting in order to further professionalize project management and development of the tool. Ideas for this process are presented as the implementation guidelines based on brief analysis of change management literature.

The described research process lead to the conclusion that the designed artifact is a first step towards a decision aid for practitioners to connect project management activities to the situation of the project and further evaluation, practical as well as theoretical, is necessary. In this development it is concluded that company culture is an important facet and especially the soft aspects of the change process should receive close attention.

These conclusions lead to the formulation of the following propositions:

- The decision tool should be used by project managers at Nibag, because this matrix provides insights in important activities under specific circumstances of their project. This is relevant, since we recognized the complexity of their decision making and hence support in decision making concerning the project management approach is desirable.
- The second recommendation follows from the consensus matrix where it can be concluded that there is a great diversity in opinions on the values of the decision tool. It is therefore recommended to create a task force, consisting of project managers that have a clear image of the work processes, have considerable knowledge on project management and above all have a high social impact in the organization. They should organize a workshop in order to clarify this variety of answers with the other project managers. This is an important step

since the tool is all about the sharing of knowledge and the value of the matrix is based on the experience of the practitioners.

- A third recommendation is based on the preliminary state of the design. Since the field of research is in its early days and a new artifact was to be designed, further development is needed. It might be that the selected top 10 of contingency factors will not describe the context to a sufficient extent or that additional information is needed with the matrix in order to be of practical use. Therefore we advise the company to thoroughly test this matrix in a pilot setting.
- A fourth recommendation is to extent the matrix with tasks and techniques. This will operationalize the decision tool and makes it of even more practical use for the project managers. Use of new technology, for example an intranet, is crucial to make this knowledge explicit and available for all practitioners.
- Fifth recommendation concerns the implementation process of the matrix. As concluded in the chapter on the deployment a holistic view to implementation is advisable. Based on earlier research, soft aspects concerning this type of change yields are often overlooked. It is especially the people that need attention and involvement of the practitioners in the further development of the tool is highly recommended. The task force, with project managers who have a high social impact, is critical in this process.
- Finally, in line with recommendations two and five is the company culture. At the moment the culture is far from ideal to optimally conduct knowledge sharing. Momentarily, practitioners are not used to the transfer of knowledge and theoretical thinking on their project management approaches. Although this is gradually improving, attention is advised in order to optimize the company culture. Several techniques are suited to this end and a combination of further development of the matrix and optimizing culture is a possibility to efficiently use time and resources.

Concerning the management of Nibag B.V. these propositions have the following consequences:

- In order for practitioners to use the decision tool, further development will be necessary. This means that time and resources should be made available in order to further evaluate and conduct the pilot projects.
- To increase understanding among practitioners and to higher the value of the tool, meetings should be organized which also implicate that time and resources should be made available.
- In order to improve company culture and stimulate knowledge sharing, new initiatives are needed. This means that time and resources should be made available for research in cultural aspects, training and other valuable activities that contribute to the improvement of the company culture.

Based on these recommendations this research contributes heavily in professionalizing project management in practice. Project managers are given a language with which they can discuss their approaches more efficiently and this yields optimization of project management at Nibag. Furthermore, the process in which this research was conducted has already helped the project managers in a first change towards a knowledge sharing culture.

Acknowledgements

Finalizing my master thesis in Industrial Engineering and Management marks the end of a defining phase of my life. The life as a student. This significant period would not have been as joyful, exciting, inspiring and motivating without the accompaniment of many friends and fellow students. The attendance of the lectures, working together on projects and moreover the fruitful and inspiring conversations about study and everyday live were the preconditions of a further development as a person. I cannot thank enough people for their input in this phase.

The possibility to work on my final research project at the University of Twente was offered by Pim Boswerger from Nibag. Inspirational discussions we have had on dynamics the company was facing and the young and ambitious environment proved the basis for a valuable research project. Conducting this research in a participatory fashion was a challenging yet exciting experience. The skills I developed here will be very helpful for the next phase of my life as a practitioner. Based on these fruitful experiences and the very pleasant working environment, I accepted a job offer at this company and I think the knowledge and skills I acquired during my study will be very helpful here. This means that where my life as a student ends, an exciting period of working as a professional will begin! I would like to thank Pim for his practical insights, motivational feedbacks and the pleasant time working together at the safety department. I also would like to thank all my other colleagues at Nibag, graduate Paul Eidhof in particular for endless helpful conversations on our projects.

The completion of my master thesis would not have been possible without the valuable sessions with prof. Dr. Jos van Hillegersberg, assistant professor Christiaan Katsma and PhD. candidate Diederik Rothengatter. Their feedback was critical, constructive and above all very practical and hands on. Time after time they were able to provide clear visions on this complex subject, which helped me greatly in my focus on the subject. Whenever hard times arose during the research period, discussions always provided new direction. Direction and help for which I am very grateful.

Next to this subject-matter support, finalizing my thesis and master would not be possible without the continuous support of my family and girlfriend Lotte Kempers. When motivation was decreasing or in times of greater pressure, they were unconditionally there for a talk and providing guidance in other aspects of life.

Elmar Heupers

Enschede, July 2011

Contents

Management Summary 4
Acknowledgements 7
List of figures 11
List of tables 12
List of abbreviations 13

1. Introduction 15
1.1 Research Setting 16
1.2 Initial Investigation 17
1.3 Problem Description and Research Goal 18
1.4 Research Question 20
1.5 Research model 21
1.6 Scope 23
1.7 Practical Relevance 24
1.8 Theoretical Relevance 24
1.9 Structure of the thesis 25

2. Theoretical background 26
2.1 Project (management) 27
2.2 Project Contingency Theory 30
2.3 Situational Method Engineering 31
2.4 Concluding remarks 33

3. Situational Project Management Method Engineering (SPMME) 34
3.1 SPMME 35
3.2 Methodology 35
3.3 Findings 42
3.4 Presentation of results 45
3.5 Concluding Remarks 57

4. Design phase 59
4.1 Ranking factors and identify activities 60
4.2 Deontic Matrix 66
4.3 Concluding Remarks 70

5. Implementation 72
5.1 Use and potential 73
5.2 Change management 73
5.3 SPMME implementation at Nibag 77
5.3 Concluding notes 79

6. Discussion 80
6.1 Conclusion 81
6.2 Recommendations 82
6.3 Contributions 83
6.4 Validity 84
6.5 Limitations and future research 85

References 88

APPENDIX 91
APPENDIX A: INFORMAL LITERATURE SCAN 92
APPENDIX B: LITERATURE REVIEW METHODOLOGY 93
APPENDIX C: STUDIES INCLUDED IN RESEARCH 98
APPENDIX D: INTERVIEW 99
APPENDIX E: STATISTICS ON THE RANKING OF CONTINGENCY FACTORS 101
APPENDIX F: INPUT SPMME MATRIX 102

List of figures

Figure 1: product-market matrix 16
Figure 2: Problem bundle 19
Figure 3: Research model, based on the regulative cycle as presented by Wieringa (2009) 22
Figure 4: Figure on the effect of tailoring procedures, adapted from Payne & Turner (1999) 29
Figure 5: Interconnection of elements (based on Firesmith & Henderson-Sellers (2002)) 29
Figure 6: Situational Method Engineering from method fragments in the method base, while taking the project characteristics into account(Henderson-Sellers & Ralyté, 2010) 32
Figure 7: Flowchart resulting from synthesized review of literature 40
Figure 8: Screenshot of NVivo displaying list of transcribed interviews 42
Figure 9: Screenshot of NVivo displaying the coding of contingency factors 42
Figure 10: Adding project management activities in SPilter 61
Figure 11: Ranking of contingency factors 62
Figure 12: Graphical presentation of outcome 64
Figure 13: Prototype of the SPMME matrix 67
Figure 14: Matrix indicating likelihood levels 68
Figure 15: Matrix indicating consensus on the deontic values 69
Figure 16: Leids Octahedron(J.J. Boonstra & Vlist, 1996) 74
Figure 17: Prototype project identification on intranet 75
Figuur 18: Prototype activity knowledge screen 76
Figure 19: SPMME implementation process 77
Figure 20: iterative process 93
Figure 21: Flowchart visualizing literature review 97
Figure 22: Input SPMME matrix 102

List of tables

Table 1: Top 26 journals in field of Project Management 37
Table 2: Top 25 IS Journals 38
Table 3: Information on interviewees 41
Table 4: Concept Matrix 43
Table 5: Listed contingency factors after first review round 44
Table 6: List of identified project management activities 63
Table 7: Top 26 journals Project Management 94
Table 8: Top 25 IS Journals 95
Table 9: List of papers included in the research 98
Table 10: Statistics on the ranking of contingency factors 101

List of abbreviations

ADR	Action Design Research
ASD	Agile Systems Development
CPM	Critical Path Method
ES	Enterprise Systems
FT40	Financial Times Top 40
GDSS	Group Decision Support System
IS	Information Systems
IT	Information Technology
ME	Method Engineering
MIS	Management of Information Systems
NPT	Nibag Project management Tool
OGC	Office of Government Commerce
PCT	Project Contingency Theory
PERT	Program Evaluation and Review Technique
PMI	Project Management Institute
PRINCE	PRojects IN Controlled Environments
SMART	Simple Multi-Attribute Rating Technique
SME	Situational Method Engineering
SMEs	Small and Medium Enterprises
SPMME	Situational Project Management Method Engineering
SQ	Sub-question

Introduction

1

This research is conducted as a graduation assignment for the Master Industrial Engineering and Management at the University of Twente. The assignment is mainly performed at the headquarters of Nibag B.V., which is located in Oldenzaal (NL), and partially at their location in Uden (NL). In this introduction, after providing information to the reader on the research setting, the initial investigation that leads to the research idea is explained. This first investigation is then more elaborated in the problem description where also the goal of this research is noted. This research goal serves in formulating the main research question. In order to derive an answer to this question, sub-questions are stated and the process of this research is guided by the research model. Afterwards, the scope of this research is described. Finally, theoretical as well as practical relevance is denoted and the structure of the thesis is presented.

"The choice of research problem—choosing the phenomena we wish to explain or predict—is the most important decision we make as a researcher. We can learn research method. Albeit with greater difficulty, we can also learn theory-building skills. Unfortunately, teasing out deep, substantive research problems is another matter. It remains a dark art."

- Ron Weber-

1.1 Research Setting

To provide the reader with a background on the setting in which this research is conducted, a description is given on the company, the department where this is done and their way of working concerning project management.

1.1.1 The company

Nibag was founded in 1984 and started as a service provider for housing corporations. Their first assignments were mainly about sound insulation and sound proofing. Throughout the years, the services Nibag provide increased and at the moment they offer a wide range of housing services. The company is serving the profit as well as the non-profit sector from two locations, Oldenzaal and Uden. Nibag is part of NyStaete Participations. After bankruptcy in 2009, the company continued with two company parts; Nibag Milieu & Ruimte (transl. Environment & Space) and Nibag Personal Services. At the moment Nibag employs around 50 people. The company works mainly project-based and is matrix structured around their markets and products. A part of this matrix is shown in figure 1. Only a few of the products (services) that are provided are shown, to get a picture of the project-based structure of the organization.

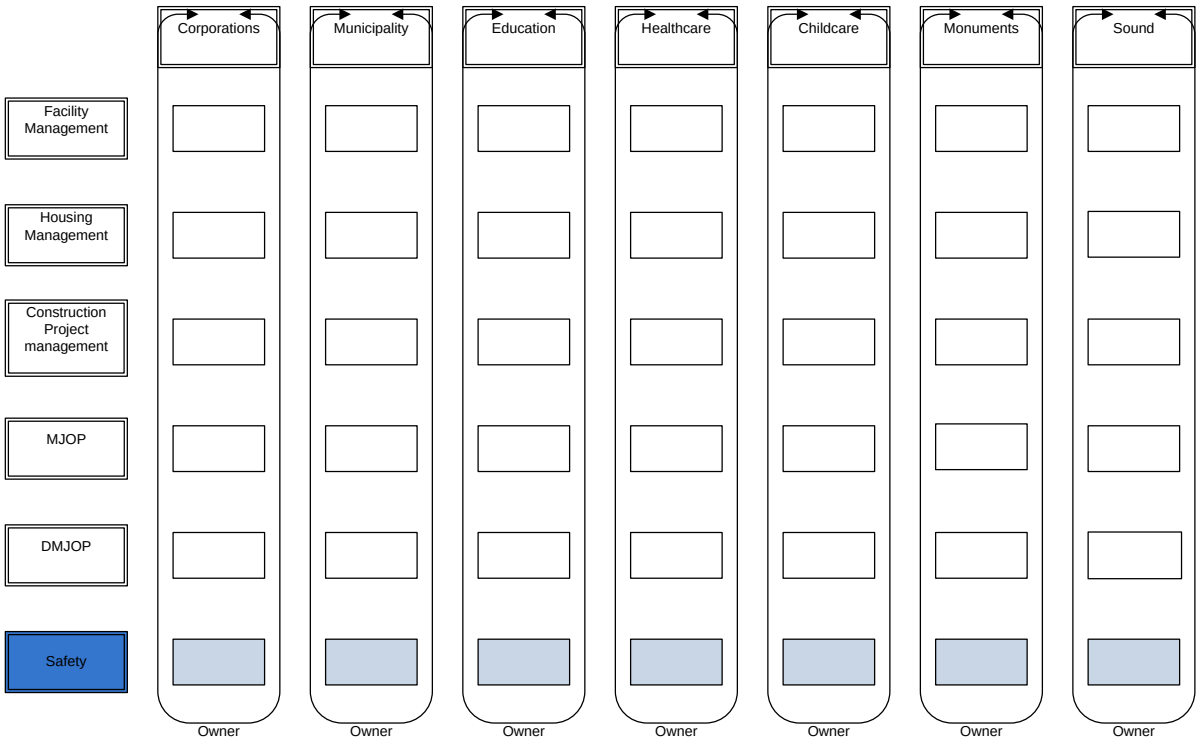

Figure 1: product-market matrix

The product line marked in blue indicates the part of the company from where the research is conducted.

The **Mission** of Nibag is stated as:

"*The Nibag housing advisors aid organizations with social real estate in initiating, realizing, organizing and managing their real estate portfolio.*

The organization does this in a proactive manner and works preferably based on partnerships with the principals, suppliers, and other professional parties."

The **Vision** of Nibag is stated as:

"*The optimal development, deployment and managing of social real estate demands a multi-disciplinary approach, where durability and cost efficiency play an important role. With their knowledgeable advisors, Nibag wants to play an important role in this.*"

1.1.2 Safety Department

As indicated in the product-market matrix, the research is conducted located in the safety department. Around 7 people are employed in this department and the focus is on fire safety. Since the foundation of the department 2 years ago, the department is fast growing and responsible for a significant part of the company revenue. More recently, the company acquired a large governmental principal after an open invitation to tender.

The open invitation to tender was about 65 governmental buildings with a high priority on fire safety. Nibag won a significant part of this tender and estimations are that about one third of these buildings will be done by Nibag. This is also the first principal of this size for the fire safety department.

1.1.3 Current Project Management

Within the fire safety department, project management is conducted in an ad hoc fashion and no specified method is applied. The way projects are conducted at the moment is preliminary based on the experience of the project manager.

As a core element of the year-plan 2010 (Nijkamp, 2010), among others, Nibag aims to standardize and improve the quality of their processes. Based on this, the current way of project management is open for discussion in the organization and Nibag looks at ways to standardize and optimize project management throughout the organization.

1.2 Initial Investigation

In order to gain some first insights into the problem situation of the company and to get some first ideas for this research an initial investigation is conducted. This investigation consisted of several meetings with the head of the fire safety department, Pim Boswerger, scanning of available handbooks and reading materials and informal discussions with 4 other project managers.

During the first meetings with Pim, he explained the high growth situation in his department and the acquiring of a large new project concerning the fire protection of governmental buildings. Due to the different project context and size, the question was posed to aid in professionalizing the project management and to fit it to the situation.

Problems connecting the project management approach to the context of the project are of issue to other project managers as well. In some informal meetings with heads of other departments, they indicate that this is preliminary based on their own insights and no methodology is prescribed to them. In these informal discussions, it became clear that there were more company-wide issues concerning project management and a deeper look into it is needed.

1.3 Problem Description and Research Goal

Now the first insights and ideas for this research are developed, a more thorough investigation is needed. The initial step in this problem investigation is a more in-depth look at the problem situation and derives a clear problem description. As part of this phase, a problem bundle is constructed (figure 3).

In order to gain more insight into the problem situation identified in the initial investigation and to identify the core problem, interview sessions with the project managers within Nibag were conducted and reading materials and documents scanned. A semi-structured interview is chosen as the research method to this end. The reasoning and description of this methodology is provided in chapter 3. Main findings of this first investigation of the problems are captured and presented in a problem bundle. In a problem bundle, causal relationships are identified in order to derive the core problem, which in turn is central in this research (Heerkens, 2005) and also serves as a visualization to aid the reader. The results of this first part of the problem investigation described in this section are derived from and based on the viewpoints of the project managers within the organization. This problem bundle does not serve as an extensive list of problems in the company, but serves as a quick scan of the problem situation.

As described in the part about the research setting, there is no prescribed project management methodology in the safety department. Based on interviews in the initial investigation, it can be stated that this problem is companywide since there is no prescribed methodology at all concerning project management. Project managers have been expected to achieve their financial goals, regardless of the way they would achieve these. Quality of the project management approach and the success of the project totally depend on their own previous experience. Although giving a lot of flexibility to the project manager, which is needed concerning the great diversity in projects, this comes with some downsides that have been identified in this problem investigation.

First, no guidance can be given to new project managers that are hired by Nibag. Their learning curve is totally based on ‘trial-and-error’. Minor guidance is given by experienced project managers to the ‘rookies’ and this is experienced by the majority of the project managers as negative. Although sometimes stated as the best way to learn, it is indicated to cause unnecessary inefficiencies as experience of others could prevent a lot of early made mistakes. Second, because no project management methodology is defined there is no foundation for capturing knowledge and experience in this area. Since most project managers use an ad hoc approach, the framework and language to discuss the project experiences is lacking. Another problem indicated by the project managers is concerning continuity. Because each project manager has his individual and mainly different approach, handing a project over to another is made unnecessarily difficult. In line with the same issue are the cooperation problems when working with another project manager on the same project looking at the matrix structure of the organization. Next to this, performance management is far

from optimal when ad hoc approaches are used since areas for improvement are almost impossible to identify.

In interviews with the project managers, it has become clear that another aspect to the experienced problem is the company culture. As indicated earlier, the focus has been mainly on achieving the financial targets, without great concerns about the way to achieve it. This mindset is clearly visible in their attitude towards, for example, knowledge sharing. Although this is not the main focus of the research, it will be taken into account and is also visible in the problem bundle.

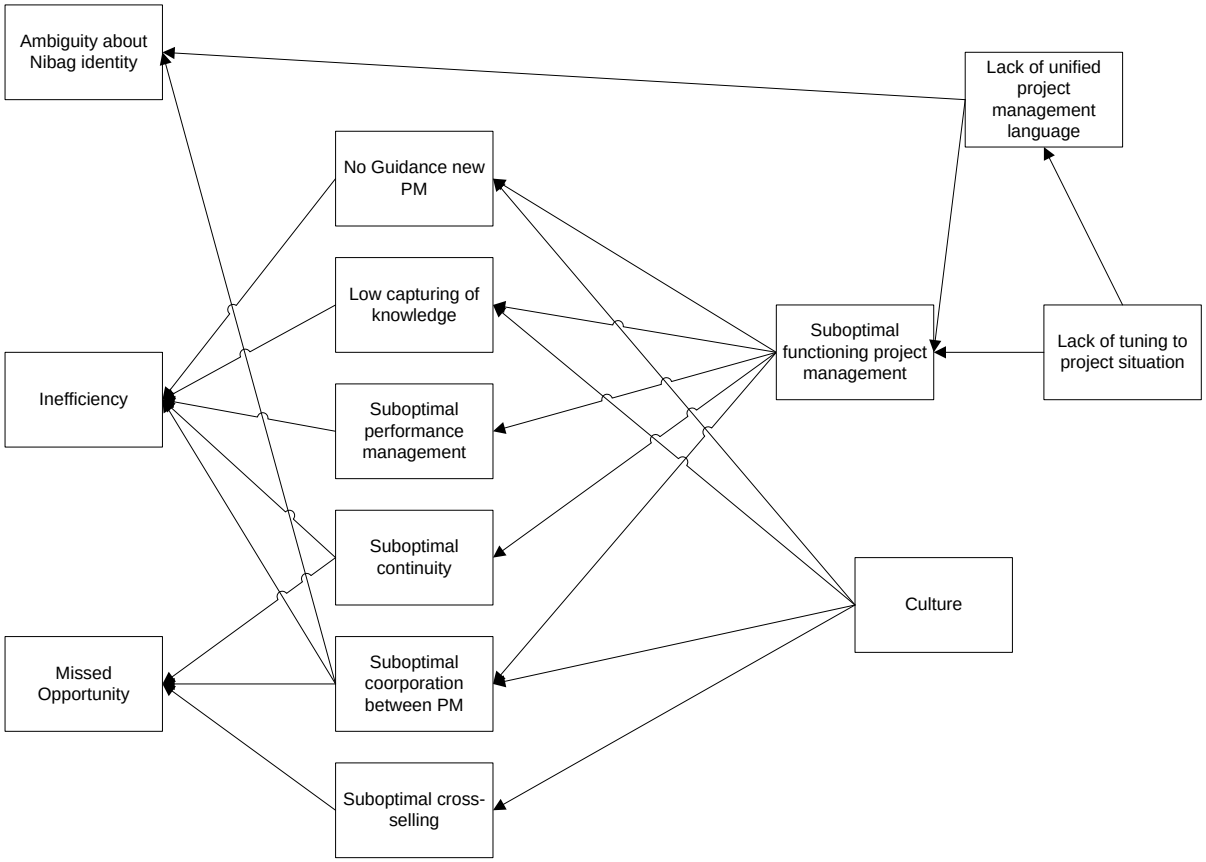

Figure 2: Problem bundle

1.4.1 Core Problem Identification and Research Goal

By using a problem bundle the core problem can be identified (Heerkens, 2005). In a problem bundle it is possible that there is more than one core problem. As reality can be very complex, there can be a lot of problems going on and different problems can be the cause of this. The core problem to choose in such a case is the problem which has the highest impact and relevance on the problem situation. In this research, the core problem is identified as:

"The company does not have a way to tailor project management to the project situation"

The owners of this problem can be identified to be the project managers within Nibag.

Based on the description of the problem we are able to formulate a **goal** for this research.

"*Creating an artifact connecting the situation of a project to project management in order to aid the project managers in tuning the project management method to the context and raise efficiency and uniformity*"

From a formal point of view, a problem can be defined as the difference between a goal stated (or the desired situation) and the current state of a system (Hevner, March, Park, & Ram, 2004). More specifically the identified core problem can be named a difference between the way the world is experienced by stakeholders and the way they would like it to be (Wieringa, 2009), and can thus be defined as a practical problem.

Heerkens (2005) views the practical problem, or as he calls it a handling problem, as changing an aspect in the world around us. Handling problems and knowledge problems, studying the world around us, are often intertwined (Heerkens, 2005). Knowledge is needed in order to solve a handling problem, knowledge that is not always readily possessed by the researcher. In such a situation the researcher has, next to a handling or practical problem, a knowledge problem.

After formulation of the research question the method to encounter these types of problems is described.

1.4 Research Question

The core problem is identified as a lack of tuning the project management method based on the situation or context of the project. Based on this problem a research goal was formulated and this research goal leads to the definition of the main research question:

"How to tailor the project management method based on project context in small to medium sized enterprises?"

As indicated in the research question, the scope of this project is small to medium sized enterprises (SMEs). This is chosen because of the relevance to the company and the lack of literature on the subject to this group of companies. This relevance will be explained later on in this chapter. The goal of the research is to provide the company with a usable artifact by means they can tune a project management method based on the context of the project.

In order to answer the research question, the following sub-questions are derived (also based on progressive insights):

- **SQ1.** *What is the **current situation** in the company concerning project management?*
  - *What is the current approach to project management?*
  - *What problems are encountered?*

In order to get more insight in the situation at the start of the research project, interviews are conducted with the project managers in the organization. The approach of these interviews will be explained later in this thesis. The insights acquired from the interviews are used in order to get to a refined problem description. Results of this step have been described earlier in this chapter.

- **SQ2.** *What can be identified in **scientific literature** to serve as theoretical framework?*
  - *a) What is the state of research on project management?*
  - *b) What is the state of research on contextualization of project management?*

c) *Which contingency factors can be derived from literature?*

After analyzing the problems identified in practice, the core problem is further investigated by conducting a systematic literature review. By means of this review, the latest insights from scientific theory are derived to serve as a theoretical foundation throughout the research project.

- **SQ3.** *What does the **desired situation** in the company look like?*

Together with the problem description from practice a view on the desired situation is derived. Interviews with project managers are held not only to get a grip on the problems going on, but on their view of the desired situation as well.

- **SQ4.** *What does the artifact for **contextualizing project management** at Nibag look like?*

Based on the identified desired situation, practical input and the latest insights from scientific theory, an artifact is created for fitting project management to the context. In order to arrive at this artifact, a workshop will be conducted to fit it to the company context. Next to this, output from SQ5 is used by applying the principles of concurrent evaluation and reciprocal shaping to bridge the gap between theory and practice.

- **SQ5.** *How are the elements of the artifact **evaluated**?*

In the design process, concurrent evaluation is applied to close the relevance gap as described earlier. Answering this sub-question is therefore not a one off activity, but answers to this question are provided along the way. This input is used in turn to adjust the design.

- **SQ6.** H*ow does the designed artifact need to be **implemented** at Nibag?*

Based on the designed artifact resulting from the last two steps, implementation of the artifact is also discussed and guidelines for this process are provided.

This step will also serve as a foundation for the conclusions and recommendations, which are stated at the end of this thesis. Next to this, topics for future research will be formulated.

1.5 Research model

For working towards a solution for a practical problem, a design research methodology is chosen since this type of research *"... is motivated by the desire to improve the environment by the introduction of new and innovative artifacts and the processes for building these artifacts*"(Simon, 1996). Based on the conceptualization of the term by Simon (1996),Boland (2002) states about the designed artifact *"… be it an organization, a policy, or a work practice as instantiated in the interface between an inner and an outer environment"*. These two statements are connected citing the mission statement of design science by Van Aken (2004); *"… to develop knowledge for the design and realization of artifacts, i.e. to solve construction problems, or to be used in the improvement of the performance of existing entities, i.e. to solve improvement problems*".

In working towards an artifact, we will use an adapted version of the regulative cycle presented by Wieringa (2009), which in turn is based on work by Van Strien (1997), as a research model. Following Wieringa (2009) and Van Strien (1997), it is used as the logic in the problem solving process in design research. The adapted version of the research cycle that we use in our research is presented in figure 2.

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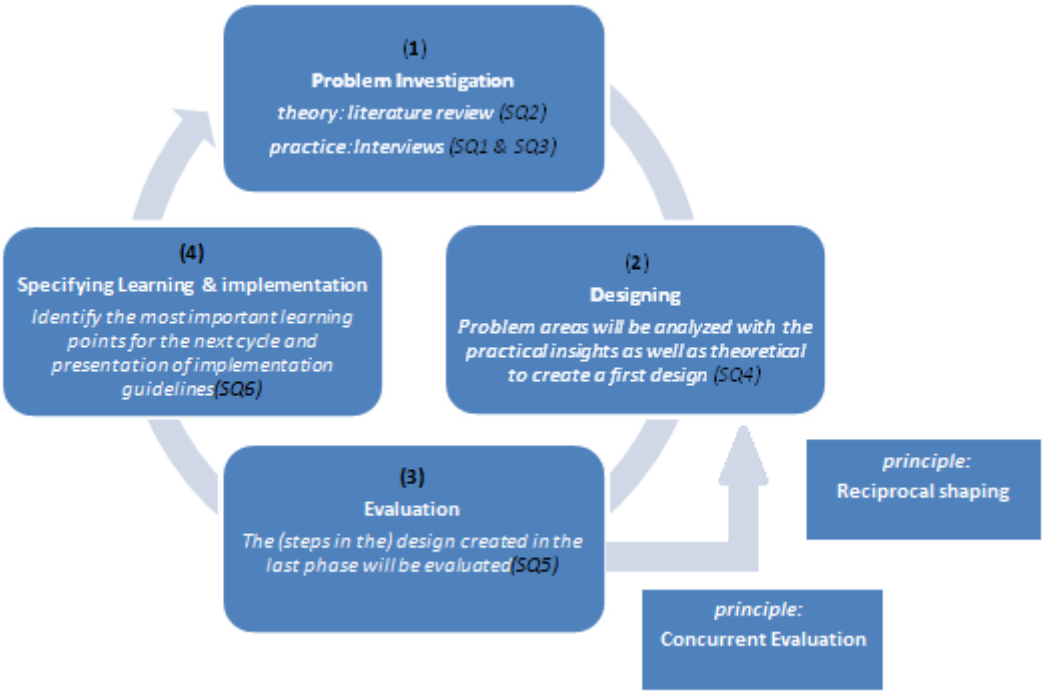


Figure 3: Research model, based on the regulative cycle as presented by Wieringa (2009)

This model is quite similar to the regulative cycle as presented by Wieringa (2009), except for two adjustments. We used the term 'designing' instead of 'solution design' as we think providing the solution might be a bit too optimistic considering the early state this field of research is in and the given time frame. A consideration also shared by Wieringa (2009) and the terminology used in some other phases is also adapted to fit to this research. In the light of design research the end product will never be finalized, instead the artifact improves in every iteration which in theory could continue till infinity. However, due to the time constraints only one full cycle will be conducted in this research.

Second adjustment is the addition of two principles derived from action design research(ADR) (Sein, Henfridsson, Purao, Rossi, & Lindgren, 2011). This is based on the widely named 'relevance gap' between management science and management practice. As Fendt et al. (2011) state: *"Management science still functions by and large in splendid isolation from praxis…".* With this statement, they mean that management science aims to provide theory which in turn is not very relevant to the practitioner. This gap is also acknowledged by Van Aken (2004), who states "*management theory is*

either scientifically proven, but then too reductionistic and hence too broad or too trivial to be much of practical relevance, or relevant to practice, but then lacking sufficient rigorous justification".

A critique on design research by Sein et al. (2011) is that design research does not view artifacts as emergent from the context. This is seen in the separation and sequencing of the steps "design" and "evaluation", hence the choice to connect these steps in our research by adding the principles of reciprocal shaping and concurrent evaluation. Reciprocal shaping *"emphasizes the inseparable influences mutually exerted by the two domains…*" (Sein, et al., 2011). The two domains are the artifact and the organizational context. Concerning Sein et al. (2011) "*evaluation is not a separate stage of the research process that follows building*". Instead, they state *"…decisions about designing, shaping, and reshaping the ensemble artifact and intervening in organizational work practices should be interwoven with ongoing evaluation*". In their work they call this principle "authentic and concurrent evaluation", where authentic means the part of intervening in the organization. In this research we will not intervene in the organization, hence this is no action research and therefore we adapted the principle in an adjusted fashion.

This research will start by analyzing the problem situation (**Phase 1**). In order to gain practical insights in the situation, informal as well as semi-structured interviews are conducted and documentation is reviewed in order to answer sub-question (SQ) 1. To cover the theoretical insights, a systematic literature review is conducted. The situation is then diagnosed based on both derived insights. In this phase, SQ2 and SQ3 are answered.

Thereafter, a design is made in order to work towards a solution (**Phase 2**). This will be created based on the theoretical insights and the practical requirements and this will answer SQ4. This phase of designing is interwoven with the evaluation phase(**phase 3**) in order to close the relevance gap as much as possible (Sein, et al., 2011). So as can be derived from the added principles, the phases of designing and evaluating are not conducted in a separate fashion. Both phases are interwoven to increase relevance and make the design fit to the organizational context.

Finally, learning moments are derived to be used as input for the second research cycle (**Phase 4**) and guidelines for implementation will be provided.

1.6 Scope

As indicated in the research question, the scope of this thesis is small to medium sized enterprises. As will be explained in the part on the theoretical relevance, the development of an artifact to aid tuning of a project management method is particularly relevant to this category of companies. Nibag, also an SME, is used as a case from which results can be generalized to SMEs in general.

The ambition at the start of this research project was to provide an artifact for tuning project management based on the context and to deliver a repository concerning all elements (work units as will be described in the theoretical background). However, based on progressive insights and limited time frame this proved not possible. The scope of this research will be limited to the creation of an artifact concerning project management activities. Extension of this artifact to tasks and techniques is briefly discussed at the end of the thesis.

As can be derived from the problem bundle, company culture is identified to be a problem as well relating to the subject of this research. Although being very relevant, this study concerns the

identified core problem and hence culture will be left out of scope. Because of its relevance, we do however take it into account during the process of this research.

1.7 Practical Relevance

Referring to the problem bundle, the core problem is identified to be the misfit between project management and the context. Here we will explain why solving such a problem is relevant to practitioners.

The importance of projects to organizations cannot be underestimated. This not only holds for the largest of corporations, but perhaps even more for small and medium enterprises. Based on the European Competitiveness Report and earlier research, the impact of SMEs and their projects on companies and the economy in general is significant (R. Turner, Ledwith, & Kelly, 2010). The authors state that within the European Union, SMEs account for 99,8% of the number of all companies. Next to this, projects in this type of companies account for one third of their turnover accounting for almost one fifth of the economy. Despite being of significant importance to SMEs and to the economy, failure of projects often occurs. Or as Cooke-Davies (2002) puts it: "*… despite column-miles of words that have been written on project management, despite decades of individual and collective experience of managing projects, despite the rapid growth in membership of project management professional bodies and despite a dramatic increase in the amount of project working industry, project results continue to disappoint stakeholders".* Throughout the literature a lot of figures on project failure can be found, in some fields even noted to be up to 60% (Goepp, Kiefer, & De Guio, 2008). Here, failure can be in terms of exceeding the budget, exceeding the deadline or delivering unsatisfied requirements. Research in the field of project management is therefore of high relevance to practitioners, since these types of figures indicate that advancements are needed. Next to this impact on the field of project management in general, this research will also contribute to the needs expressed in the organization.

1.8 Theoretical Relevance

Solving of the identified core problem is next to its relevance to practitioners also of theoretical relevance.

Research in the field of project management in general is not new. In fact, the first publications on project management in a prestigious management journal was back in 1959 (Gaddis, 1959). As this field of research matured during the decades to follow, most interest would go to projects and project management in large companies. Despite this being very interesting for this type of companies, management of projects this size has very different characteristics than the management of projects at SMEs (R. Turner, et al., 2010). Differences between large companies and SMEs are that SMEs require less bureaucratic methods of management, with a greater flexibility. Next to this, the focus is more on people and methods should be more suited to the environment. The authors conclude in their research that their results very strongly indicate that SMEs need a "light" version of project management. To go even further, they looked at the difference between micro, small and medium sized companies to conclude that the needs for project management even differ between these types of SMEs. The authors also propose further research into a "light" version of project management. The increasing diversity in project types and project management approaches is also recognized by Howell et al. (2010). They however also indicate that decision tools and theory connecting the two are limited. Based on the Project Contingency Theory they started with

developing a contingency framework to connect factors relating to project management to the choice of a project management approach. This type of research however is fairly new in the field of project management and as the authors indicate their framework is limited since it is only based on analysis of prior literature, therefore lacking practical experiences and case studies. This would be needed to help their framework forward. Next to this, they indicate that the literature base on this subject itself is limited because it was of minor interest and extension could therefore be very interesting, which would also mean an expansion of Project Contingency Theory. Finally, they recognize the potential of combining literature in the IT field on Agile Systems Development (ASD) and emergent approaches documented in general PM literature.

1.9 Structure of the thesis

In chapter 2 the theoretical background for this study is provided for the concepts used in this research. Chapter 3 presents the methodologies used for deriving the practical as well as theoretical insights and presents the findings resulting from this analysis. In chapter 4 the design phase is conducted and the resulting deontic matrix is presented. Chapter 5 provides guidelines for an implementation plan to the company. Finally, chapter 6 serves as a discussion of the results and presents the conclusions, recommendations, contributions, validity, limitations and ideas for future research.

Theoretical Background

2

The aim of this chapter is twofold. First, a better understanding of the field of project management and especially Project Contingency Theory (PCT) will be acquired and concepts used in this thesis will be explained to the reader. Second, insights in related fields of research will be provided in order to get a more fundamental basis for conducting this research. The literature used for this conceptual background and ideas for this research are acquired by using the methodology described in Appendix 1. This can be seen as a quick scan of the literature, since the goal of this chapter is to provide a conceptual background and acquire insight in the state of research in the field to answer sub-question SQ1.

"There is nothing quite as practical as a good theory"

- Kurt Lewin-

2.1 Project (management)

Project-based organizations, like Nibag, are organizations where the operations are primarily projects (PMI, 2004). Therefore, the first goal of this part of the chapter is to provide the reader with the background on what a project is and what is meant with project management. This background is mainly derived from the Project Management Body of Knowledge (PMBOK), written by the Project Management Institute (2004).

First, a definition will be given on what a project is. According to the Project Management Institute, a project is *"... a temporary endeavor undertaken to create a unique product, service or result".* As can be seen in the definition, a project is called *temporary*. This does not necessarily mean that the project is short in duration; in fact it can take years to finish a project. Temporary means that there is a definite beginning and a definite end to a project. The project is ended when the objectives have been reached or that the project is terminated because they can no longer be met. So temporary means the duration is finite. Where the Project Management Institute defines projects as an endeavor, Shenhar (2001) describes it a little more specific as being "*temporary organizations within organizations*". This nature of projects is also acknowledged by the Project Management Institute as they recognize that a project team seldom outlives the project. PRINCE 2, which stands for PRojects IN Controlled Environments and is a widely used and acknowledged project management method owned by the Office of Government Commerce, gives a definition on projects that seems to combine the two definitions mentioned above: "*... a temporary organization that is needed to produce a unique and predefined outcome or result at a pre-specified time using predetermined resources*" (OGC, 2002). A second characteristic of projects, that can also be derived from the two definitions, is that they create unique products, results or services (PMI, 2004). This can be an artifact, a capability to perform a service or a result, such as outcomes or documents. The uniqueness of these is that there is always something different in the project to get to an outcome. Presence of repetitive elements in this process does not change this fundamental uniqueness. A third characteristic is the progressive elaboration of a project. This is defined by developing in steps and continuing in increments.

Failure of projects is all too common. Throughout literature, failure is described in general or specific figures have been derived from empirical study indicating that it still poses a great problem to practitioners. Some reasons are identified by the OGC (2002) to be:

- Insufficient attention to checking there is a valid business case for the project
- Insufficient definition of the required outcomes, leading to confusion over what the project is expected to achieve
- Inadequate planning and co-ordination of resources, leading to poor scheduling
- Lack of communication with stakeholders and interested parties, leading to products being delivered that are not what the customer wanted

Of course, next to these there are many different possible reasons for project failure. This is where the idea of project management comes into play. Project management helps to ensure benefits or

objectives of the project are achieved within time, budget and with the desired quality. It is defined as *"... the application of knowledge, skills, tools and techniques to project activities to meet project requirements*" (PMI, 2004). According to the Project Management Institute, it is accomplished by application and integration of processes as initiating, planning, executing, monitoring, controlling and closing. This plan-driven model is still the dominant approach according to Howell et al. (2010). Other approaches, alternatives or complementary, are for example agile, lean or soft methods.

With this basic knowledge of projects and project management in mind, a global review of scientific literature is conducted to show the developments in this research field.

These developments are said to be originating from the 1950s. In fact, the first publications on project management in a prestigious management journal was back in 1959 (Pellicer & Victory, 2006). In the 50s and 60s the focus of development in project management was on network analysis and planning techniques like PERT and CPM (Crawford, Pollack, & England, 2006). PERT, or Program Evaluation and Review Technique, is used to calculate the minimum time needed to complete a project. In the more routine work, CPM, or Critical Path Method, is used to prioritize activities based on a determined critical path. Based on a review of project management literature, the authors note the further development in project management to focus on teamwork and breakdown structures in the 1970s, an emphasis on project organization, risk and a first start towards standards in the 1980s. Furthermore, Crawford et al. (2006) note that "*a great deal of similarity can be seen between the forces influencing the general management and project management communities*". In their literature review, some topics noted to be dominating the 90s were human factors, information management, scheduling and performance (among others). The authors conclude with an increase in significance of project evaluation and improvement over the last 10 years up to 2003. Looking back at the developments in project management literature, little is written about project management in SMEs (R. Turner, et al., 2010). The focus has been on project management in predominantly large projects. These traditional approaches to project management will not hold for SMEs, because the characterization of big projects does not hold for smaller projects:

- Processes: the processes are formal and often bureaucratic
- Procedures: the procedures encourage specialization and formal decision making
- Structure: roles are well defined and traditional project management stifles innovation
- People: traditional project management is systems rather than people focused

Based on these type of characteristics, literature often ignored the fact that not all projects are the same and there is no universal set of managerial characteristics to a project (Shenhar, 2001). Or to use the words of Shenhar (2001): "*Indeed, several authors have recently expressed disappointment in the universal 'one-size-fits-all' idea…".*

Other scholars also argued that the universal idea is suboptimal and indicate that the project's structure and management approach should be tailored to the suit the context.

		Tailored procedures		Common procedures	
		% success	% failure	% success	% failure
Projects by size	Large	78%	5%	69%	9%
	Medium	73%	5%	73%	7%
	Small	80%	2%	59%	16%
Differing resource types		74%	7%	70%	10%

Figure 4: Figure on the effect of tailoring procedures, adapted from Payne & Turner (1999)

Figure 4 illustrates these statements, since it can be seen that tailoring of projects increases the chance for success and failure rates are reduced. Moreover, what can be derived from the research by Payne and Turner (1999) is that this statement especially holds for smaller projects.

As can be derived from the definition of project management by the Project Management Institute, project management is about applying knowledge, skills, tools and techniques to project activities. It is also this collection of elements which provide the flexibility in tailoring project management. More specifically, the OPEN process framework (Firesmith & Henderson-Seller, 2002) defines these operations as Work Units. The definition they provide is "*a functionally cohesive operation that is performed by a Producer during an Endeavor and that is reified as an object to provide flexibility during the construction and tailoring of a process*" (Firesmith & Henderson-Seller, 2002). Although the exact definition is stated in the context of the full life cycle, object-oriented development methodological approach, it gives a view on key project management elements. These are according to this framework; *activities, tasks and techniques.* The interconnection between these elements is visualized figure 5.

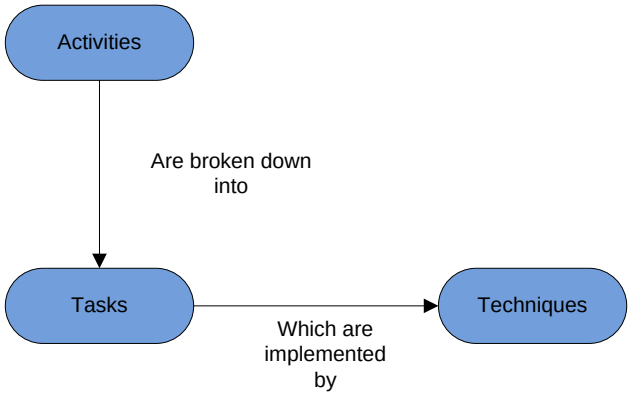


Figure 5: Interconnection of elements (based on Firesmith & Henderson-Sellers (2002))

These elements will be described based on definitions in the OPEN process framework. Since these are written in another context, descriptions are given in the context of this research. Activities can be seen as major parts of work consisting of a collection of tasks and described what needs to be done. These are described on the long-term. In order to be able to manage activities, these are narrowed down into tasks. Tasks can be seen as the smallest units of work, worth of assigning and can either be finished or unfinished. They do not provide a direct answer on how these units of work should be conducted. This is what a technique is about. According to the OPEN process framework, these

elements provide the flexibility in the tailoring process. Information on the tailoring itself instead is hardly provided.

2.2 Project Contingency Theory

As can be derived from the definition given on the concept of a project, a project is an organization by itself. More specifically, Shenhar (2001) states *"… projects can be seen as "temporary organizations within organizations," and may exhibit variations in structure when compared to their mother organization"*. This view of projects as temporary organizations has led scholars to extend the study of organizations in general to the field of project research. This extension of the theory seems to be a "*natural evolutionary step at this time*" (Shenhar, 2001). Especially, concerning the more recent developments in project management research, where a "one-size-fits-all" approach no longer seems to hold and scholars as well as practitioners are looking for ways to fit the project management method to its context. This topic of organizational fit, which is extensively researched in classical contingency theory, seems to have found its way into project management research (Howell, et al., 2010) to look for ways to improve the effectiveness of these "temporary organizations". This extension also seems in line with the earlier quote out of the work of Crawford et al.(2006), that forces influencing general management communities show similarity with those influencing project management communities. However, Howell et al. (2010) state that the Project Contingency Theory is still narrowly based, indicating that further research is needed to extend this theory, and not yet allows for the full range of projects. Because of this 'limitation' and of the lack of literature in this new field of research, we will first provide a short review on the domain of the classical contingency theory.

Based on earlier work (Drazin & Van de Ven, 1985; Lawrence & Lorsch, 1967), Shenhar (2001) states that classical contingency theory *"asserts that different external conditions might require different organizational characteristics, and that the effectiveness of the organization is contingent upon the amount of congruence or goodness of fit between structural and environmental variables."* The foundation of this theory was made in the late 1950s and gradually evolved since then. From literature it is not crystal clear who exactly can be named the founding father of the theory, but researchers like Woodward, Lawrence and Lorsch, Burns and Stalker seem to be the most influential ones (Sauser, Reilly, & Shenhar, 2009). Burns and Stalker for example were among the first to suggest that there is a distinction between incremental and radical innovation and between the type of organic and mechanistic organizations (Burns & Stalker, 1961). The external conditions that impact the organizational characteristic which is considered are called contingency factors (Howell, et al., 2010). A definition used in the field of IS, also related to project management, is the definition by Van Slooten et al. (1994): "*contingency factors are circumstances of the project influencing in some way the selection or construction of an approach (situated method) to systems development*". It is the task of contingency research, to identify the factors to which the particular characteristic of the organization needs to fit. In the decades after the birth of this research domain, contingency theory has been applied to a vast array of organizational characteristics as organizational strategy, structure, IT, operational management as well as to for example leadership characteristics.

Being one of the main theories in organizational science, this topic has already been extensively discussed in scientific and organizational literature and therefore we won't go through this whole history again.

The development of general organizational contingency theory we are interested in is the application to project management, also named Project Contingency Theory. For reasons addressed earlier, high rates of project failure and recognition of the complexity surrounding project management, the notion started to arise that the structure and management of projects should be tailored to the context. Here, the context can be described by contingency factors, as proposed by the Project Contingency Theory. All projects are simply not the same and this has an impact on how they need to be managed.

Based on a more in-depth, systematic literature analysis, contingency factors relevant to this research are identified in the next chapter.

2.3 Situational Method Engineering

One of the fields where the adaption of project management methods, especially development methods, has been actively researched is the field of management of information systems (MIS). Here, the notion of a one-size-fits-all-methodology has long been passed and the field of research has developed on this topic with the idea of Method Engineering (ME). A state-of-the-art review of the literature in this area was conducted by Henderson-Sellers and Ralyté (2010) in 2010, which provides insight in the particular field of research. Method Engineering is defined as the engineering discipline to design, construct and adapt methods, techniques and tools for systems development (Henderson-Sellers & Ralyté, 2010). This leads to the in-house construction of a methodological approach, which could be organization-specific of project-specific. This is accomplished by the selection of methods, or pieces, which already have been created and stored in a so-called method base. Henderson-Sellers and Ralyté (2010) define a major component of ME, termed Situational Method Engineering (SME), as encompassing all aspects of creating a development method for a specific situation (and excludes topics such as comparing methods and method knowledge infrastructures). It is indicated to be a solution offered to the problem of selecting the most appropriate method for a project. Method can be defined as "*an approach to perform a systems development project, based on a specific way of thinking, consisting of directions and rules, structured in a systematic way in development activities with corresponding development products*" (Brinkkemper, 1996). Following the line of reasoning of Henderson-Sellers and Ralyté (2010), we will take the words method and methodology as synonyms for the purpose of this study.

The term Method Engineering was first mentioned in 1985, was also named Methodology Engineering in 1992 but Brinkkemper (1996) strongly recommended to use Method Engineering, the name which is used up till now (Henderson-Sellers & Ralyté, 2010). The idea of engineering the method based on the situation is also linked in literature to contingency theory (Bucher, Klesse, Kurpjuweit, & Winter, 2007). Since there is no best way of organizing an organization or a project, the method must be contingent upon various internal and external factors that influence effectiveness. Where developments in the field of general project management research have come to at this moment in time, the field of research in MIS has already made some further progress. We will highlight the basic idea which is somewhat further developed in Situational Method Engineering, although to an extent that is not usable in the context of this assignment.

The method or process in Situational Method Engineering is made up of smaller components, called method fragments or method chunks. In the field of IS, a method fragment is defined as a description of an IS engineering method, or any coherent part thereof (Harmsen, 1997).According to Henderson-

Sellers and Ralyté (2010), a method fragment can be seen as an atomic element of a method. A method chunk on the other hand is defined to be a combination of a process-focused fragment plus one product-focused fragment. Here, the process part is a 'guideline' and the product-focused fragment is the product part. This distinction is used in the IS field to automate the selection of fragments.

Based on the work by Henderson-Sellers and Ralyté (2010), it can be said that it is well established that these method fragments are stored in something called a 'method base'. They state that, by taking the project characteristics into account, appropriate method fragments can be selected from this method base to assemble the best method for the situation. Furthermore, automated support is suggested (and also elaborated in literature, see the literature review on Situational Method Engineering for that (Henderson-Sellers & Ralyté, 2010)), but this is out of the scope of this research and will not be further looked into at the moment. However, the basic idea about this selection from a method base is very useful to get a picture of the possibilities of method engineering and we therefore adapted the graphical representation of this idea.

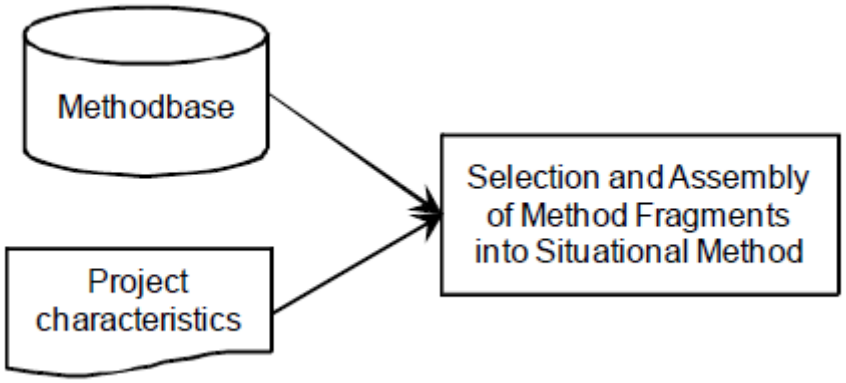


Figure 6: Situational Method Engineering from method fragments in the method base, while taking the project characteristics into account(Henderson-Sellers & Ralyté, 2010)

Situational Method Engineering can be applied to a development project at different levels of extension. This range varies from the selection of a complete and rigid method, to the full use of Situational Method Engineering. The range discussed here is called the Situational Method Spectrum, adapted from Harmsen (1997). Although this spectrum of Situational Method Engineering is mainly focused on development projects, it will serve as an idea for possibilities to integrate this concept to projects in this research as well.

- Use of rigid methods: This means the use of a standard method that inherently leaves no room for adaptation. Rigid methods adopt standards, based on one philosophy and are suitable for one type of project. There are no guidelines to adapt to other project types.

- Selection from rigid methods: This second approach in the spectrum is selecting one of the rigid methods, based on the project situation. When the most suitable one for the situation at hand is selected, this will be used without adaptations. Such a method will never fulfill all requirements. Next to this, high purchase and training costs are often involved.

- Toolkit/Multiview approach: This boils down to the inclusion of several methods, each addressing a specific aspect of the object system, into one method. This is dependent on the situation, but the approaches, however, provide no concrete suggestions about these factors. Next to this, the compatibility of the sub-methods seems problematic.

- Paths within one method: This means the use of a method where a certain path within that method can be chosen. An example is the choice between classic or rapid application development in IT.

- Selection and tuning of a method outline: This is an approach where a certain method will be selected to be suitable to the situation at hand, but unlike the selection from rigid method, the selected method can be tuned. The selection of the method is more a method outline

- Modular method construction: Indicated as the most radical solution, is the modular construction of methods out of method fragments. The fragments are derived from a method base. By certain rules and guidelines the method fragments are assembled together and form a consistent situational method.

2.4 Concluding remarks

This theoretical background has discussed the important concepts *project* and *project management.* This serves as a conceptual foundation to the reader for the rest of this thesis. Additionally, insights were acquired into the state of research of project management and Situational Method Engineering. The latter subject has evolved over time in the more developed field of IS research. Although this concept is more elaborated in the context of development methodologies, its basic notion of combining fragments into one method is useful. To determine in which form and to what extent this can be used in this research, referring to the SME spectrum, more research and insights into the organization are needed.

The linking theory between these two concepts has been introduced as the Project Contingency Theory. This theory refrains from a “one-size-fits-all” approach and emphasizes to investigate the fit between the project approach and its context. The evolution of classical contingency theory into the field of project management is still in its infancy, concerning the literature is still narrowly based. Accordingly we can conclude that although PCT is a good foundation, more in-depth study is needed. This systematic literature research is presented in the next chapter.

The elements for tailoring project management to these contingency factors have found to be, what the OPEN process framework calls, work units. Activities, tasks and techniques serve as the building blocks of a project management approach. However being conceptually identified, research into these elements in company context is necessary and will be conducted in chapter 4.

SPMME

3

In the previous chapter, the theoretical background of this thesis has been discussed. The concepts project (management) and situational method engineering have been explained by reviewing the field of research on these concepts. The goal of this chapter is to elaborate on the identified concepts in order to work towards Situational Project Management Method Engineering (SPMME). First, it will be explained what is meant with this new term. Then the methodology used in the literature review is shown. Based on this literature review, contingency factors from scientific theory are identified. These conceptual definitions are elaborated and further defined by using insights from practice derived from semi-structured interviews with project managers in the company.

"The important thing in science is not so much to obtain new facts as to discover new ways of thinking about them."

- William Lawrence Bragg -

3.1 SPMME

Referring to the previous chapter, the importance of projects in organizations is significant. Particularly for a project-based organization. However, despite being so important the failure rate remains high. Looking at the background that was introduced in chapter 2, it can be stated that the one-size-fits-all paradigm is more and more being regarded as insufficient in today's ways of doing business. In order for projects to work and deliver results, their management methods have to be fitted to the context in which they apply and tailored to the needs of the project.

Based on the theory in the previous chapter it can be stated that in the field of IS, software development processes in particular, the one-size-fits-all paradigm has long been set aside. A great diversity of development methodologies has been created to suit the needs of the business. A research field called Method Engineering arose from this process and with it methods could be created based on the company needs. This idea has even further developed, to where methods are created not only to fit company needs, but even to the situation in which the development process is taking place. This tailoring of the methodological approach to the situation is called Situational Method Engineering and its background has been described in chapter 2.

This research is aiming to combine the latest developments in both fields of research into an instrument that can be used by practitioners in the more general business domain of project management. On the one hand there is the need for ways of tailoring project management methods to the needs of the business, where on the other hand the developments of situational method engineering in development processes have come to the point where the choices are being automated. The discrepancy here is that there are no clear contextual elements identified in combination with guidelines on how these should be connected to the tuning of project management methods, explained in a language that can be used by practitioners in the field of business. In this research, we will try to fill this gap by working towards '*Situational Project Management Method Engineering',* or SPMME. A term we introduce for the application of situational method engineering into the more general domain of project management.

3.2 Methodology

In working towards a workable list of contingency factors, different research methods are applied. First a systematic literature review is conducted in order to capture the most relevant insights from scientific literature. Next, semi-structured interviews are conducted with project managers at Nibag in order to capture the practical insights. Afterwards, both are combined to get to the finalized list of project contingency factors. In this part of the chapter, both research methods are first explained.

3.2.1 Approach

As briefly described in the introductory part of this paragraph, different research methods are applied to capture both theoretical and practical insights on project contingency factors. To provide

the reader with the reasoning behind the approach of identifying contingency factors, this is noted before the methodology is further explained.

After finishing the literature review, conducted in October and November 2010, it became clear that not all identified contingency factors are clearly defined in theory. Next to this, Howell et al. (2010) state that the literature base on the subject is limited and therefore the combination of theory with practice will provide more insights and can extent findings found in scientific papers. Furthermore, practical insights are used to state definitions closer to the perceptions of the project managers at Nibag in order to increase usability in the company context. Since the majority of the contingency factors is derived from IS literature, which is not strange because situational method engineering is much more developed in this field of research, some of these identified factors might also possess a different meaning outside the context of IS research and this is captured by the practical insights.

To acquire these practical insights it is chosen not to give them information on contingency theory in advance. This, in order to capture as much of their own interpretation on contextual factors relevant to project management as possible and not to confuse them with found theoretical definitions. Their descriptions are used to contextualize theoretical definitions to fit the company situation and factors not identified in literature are added.

Next to this hard side of the research, the soft aspects of this research project are covered by application of the line of thought of '*technochange management*' (Markus, 2004). This term, first coined by Markus in 2004, stands for technology-driven organizational change. Line of reasoning to apply technochange management to this research project is that the introduction of a new artifact, which could be introduced with some new form of IT in the organization, will involve an organizational change that is driven by new technology. In this light, the users (project managers) will be involved as much as possible in the design of the artifact. This is also in line with findings by Boonstra and Vink (1996) based on the sociotechnical perspective; "*With respect to the power and political processes, an important prerequisite for a successful change process is that the largest support possible should be generated in the earliest state possible*" (Jaap J. Boonstra & Vink, 1996). However being introduced here, the idea is further elaborated on in the chapter on implementation.

3.2.2 Systematic Literature Review

A review of prior literature on the concepts of interest is conducted in order to create a theoretical foundation for the artifact developed in this thesis and to provide an answer to SQ2. As the collection of scientific knowledge will create a head start in the construction of the artifact, an effective and systematic way of reviewing is needed. To do so, the structured approach proposed by Webster and Watson (2002) is used. The authors state that using the proposed systematic way of reviewing scientific literature should ensure the accumulation of a relative complete census of relevant literature. This does not mean that every single important paper is captured by this methodology, but the chances of missing relevant articles are reduced to a minimum within the given time frame. This structured approach consists of the following three steps.

Step 1. Identify key journals and select key words

The reasoning is that major contributions will be published in leading journals and therefore it is the best source to start reviewing the literature (Webster & Watson, 2002). Next to this, due to the time frame, reviewing all scientific literature is impossible. Therefore a purposely-biased sample of literature is wanted: only the most influential papers in the fields of research. To achieve this goal,

the selection of relevant top journals by Kwak and Anbari (2009) is used. They took the FT40 (Financial Times top 40 journals in Business) to review the most important literature of allied disciplines to Project Management. They reviewed this list on relevance to project management and eliminated 24 journals. A list of the remaining 16 journals was then extended with two practice-oriented journals. This list of 18 journals did not include the journals that focus on Project Management as a discipline, since their interest was towards the allied disciplines only. For the coverage of relevant journals in this research however, it is important to add the specific journals as well. By adding the specific journals related to PM research mentioned by Kwak and Anbari (2009), a list of 26 journals is created that will at least be covered in this literature review and is given in table 1. The 8 specific PM journals are indicated with an asterisk (*).

Table 1: Top 26 journals in field of Project Management

Top 26 Journals in project management
AOM Perspectives/Executives
AOM Journal
AOM Review
Operations Research
Management Science
Organization Science
Information Systems Research
Interfaces
Harvard Business Review
California Management Review
Sloan Management Review
Longe Range Planning
IEEE Transactions of Engineering Management
Journal of Operations Management
MIS Quarterly
Strategic Management Journal
Administrative Science Quarterly
Journal of Small Business Management
Project management journal (*)(+)
International journal of project management (*)
International journal of managing projects in business (*)(+)
Journal of construction engineering and management (*)
Journal of management in engineering (*)
Construction of management and economics (*)
Technovation (*)
R&D management and research policy (*)

Next to the fields of business and project management, the field of IS research is reviewed in order to gain insights in developments of situational method engineering. This field of research will provide valuable insights, since it is more developed on this subject than any other field. Top journals within IS management research have been identified using the paper of Schwartz and Russo (2004). In their

study they present the top 50 world ranking IS journals. In this research, coverage of the top 25 journals in this field of research is used. This list can be seen in table 2.

Table 2: Top 25 IS Journals

Top 25 IS Journals
MIS Quarterly
Communications of the ACM
IS Research
Journal of MIS
Management Science
IEEE Transactions (various)
Harvard Business Review
Decision Sciences
Decision Support Systems
Information and Management
European Journal of IS
Sloan Management Review
ACM Transactions (various)
Data Base
Organization Science
Information Systems Journal
Academy of Management Journal
Communications of the AIS (+)
IEEE Computer
Journal of Strategic IS
Admin. Science Quarterly
Academy of Mgmt Review
International Journal of E-Commerce
ACM Computing Surveys
Accounting, Management & IT

In order to gain coverage of these journals, the scientific literature databases Scopus ("Scopus," 2010) and Web of Science ("Web of Science," 2010) were scanned on their coverage of these journals. Neither of the two databases covers the total list of 26 journals in project management identified above. A combination however does provide the coverage. Scopus covers 24 out of 26 of the journals, and the other two journals (Project Management Journal and the International Journal of Managing Projects in Business) can be covered using a specified query in Web of Science. In this research project it was preferred to use the option of hand search for these missing journals. It should be stressed out that the search query in Scopus does not focus on these 24 papers alone, but it will search in the entire database of Scopus in order to reduce the chance of missing out on other important papers which are not published in the identified top journals, but could contain relevant information for this research. However, by combining the search options, the coverage of the most relevant 26 journals is guaranteed. By using Scopus, a coverage of 24 out of the top 25 journals in IS research is guaranteed. Only the journal Communications of the AIS remains uncovered. This journal

was therefore also hand searched. The three journals that are hand searched are indicated with a (+) in the tables.

Key words, search criteria, prioritization criteria and a graphical presentation of this methodology are given in appendix B.

Step 2. Backward search

Due to the multidisciplinary characteristic of these fields of research and the years of research that have already passed, most important prior work can also proof very interesting. In order to select these articles, the acquired collection of papers was posed to backward search. This means that references were reviewed to select further interesting papers.

Step 3. Forward search

Having identified the most important papers, further articles citing these papers were identified and scanned using the forward search technique.

After applying the methodology described above, a number of articles were selected to be included in this research. In order to synthesize the findings in these articles, a concept-centric approach was used (Webster & Watson, 2002). The concept matrix listing these papers and the topics discussed is presented in the next paragraph. As a result of this synthesize, a total amount of 25 papers was included in this research and the process of selection is visualized in the flowchart (figure 7).

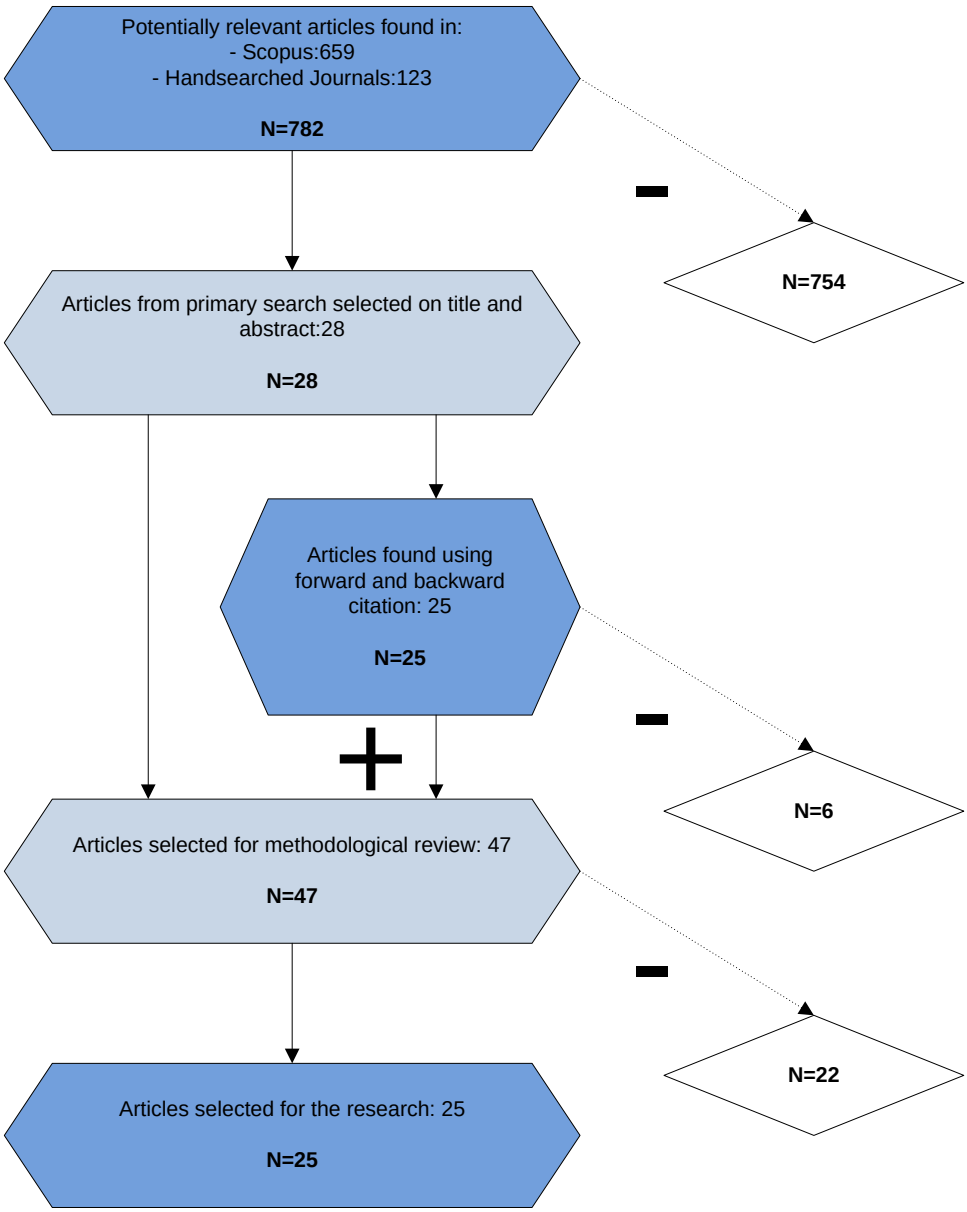


Figure 7: Flowchart resulting from synthesized review of literature

3.2.3 Semi-structured interview

In order to answer sub-question SQ1 and SQ3, the semi-structured interview is chosen as the research method. The goal of the interview is to get information on contextual factors they identify in practice, without receiving information on any found contingency factors in literature as also explained in the approach. The interviews are also conducted to acquire insights in the current way of project management, the problems they encounter and on requirements for a possible solution. In selecting a methodology for collection of this qualitative data, a few criteria lead to the choice of this research method. First, reducing what the respondents say about a certain topic to a set of predetermined answer categories seems unsuitable. Applying such a method would include a high risk of missing out on topics that are not captured by the answer categories and is therefore considered non-effective. Second, to acquire as much contextual information as possible on the identified topics, deeper questions need to be asked based on the information given by the

respondents. The list of topics and subtopics identified at the start of the interviews is given in the Appendix.

The sample consisted of the people concerned with project management in the company and was identified in a meeting with Pim Boswerger. Interviewees have been selected based on their connection with the problem situation and/or their experience concerning this research subject. Since this group was not larger than 8 persons, this did not pose any considerable time issues. The duration of the interviews was between 45 and 90 minutes and they were audio recorded after approval of the interviewee. In order to be able to optimize the interview session, the first interview was conducted with Pim Boswerger and evaluated to learn and improve for the next 7 sessions. The following people were interviewed in January and February 2011;

Table 3: Information on interviewees

Interviewee	Function	Years at Nibag	Intern/Extern	Date	Location
Jacco Bakker	Segment owner Care	5	Intern	21-1-2011	Uden
Pim Boswerger	Project Manager Safety	5	Intern	11-1-2011	Oldenzaal
Bjorn ten Broeke	Project Manager Monument Conservation	4,5	Intern	7-2-2011	Oldenzaal
Nico Jans	Project Leader Energy	0-1	Intern	21-1-2011	Uden
Gijs van der Kolk	Project Manager BPM and MJOP	4,5	Intern	22-1-2011	Oldenzaal
Jeffrey Mennen	Segment owner Corporations	5*	Intern	26-1-2011	Uden
Mark Schipperen	Project Manager Insulation	18	Intern	26-1-2011	Uden
Manuel Schoonveld	Project Manager Durability	2	Extern	2-2-2011	Ommen

*Jeffrey has been employed elsewhere for the last 4 years and is back since a few months.

The audio fragments were transcribed after the interviews and this was done at the same day or a day after in order to take all non-verbal information into account as well. In order to optimize this process, the most important interview characteristics were written down immediately after the interview session. Data analysis was conducted by using the software package NVivo.

3.2.4 Data analysis

As indicated in the last paragraph, small notes were made immediately after conducting the interview to capture as much of the non-verbal information as possible. The verbal information was transcribed at Nibag Oldenzaal the day of the interview or in some cases a day later. The period was kept to a minimum in order to capture the meaning of the verbal statements in an optimal way. Transcription was not word by word, but due to time constraints and interview length limited to capture most important insights. Nevertheless, the amount of text of the transcription still ranged from 5-10 pages full text per interviewee. For the data analysis, research software package QSR NVivo 8 was used.

First, transcribed interviews were imported as internal sources in order to be able to code these documents on their topics (figure 8).

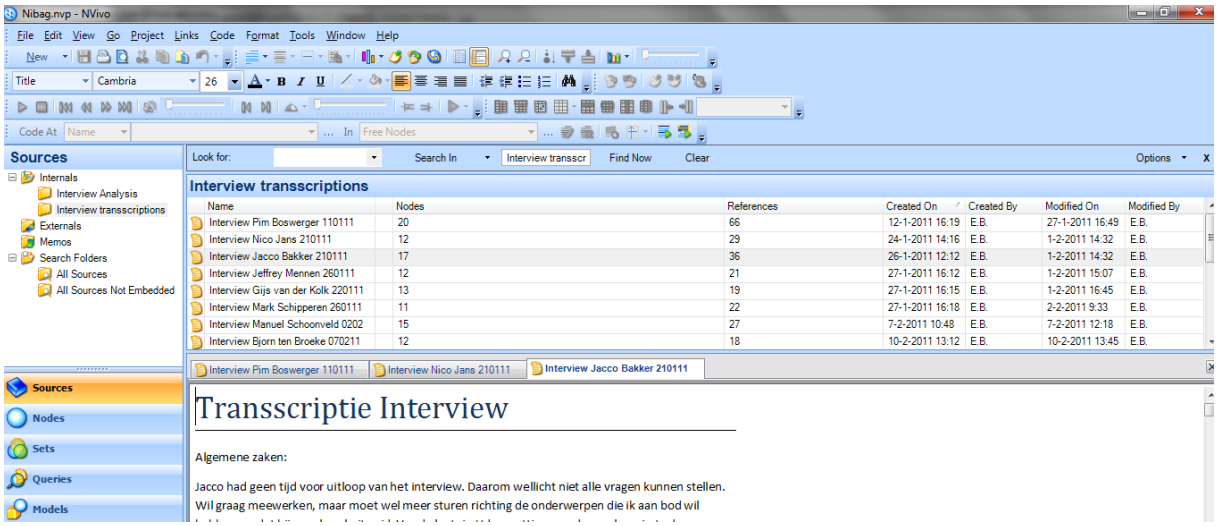


Figure 8: Screenshot of NVivo displaying list of transcribed interviews

Importation of the transcribed interviews enables you to code selected interview fragments. This was initially conducted based on topics of the interview. These topics were again coded based on relevant identified sub topics. Thereafter factors were coded in order to capture all insights on identified contingency factors (figure 9).

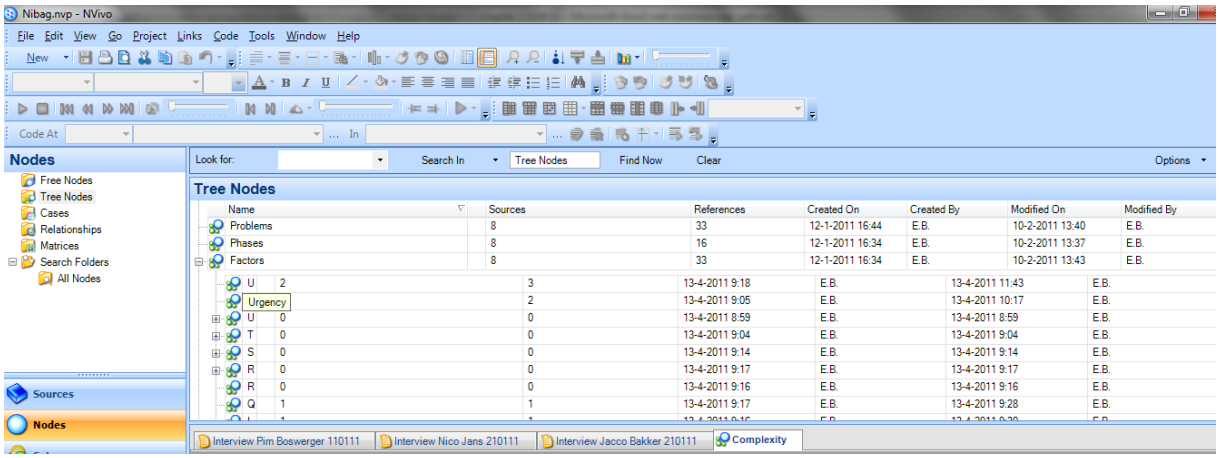


Figure 9: Screenshot of NVivo displaying the coding of contingency factors

Based on this coding of contingency factors, deriving quotes and analyzing statements on these factors is made easy. Findings combining practical as well as theoretical insights will be discussed in the next paragraph.

3.3 Findings

The idea of the contingency theory is that fitting organizational characteristics to contingencies that reflect the situation yields better performance of the organization (Donaldson, 2001). In the background, the idea of viewing projects as "temporary organizations within organizations" has been elaborated. Combining this definition of projects with contingency theory (as being a theoretical lens on organizations) yields a foundation for looking at the project context from the perspective of the contingency theory. Or to use the words of Howell et al. (2010) *"…provided that projects can be differentiated in terms of contingency factors, contingency theory allows for the possibility that different approaches may provide better performance and provides a framework for investigating*

why". Following this line of reasoning, the project contingency theory appeared and this part of the chapter will investigate which contingency factors might be applicable to the context of this research. Citing Howell et al. (2010), criteria to be considered a contingency factor are; "*(a)...variables which are primarily environmental (i.e. external to the project), and (b) potentially require different project characteristics for optimal performance".*

Following Webster and Watson (2002), a concept matrix was created to order the findings resulting from the systematic literature review. This matrix is presented in table 4.

Table 4: Concept Matrix

Concept Matrix																											
Articles	Concepts																										
	Uncertainty/stability	Complexity /scope	Team Empowerment	Criticality	Urgency/Pace/time/duration	Size	external control/power	interdependencies /dependency	Openness	Novelty/innovation	Technology	Management Commitment	Importance	Impact	Shortage of resources	Cost	expertise degree / Knowledge/ deepness	Stakeholder number	Formality	Repetitiveness / Reusability	domain (knowledge gap)	quality	Resistance	User involvement	Relationships	clearness / ambiguity/ clarity	Team location
1	X	X	X	X	X																						
2	X	X				X	X																				
3								X	X																		
4																											
5		X			X					X	X																
6								X																			
8	X	X			X	X		X			X	X	X	X	X	X	X	X	X	X			X	X			
9	X			X	X	X		X		X							X			X	X	X				X	
12	X	X									X																
13		X			X												X										
14	X	X															X										
15	X	X																								X	
16	X	X									X																
19	X				X	X				X		X	X	X	X		X	X	X	X	X		X	X		X	
24	X	X			X	X		X		X		X	X	X	X		X		X				X		X	X	
25	X	X		X	X		X				X						X					X					X

The number on the left refers to an article from a scientific journal or proceedings of conferences on related themes and have been identified using the literature review methodology. The articles the numbers refer to can be found in appendix C. Concepts that share the same meaning have been grouped together. As can be seen in the table, the identified contingency factors are not all stated at the same level of abstraction and a critical review is needed. In order to derive a logical set of

contingency factors and to remove factors not considered relevant, a first theoretical analysis was done based on the factor definitions stated in the articles. Based thereon, the following list was created (table 5).

Table 5: Listed contingency factors after first review round

Contingency Factors		Recognized in practice(1)	Added from practice(2)
Ambiguity		X	
Complexity		X	
Cost		X	
Criticality		X	
Dispersal		X	
Domain knowledge gap			
Expertise degree		X	
Formality		X	
Impact			
Importance			
Innovation		X	
Interdependecies		X	
Law and regulation			X
Management commitment			
Novelty		X	
Openness			
Politics			X
Quality		X	
Repetitiveness			
Resistance		X	
Shortage of resources		X	
Stakeholder number			
Team empowerment			
Team size		X	
Time		X	
Uncertainty		X	
Urgency		X	
User Involvement		X	

In this revised list of contingency factors only 'relationships' is left out as it is considered to be irrelevant outside the field of IS. Relationships is defined by Van Slooten & Hodes (1996) as "*to what extent there are relationships between the old system and the new system*". This is a typical feature for IS and therefore considered irrelevant in this research.

Not all factors are well described or defined in literature. Sometimes definitions are missing, or the context is different from this research. In order to get to workable definitions in the context of this research and to make these factors more tacit for practitioners, semi-structured interview sessions were conducted. The methodology of this interview session has already been discussed in the previous paragraph. Information derived from this interview was used to more practically define the

identified contingency factors from literature and to identify possible practical contingency factors that were not found in literature. In table 5, factors that were identified by practitioners and also found in literature are marked with an X in column 1. Factors that were not found in literature, but are identified in practice as being important, are marked with an X in column 2.

These findings are presented in the next paragraph. Here, theoretical insights on the factors are given first. Thereafter, relevant quotes from the interview sessions are presented in order to provide practical insights. Quotes are selected based on their relevance and on their summarizing nature of the verbal statements made during the interview sessions. It is possible that multiple quotes were made on a certain subject, by several practitioners. Listing quotes that represent the same meaning will not yield additional insights and are therefore left out of this presentation of findings.

3.4 Presentation of results

In this paragraph findings briefly discussed in the previous section are presented. The relevance of identified contingency factors is noted. Next to this, definitions of the factors are presented in the context of this research based on both theory and practice. The contingency factors are noted in alphabetical order.

3.4.1 Ambiguity

At the start of a project, clear formulation of what a customer wants is important. Clarity, or ambiguity, can be defined as *"... to what extent the goals, needs and desires of the users are clear and coherent enabling a sound specification of the functional requirements*" (van Slooten & Hodes, 1996). A sound specification can also be named unambiguous.

This sound specification can be noted in very different formats, as stated by Jacco for example:

"... one time it is 1 A4, another time 2. A contract in Energy Procurement is sometimes not more than an e-mail, saying sign this and you'll save that. <…> But I also have a contract with a specification of more than 70 pages… Is that workable? Not quite, but there were some thoughts specified that proved very useful…"

For organization where the stakes are a bit higher, Nico states:

"Take for example governmental organization X. I did not know that organization that well, it was very formal. They will check everything in the contract, small letters… That's where they will judge you on. I think we should check this very well in the beginning. You should steer such a project very much on what it is they ask. Exceeding schedule for example would result in a big fine. <…> we often decide on information that is not complete, and sometimes you hurt yourself by doing that. We should get things clear in the beginning."

The importance of getting clear what it is a customer wants is also underlined by Pim:

"It is something I've learned that is very important to get clear before the project starts: know what moves the customer, why is he doing it and what is it exactly what he wants. Earlier, when company X said we have €500.000 for a project, I would immediately start running…"

Definition: To what extent the goals, needs, and desires of the users are clear and coherent enabling a sound specification of the functional requirements

3.4.2 Complexity

Complexity is noted as being one of the most prominent contingency factors identified in scientific literature (Howell, et al., 2010). Together with uncertainty, the concept of complexity is noted in more than half of the papers in the literature review. Project complexity is defined as *"... the degree of differentiation and interdependence of project elements*" (Howell, et al., 2010).This definition of complexity is also strongly related to the scope of a project (Punter & Lemmen, 1996; Shenhar & Dvir, 1996; Van Slooten & Schoonhoven, 1996).

In their work, Shenhar & Dvir (1996) distinguish three different levels of scope based on the complexity. The first level is called '*assembly projects'* and these projects are dealing with the construction of a single component or the assembly of a collection of components and modules into a single unit. The second level is called '*system projects'* and this is defined as *"...a complex collection of interactive elements and subsystems within a single product, jointly performing a wide range of independent functions to meet a specific operational mission or need*" (Shenhar & Dvir, 1996). Here, the element of complexity is also part of the definition and the degree of differentiation and interdependence of project elements is visible. The degree of interdependency and differentiation is even higher in the third level that is distinguished, named *'array projects'*. These are large and widely dispersed collections of different systems that function together to strive for a common goal. Because of the great similarity with the definition of complexity, scope is taken as a synonym in this research. In later work by one of the authors, the system scope is also named the complexity dimension (Shenhar, 2001). Another way of distinguishing levels of complexity is described by Van Donk and Molloy (2008), based on the work by Mintzberg (1979). The typology of projects used here, based on complexity and ranging from a low level of complexity to a high level is; the simple project, the bureaucratic project, the divisionalised project, the professional project and the adhocracy project.

This idea of complexity, or scope, is also identified as relevant in practice. In working with advanced concepts, Manuel indicates that often multiple initiatives and services come together in one project. This increases the complexity in project management as well.

The coming together of multiple processes in one project and its influence of on project management is also recognized by Pim:

"These contain some specific things, but in general also have identical behavior. Then you go searching for processes to improve and optimize things inside the project."

It should be stressed that the differentiation and interdependence indicated here, relates to the internal part of the project. External dependencies are defined by other contingency factors.

Definition: The degree of differentiation and interdependence of project elements

3.4.3 Cost

Kornyshova et al. (2010) identify cost as being context characteristic essential for a IS engineering project. Next to being identified, no definition is provided by the authors on what exactly is meant with cost. Although lacking a definition, cost is noted to be an organization facet. Hence, we use cost as being the amount of costs that have to be made by the organization in order to make the project work.

In practice, the costs involved in a project were not named as a contingency factor.

Definition: The amount of costs that have to be made by the organization to make the project work

3.4.4 Criticality

Criticality means how much is "at stake" in the project (Howell, et al., 2010). This means the effect upon the organization or individuals of project failure. According to Howell et al. it is mainly cited in IT papers as being a contingency factor. Although being derived from this field of research, it is a factor relevant to other fields of research and practice as well. The line of reasoning is that there can be great financial as well as non-financial consequences to project failure. However being most of the time proportional to the size of the project, in IT this can have considerable impact. But also for a project like fire safety it can be imagined that failures in the project can have huge (disproportional) consequences to the business.

Although being identified as a contingency factor mainly in IS papers, criticality is also named by the majority of the interviewees. Different terminology is used by the interviewed project managers to relate the effect upon the organization or individuals of project failure. Examples are; consequential costs of failure (Jeffrey), risk factor of failure (Mark), and company risk (Pim) or liability (Manuel).

Concerning liability, Manuel notes:

"*Recently, I started to work in a more formal fashion, but purely considering the liability. <….> these are some pretty progressive concepts. It still is a calculation on paper, but if company X starts building such an innovative building…. What if the building turns out to be uncomfortable or not energy neutral… Quite a big claim can be the result.*"

Pim links the amount of business risk also to the decision of buying knowledge:

"*In the beginning I did not really consider the business risks. <….> But project risks as well as business risks, they also influence the effect on decisions to buy in expertise.*"

Definition: The effect upon the organization or individuals of project failure

3.4.5 Dispersal

One element to be related to the functioning of a project team is identified to be dispersal (Howell, et al., 2010). This factor is also named team location in literature (Little, 2005). Dispersal affects the ease of communicating between team members and therefore limiting the ability to use the power effectively. As noted by Little (2005), operationalizing this factor is hard. As can be imagined, when a team is dispersed among different locations the functioning of the project team depends on the kind of people that have or lack the ability to easily communicate with each other.

The problem with communication between team members when they are not located in the same room is also noted in practice by Jacco.

"*The extent to which project management is formalized also depends on where your people are. Is it wise to do when all three project members are in the same room? When you have to communicate with people throughout the country, then it might be a smart thing to do."*

Based on the description in practice and the notion made in practice, the definition we will use, as the definition is lacking in literature, is "*the extent to which the spreading of members of the project team over different locations affects the team empowerment*".

Definition: To what extent the spreading of team members over different locations affect team empowerment

3.4.6 Domain knowledge gap

The contextual characteristic domain is identified in two papers (Kornyshova, et al., 2010; Kornyshova, Deneckère, & Salinesi, 2007), but they do not provide a definition for this factor. It is imaginable that a certain domain or market, where Nibag is providing services, poses different demands on project management than another. Although this line of thought is relevant on project management, we think this part is covered by the factor politics, which is described later on in this paragraph. Since there is no further definition given by both authors we take this logic for covered.

Little (2005) has a different look on domain and uses the term *domain knowledge gap*. Although the author does not provide an explicit definition, the line of reasoning makes sense. Domain knowledge gap is the discrepancy between the amount of knowledge available in the project team and the amount of domain knowledge needed. Lack of knowledge about the domain should indicate the need for an expert. To translate this to the situation of Nibag, lack of knowledge about a market by the product owner should imply contact with the segment owner to provide the needed information. Despite making sense, this factor was not directly identified during the first interview sessions. However, based on the reasoning above we think it is useful in this research and will use a definition based on the description found in the work by Little (2005). The authors additionally note that it is a hard factor to measure and using judgment of the teams is advised.

Definition: The discrepancy between the knowledge the project manager has about the domain and the amount of knowledge needed

3.4.7 Expertise Degree

In a diversified portfolio of projects, there is also a differentiation in the amount of knowledge that is needed to complete the project. As projects require more knowledge, it poses different demands on project management. For the field of IS the knowledge/skills or expertise degree is defined by Van Slooten & Hodes (1996) to be "*the extent the members of the project team possess enough knowledge and experience to develop the required information system*". In the context of this research we will therefore adjust this definition to the extent the members of the project team possess enough knowledge and experience to deliver the demanded product/service.

Relating to the concept of innovation, Manuel indicated that in certain areas the knowledge and expertise has to be bought in. Referring to his statement:

"*.. I make a report on for example some kind of climate concept and then in very awkward buildings. Some kind of house made from glass. Now, you make a sustainable office inside such a building that does not get overheated in a sustainable concept which means not using air-conditioning units. In that case I will identify where the knowledge and expertise is in this area, and we will buy it*"

Definition: The extent to which the members of the project team possess enough knowledge and experience to deliver the demanded product/service

3.4.8 Formality

One external factor limiting the ability of the project team, or pose additional demands on their way of working, is the formality demanded by the project. Formality is defined as "*to what extent there are lasting rules, procedures and standards for the business process and supporting information*" (van Slooten & Hodes, 1996). These restrictions on the freedom of the project team in conducting their project can come from inside the organization, or from the side of the principal. It is also greatly agreed on by practitioners to be relevant to their project management and the extent to which formality is demanded varies enormously between projects. A nice example is the statement by Gijs on the lack of formality:

"*Creating a schedule of requirements for example, with a good team it is not needed. The point is to know what should be where. If I don't do it, will it hurt me? I now have a customer… he doesn't even want to sign a contract…"*

In yet another project, Jacco stated that formality was a big issue and relates it to size:

"*Company X worked with some basic principles that we were obliged to follow. It was no problem, very clear. But then we are talking about a couple of buildings larger than 50.000 square feet. That is very different from a building of 200 square feet in the case of childcare."*

Also from these quotes from practice, it is clear that formality is not simply an official way of communicating. Formality is also, perhaps even more, about the rules and procedures the project team is obliged (or desired) to follow.

Definition: To what extent there are lasting rules, procedures and standards for the project and its deliverables

3.4.9 Impact

Impact is a factor mainly found in IS literature. The definition provided by Van Slooten & Hodes (1996) "*To what extent the IS will change business operation after implementation",* is also IS focused but could be transcribed to: To what extent the project will change business operation after implementation. As it was not identified in practice as being relevant, it needs to be seen if this factor is useable for a decision instrument outside the field of IS management.

In the field of IS, it can be imagined that if the new IS greatly impacts the business process, this has to be accounted for during the project. However, in the light of this type of business, the importance of this factor is questionable.

Definition: To what extent the project will change business operation after implementation

3.4.10 Importance

Importance is defined as "*To what extent the project is important to the organization*" (van Slooten & Hodes, 1996). This contextual factor is also identified by Kornyshova et al. (2007), but they don't provide a definition. Our reasoning behind this factor is that some projects can be of considerable importance to the organization conducting it. In the case of Nibag, one could expect a project being important if the company wants to make the move into another segment and the project is for example the first they conduct. Another reason might be that the company expects a lot of follow-up

projects when it is successfully closed. Due to this reasoning, this might pose additional demands on project management as well.

Definition: To what extent the project is important to the organization

3.4.11 Innovation

Shenhar & Dvir (1996), who are named one of the most notable authors on project contingency theory (Howell, et al., 2010), have related technology to uncertainty. The line of reasoning is that the amount of change in technology is associated with uncertainty and they classify the levels of technological uncertainty at the time of project initiation. Van Slooten & Hodes (1996) take this view a bit wider by not only viewing the newness of the technology, but also the newness of applied methods to the organization and call this aspect the level of innovation. This is defined as "... *to what extend the applied technology and/or the applied methods, techniques, and tools are new to the organization*" (van Slooten & Hodes, 1996). This poses great similarity with the description about technology stated above however extending it with methods, techniques and tools as well. This latter part as well as the technology part of the definition is also identified by practitioners.

In the interview, Manuel indicated the importance of the newness of the technology… he stated:

"…these are some pretty progressive concepts concerning sustainability. It is a calculation on paper, but company X will build such a building. When these calculations prove to be wrong, or the building is not comfortable, a huge claim can be the result. Next to this, I work with lots of other parties, we buy in specific knowledge, and I have to trust that this works. I will keep my accountability within limits, cause I say; guys these are such new technologies… there are risks attached to it"

Relating to this concept again later on to the newness of the used technology, Manuel indicates that in these projects knowledge and expertise has to be bought in to ensure the success in the project.

More on the part of applied methods, techniques and tools is the statement on a new project by Pim:

"…but a project like X, there you develop an entirely new product. This is a combination of products in a new look and feel, resources working together for the first time and working with new working systems… you should store this knowledge somewhere in the organization. As a project manager you should think about these topics in advance. This is important for the transfer to colleagues, as well as to the principal"

Definition: The extent to which the applied technology and/or the applied methods, techniques, and tools are new to the organization

3.4.12 Interdependencies

Earlier the dependencies of project elements internal to the project were identified as being relevant (these are however externally posed on the project). Looking at criteria a) for being a contingency factor; *… they must be variables which are primarily environmental (external to the project)*, internal factors in the organization can still be seen as a contingency factor as long as being external to the project. Interdependency of a project can be identified as "*how well projects depend on each other*" (Canonico & Söderlund, 2010). As can be imagined, this is particularly relevant to a project-based organization. This notion can however be extended to other activities going on in the organization

looking at the definition of dependency by Van Slooten & Hodes (1996) "*to what extent the project depends on activities and conditions outside the project*".

One problem when not looking at interdependencies with other projects in the organization is nicely stated by Jacco:

"… if we go back in time, we had different clients in childcare. Every different client had its own project manager. Despite selling the same kind of service, every project manager started organizing his environment in his own way. At a certain moment in time we had 4 different ways of working in the same segment, for 1 service. Lots of capacity was lost, because employees had not enough work on one project, but could not be allocated to another since they worked differently."

Referring to an earlier quote by Pim on scope…

"… in the responsibility of an outline agreement, thereby multiple projects come together. These projects have some specific characteristics, but also behave in a generic way. In such a case, you look for processes to optimize."

… we also see the importance of taking activities and conditions outside the individual project into account.

Definition: How well projects inside the organization depend on each other or on activities and conditions outside the project

3.4.13 Law and Regulation

A factor not found in literature, but indicated in practice to be of relevance to project management, is the law and regulation. Bjorn indicates that is critical to think of law and regulation in advance. It is imaginable that some form of law or regulation will affect scheduling of a project or the extent of documentation in some phase.

One could reason that the law and regulation could be seen as some sort of formality. Where the rules and procedures are preliminary posed on the project from the side of the principal or the own organization, law and regulation is posed from some sort of governmental party and we will denote this as a separate factor.

Definition: The extent to which law and regulation influences the project.

3.4.14 Management Commitment

The commitment of general management is important for a project. Lack of top management support is identified as being one of the most important issues for project failure, hence the importance of management commitment as a factor in project management. We will use the definition by Van Slooten & Hodes (1996): "*To what extent management supports the project*". This is however not indicated to be of influence in the first interview session.

Definition: To what extent management supports the project

3.4.15 Novelty

Newness of aspects of the project to the organization conducting the project has been defined as the factor innovation. The service or product which is provided by the project to the customer can

however also be new to the customer itself which can pose different demands on project management as well. Based on several works by Shenhar and Dvir (e.g. (Shenhar, 2001)), Sauser et.al. (2009) state novelty to be "*the product newness to the market and customers*".

As already seen above, newness for the organization of applied technologies and/or methods, techniques and tools poses some challenges to project management. Although not directly identified by the practitioners in the interviews, product newness to market and customers is identified in literature to be a factor to take into account. We will adapt the definition as provided in the literature.

Definition: The product newness to the market and customers

3.4.16 Openness

Looking at the definition of interdependency stated above, projects also depend on elements external to the project being external to the organization as well. This is indicated by the openness of the project. Openness is defined as "*the degree to which projects depend on other organizations' resources and expertise to be able to achieve their set goals*" (Canonico & Söderlund, 2010).

Next to the identified dependence on activities, conditions and other projects inside the organization on the one hand, and the dependence on expertise that has to be bought in, it is imaginable that projects have to rely on other elements outside the organization as well. This factor is not directly indicated in practice, but based on the literature review it is taken as a contingency factor as well.

Definition: How well the project depends on other organizations' resources and expertise to be able to achieve their set goals

3.4.17 Politics

An element not explicitly stated in literature can be termed politics. During different interview sessions this factor came up. We will define this concept as "*the extent to which the political situation inside the principal organization and other stakeholders poses higher demands on project management*". It is important to note that the factor politics is one of the most noted factors during the interview sessions, as six out of the eight interviewees made statements highlighting its importance to them in their project management. By stating some of these quotes here, we would like to indicate what exactly is meant with the political situation.

A practical concern raised by Bjorn:

"*… organization of a client... So, are you revenue driven in the case of a project developer: they try to keep the lead time as small as possible, maximize profits and with budgets as low as possible. But if it is a foundation like in a social context: sluggish, hesitation, different layers... hard…*

<…>

It is also about the person you are talking to; is it an interim manager, then he would like to score fast. Decision making is faster in such a case. But talking to a person of high age working for the government for a very long time, it is much more bureaucratic."

This bureaucratic aspect of such organizations is also provided as an example by Gijs:

"… If your client is a facility manager at child care, you know the project is very sensible to the politics. The location manager has an opinion on it, the financial manager, region manager… Your client has no permission to make the decision and is just a toy in the organization. In that case phasing of your project is very important. "

The political situation is important to understand the perspective of the organization and the individuals and also to understand their expectations and attitude towards the project. As Gijs also states:

"…it is important to know what the client thinks of it. Does he want an extensive report, a statement… or does he care at all? I think it is one of the most important things to know in project management, who exactly is your client?"

The influence of this factor can be exemplified by statements by the other project managers as well, but this concerns aspects already noted above. A small quote of Mark underlines the effect of politics on project management:

"*Some will call you once after 4 months and you explain your progress in 3 sentences, then the client knows enough*"

Finally, Pim takes the political factor a bit wider saying:

".. who are the most important stakeholders? Who are the people that influence my client or the client situation? If you only focus on the issues in your direct environment you will encounter behavior of your client somewhere in the process that you are not able to explain. If you can research this in advance, then they can respond to your interventions."

Definition: The extent to which the political situation inside the principal organization and other stakeholders poses higher demands on project management

3.4.18 Quality

The same line of reasoning as for domain knowledge gap is used to derive a definition of the factor quality. Identified in literature, but a definition is lacking. However, it is imaginable that within a certain project a specific quality will be demanded. This is not necessarily the highest, since lower quality will reduce costs.

Although lacking a definition from literature, in the interview session in practice Gijs indicated that quality is really important to him. Looking at one of his major responsibilities, long term maintenance plans, quality is really an issue since these are made based on the desired level of quality.

Definition: The desired level of quality

3.4.19 Repetitiveness

The factor repetitiveness is identified by Kornyshova et al. (2007) as being a project characteristic, but a definition on the concept is lacking. Closely related to repetitiveness is the factor called reusability. Van Slooten & Hodes (1996) define this concept as "*to what extent is the level of reuse required in the development project*". This is clearly a definition aimed at IS, where lines of code or parts of the software are sometimes desired to be reused, and needs to be revised to suit the light of this research context. In our interpretation, reuse within a project will not be required but can suit

the organization conducting the project to be more cost efficient. If the project has a repetitive character, project management can deal with it in a way it is reusable in upcoming comparable projects. We therefore define the concept repetitiveness to be "*To what extent the elements of the project are suitable for reuse in projects to follow*".

During the first interview sessions with practitioners, repetitiveness was not identified. Considering the reasoning above, it could however be relevant to the organization. Especially to a project-based organization as Nibag, where their might be projects with very similar characteristics in the future.

Definition: To what extent the elements of the project are suitable for reuse in projects to follow

3.4.20 Resistance

Resistance is defined as "*To what extent stakeholders have different or conflicting interests*" (van Slooten & Hodes, 1996). Within a project, there can be parties that have different goals or would like things to go another way. This will pose greater demands on the management of the project. One could also see their own management as a stakeholder, but it is separated from this factor. Reasoning is twofold; first, the factor management commitment is also separately noted in literature (van Slooten & Hodes, 1996) and second, lacking management support poses considerably different demands on project management then lack of support by other stakeholders.

Definition: To what extent stakeholders have different or conflicting interests

3.4.21 Shortage of Resources

The shortage of resources in a project is defined as "*to what extent the number of people available for the project is experienced as insufficient*" (van Slooten & Hodes, 1996). When acquiring a new project, it is imaginable that the amount of resources the company currently employs is not sufficient. This is especially true for a company like Nibag, where they have a flexible peel of experts and project employees for their projects contracted by Nibag Personnel Services. Naturally, working with more people in the flexible peel of a project poses greater demands on project management.

Definition: To what extent the number of people available for the project is experienced as insufficient

3.4.22 Stakeholder number

In two articles (Kornyshova, et al., 2010; Kornyshova, et al., 2007) in the literature review, stakeholder number was noted to be a project characteristic. Apart from the operationalization, a number, there is no definition given. We will therefore define the factor; "*The amount of stakeholders involved in the project*".

Definition: The amount of stakeholders involved in the project

3.4.23 Team Empowerment

The element of team empowerment is defined as "*... not only the discretionary power formally assigned to the team, but also externally imposed factors which may limit their ability to use this power effectively*" (Howell, et al., 2010). This can be explained as the amount of freedom the project team has in conducting their project as well as the possibilities to use this freedom to successfully fulfill the assignment. It is said that team size and dispersal might also be a factor influencing the team empowerment (Howell, et al., 2010), however we think that it is better categorized under size.

It has to be emphasized that the factors stated here are not mutually exclusive and it is not the goal of the research to validate and determine the strengths of the relationships between one another. The aim is to provide a usable framework for practitioners in order to guide them in their project management. It is for this reason that the factors are categorized in this fashion.

Definition: Not only the discretionary power formally assigned to the team, but also externally imposed factors which may limit their ability to use this power effectively

3.4.24 Team Size

Throughout contingency literature, the factor size and factors related to size are widely noted (e.g. (Henderson-Sellers, Gonzalez-Perez, & Ralyté, 2008; Kornyshova, et al., 2007; van Donk & Molloy, 2008). As being widely noted in the articles found in the synthesized literature review, size is referred to in different ways. Van Donk & Moloy (2008) relate size to the amount of people working in the organization and Kornyshova et al. (2007) just refer to the size of the organization in terms of low, middle or high. In this research we will use as a definition: "*the amount of people in the project team*" (Henderson-Sellers & Ralyté, 2010).

In practice, only Pim identified the amount of resources as being relevant to his project management.

Definition: The amount of people in the project team

3.4.25 Time

Looking at the definition on urgency, stated later on in this paragraph, as the extent to which the available time is experienced as being insufficient, this can be a large amount of time being available for the project, however still being insufficient. Or it can be a very small period of time and being insufficient. The actual duration of the project can however also pose it different demands on the management of the project. Also in practice, time is one of the most cited contingency factors as it is named by the majority of the interviewees.

As Pim states:

"*Some projects just take 3 weeks. But if the duration of the project is over two years, you really have to think ahead*."

Looking at the quote by Pim, we can differentiate time from urgency. We can exemplify this by imagining a project of 3 weeks, where there is no pressure since the project can easily be completed in time. On the other hand one could imagine a very large project, where even 2 years are not enough.

Definition: The extent to which the amount of time or duration of the project influences the management of the project

3.4.26 Uncertainty

Uncertainty, or lack of certainty, encompasses not only probabilistic and undefined outcomes but also lack of clarity and ambiguity over situational parameters (Howell, et al., 2010). In general, it is defined as being unable to predict future outcomes (Shenhar & Dvir, 1996). Throughout organizational contingency theory, uncertainty is the strongest theme seen (Howell, et al., 2010). It is identified as being the most dominant contingency factor and also common in project contingency

work. Looking at the definition by Shenhar and Dvir about prediction of future outcomes, this is strongly resembled in the definition of stability. Stability is defined as *"... to what extend the goals, needs, and desires of the users will not change over time enabling a stable specification of the functional requirements*" (van Slooten & Hodes, 1996). The idea here is that however the goals needs and desires are clearly and coherently formulated, they might change during the course of the project and one can have some expectations in advance.

The importance of the factor stability in practice can be seen in quotes by practitioners on what they do to cope with changes in goals, needs or desires. Pim states:

"*Changes and risks are things I standardized in my feedback sessions and agenda as well as for the kickoff. These are project risks and these are identified in advance from the perspective from us and the user*"

Also Nico recognizes this importance and problems in this area at the moment:

"*I think we should think better exceeding schedule due to stakeholders. Maybe we should think about a different payment structure*"

Uncertainty is defined as: To what extent the goals, needs, and desires of the users will not change over time enabling a stable specification of the functional requirements

3.4.27 Urgency

Urgency is the extent to which time constraints are a factor in project activities and decision making (Howell, et al., 2010). In literature, this concept is also related to as pace (Henderson-Sellers & Ralyté, 2010) and time pressure (Kornyshova, et al., 2007; van Slooten & Hodes, 1996). The time pressure is often largely externally imposed and is defined by Van Slooten and Hodes (1996) as *"…to what extent the available time for the project is experienced as insufficient"*.

The effect of time pressure is also noted in practice by Gijs:

"*Time pressure…. Sometimes you just have to deliver something. It's quite important to keep that in mind, it is a factor that is always there*."

Jeffrey even indicated time pressure to be one of the most important factors:

"It is always just to phase your project and really complete all of these phases. But often under time pressure…The most important factor to differ from these phases is time."

Definition: To what extent the available time for the project is experienced as insufficient

3.4.28 User Involvement

In literature, the definition "*The kind of user participation in the project*" (Kornyshova, et al., 2010) is used to define the factor user involvement. It is derived from the field of IS, where the involvement of users in the development of a new information system is meant. This research however aims at a different kind of business and based on interviews with practitioners we would like to propose a different definition.

The definition to indicate the relevance of user involvement in this research is based on the interview with Manuel:

"*The critical thing for me is the amount of commitment needed from the client. Especially in bigger projects, clients also have to deliver things. I'll take that into account in my project management.*"

The effect of these deliveries the client has to make becomes visible by the quote of Pim:

"*From day 1, everything was bad. There would be boxes full of documents available that weren't there. So then you are sitting there with 3 people doing nothing. The first weeks, months were like this, causing to have great tension between us and the principal*."

Based on these quotes, we define user involvement to be "*the extent to which participation of the principal is needed during the project*".

Definition: The extent to which participation of the principal is needed during the project

3.5 Concluding Remarks

In this chapter, literature has been thoroughly examined and the practical situation has been studied by using the semi-structured interview method. In this interview, cultural problems in knowledge sharing were identified. This is not something the practitioners are used to. Furthermore, indications were given that pre-described ways of working will not be accepted. So referring to the spectrum of SME given in the theoretical background, working with a method outline will not be ideal. Although a method outline does provide a certain identity, the design in chapter 4 will be a more modular method.

Reflecting on the interview sessions itself, remarks were made on the idea of capturing a project management approach by contingency factors. The argument heard from the practitioners was that the great diversity of circumstances and differences in principals make every project unique and this would make it impossible to capture management by such factors. However, when looking at the definition of a project by the Project Management Body Of Knowledge (PMI, 2004) stated in chapter 2, a project is per definition unique. Looking at a model being a simplified representation of reality, it is this tool that can be used to capture the complexity surrounding a project in a simplified way aiding practitioners in their decision making.

In the beginning of this chapter the choice for not providing the interviewees with theoretical information was explained. Reasoning was to acquire as much contextual information as possible, being able to define contingency factors close to their reality and to identify factors that were not found in literature. Referring to paragraph 3.3, it can be concluded that this choice indeed resulted in the finding of contingency factors that were said to be of influence on their project management while not being identified in the literature review. Looking at paragraph 3.4, it can also be concluded that definitions found throughout scientific papers did not always suit the practical situation if there were definitions given at all. This has to do with the fact that the majority of factors is identified in scientific papers in the field of IS research, since this is the main literature base for this topic. These definitions and reasoning is therefore mainly based on software development, instead of the context of this research. Looking at these definitions from the perspective of the practitioner proved very helpful for this reason.

The contingency factors are presented in alphabetical order. This is deliberately chosen considering this is the first research in PCT presenting a list of this extend, however reality is much more complex and a more extended investigation should be very interesting. First, during the literature review the

possibility of the grouping of factors into *dimensions* was noticed. An example is the classification of a project based on the dimensions technological uncertainty and system scope by Shenhar & Dvir (1996). Grouping of factors under two main attributes, complexity and uncertainty, was an approach used by (Little, 2005). Last example is the work by Howell et al. (2010). They use the word 'theme' to indicate a group of influencing factors. It should be noted that all of these papers use a considerably less amount of contingency factors in their studies. Second, the contingency factors that are presented are *not mutually exclusive*. Although factors are presented in this way, it is not unthinkable that factors are related to each other and hence their might be some correlation. To give on example, increasing the size of a project can in some cases also increase its complexity. In this research these kinds of relations have not been investigated. Furthermore, the extent to which the identified factors influence project management has not been statistically assessed.

Finally, the relations between these factors and project management have not been *quantitatively validated.* This means that we cannot say anything on the strength of the influence of individual factors on project management. These discussed issues of possible dimensions, relationships between factors, and validation of the influence are some very interesting possibilities for future research and are out of the scope of this research. The goal of this design research is to aid the practitioner with a usable artifact in order to aid in complex decision making concerning project management and although recognized opportunities will improve this artifact, our time frame limits these options.

Presenting a list of 28 factors does however also provide a problem to the usability. While the goal is to simplify the decision making for the practitioner, such an amount of factors will not make it that much more understandable and easy to use. In the next chapter we will work towards a selection of most relevant factors which also validates the influence of these factors to some extent.

Design

4

Having identified contingency factors in theory and practice, the foundation is created for a solution design. This chapter will explain the process in creating this design and finally present it to provide an answer to SQ4. First step in this process is ranking and weighing of contingency factors. In this step, irrelevant contingency factors are removed from the selection and weights are determined. This is done by conducting an 'online workshop' in the innovative software tool SPilter. During this 'online workshop' used project management activities are derived which are linked to the project contingency factors in the final step. Values for the decision tool are derived from practitioners and the resulting matrices are analyzed. Finally, the value for project managers is discussed.

"Concepts without factual content are empty;
sense data without concepts are blind"

- Immanuel Kant -

4.1 Ranking factors and identify activities

4.1.1 Introduction

As already noted at the end of the previous chapter, the goal of this research is to aid the practitioner in their complex decision making. This goal is well described by Goodwin and Wright (1991):

"It should be emphasized that the main role of our analysis is to enable the decision maker to gain an increased understanding of his or her decision problem. If at the end of this analysis no single best course of action has been identified, this does not mean that the analysis was worthless. Often the insights gained may suggest other approaches to the problem or lead to a greater common understanding among a heterogeneous group of decision makers."

The authors state that this help is needed since the decision maker has a limited information-processing capacity. In case of a complex problem, as can be seen in the amount of contingency factors of influence, it is hard to manage and process all this information simultaneously.

The approach the authors propose is the Simple Multi-attribute Rating Technique (SMART). Advantages of and rationality to choose this approach is the transparency of the method, which yields an enhanced understanding and will be more acceptable to a decision maker, and the speed in which it can be used. The first advantage is needed to increase the support for this research project and the second looking at the given time frame for this research.

As disadvantages, the disability to capture all detail and complexities of the problem is named. However, in practice it has found that the approach is extremely robust (Goodwin & Wright, 1991).

Weighing contingency factors using the SMART approach is done by swing weights. It is an approach fairly easy to understand by the decision makers, however would acquire a meeting with all practitioners at the same time. Concerning the timetable of these practitioners this is not desired, let alone be possible. This disadvantage is overcome in this research by using an innovative software tool SPilter®. A description of this group decision support system (GDSS) will be given in the next section.

With this tool, practitioners are also asked to provide the main project management activities they conducted during their last projects. Activities are defined as the most abstract form of work unit and serve in this research as a basis for SPMME. As described in the scope in paragraph 1.6, we will only focus on project activities due to the given time frame.

4.1.2 SPilter

The GDSS SPilter was allowed to be used by the developer in order to be tested in scientific research. This innovative software is created to acquire more efficient decision making. It is a web based tool, which makes it possible for decision makers to use it anywhere they want. This can be applied in a

central meeting, where everyone is able to participate at the same time and location, but sessions can also be created where input can be given at a time and location desired by each individual decision maker. It is this last feature of the software tool which makes it ideal to use in this research.

4.1.3 Approach

An online workshop is created in SPilter. Looking at the timetables of the project managers at Nibag, it is close to impossible to organize a session with all of these decision makers together at the same time in the same place. A solution could be to organize a meeting with only the available project managers when possible, but we think this would yield the loss of valuable insights from missing practitioners. Next to this, maximization of participation is required to achieve as much support as possible in order to make implementation succeed as also is discussed in paragraph 3.2.1. By making use of this innovative web based software, project managers are able to conduct the workshop at a moment of their choice, be it before the deadline, and at the location they desire.

When the workshop was created, an invitation was sent to each project manager inviting them to participate and providing a username and password. After logging in, a description is given on the workshop. Analyses of the results from the workshop are simplified by an automatic generated report by the tool. The participants were given a week to participate.

4.1.4 Online workshop

After logging in, an introduction screen introduces the workshop. The workshop consists of three phases. In the first phase, activities are identified. Here, the definition of *activities* is provided and a screen is presented where activities can be added.

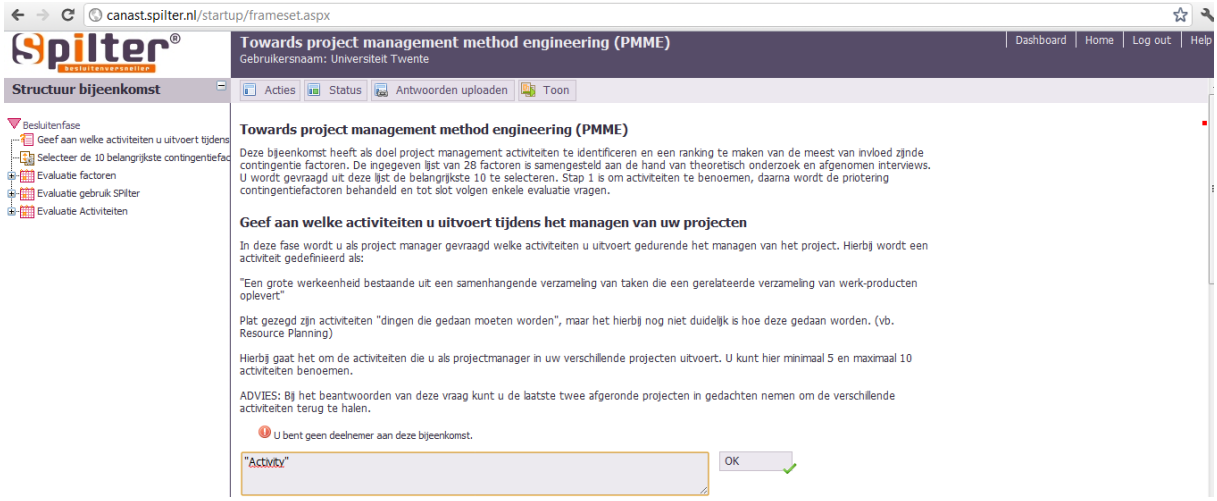


Figure 10: Adding project management activities in SPilter

In this screen, each project manager is able to add between five and ten of their activities. They are not able to see the activities filled in by other practitioners. This is chosen because we want to capture their vision on the activities they perform. In order to help the practitioner, we asked them to think of their last two finished projects.

Second phase is the ranking of contingency factors. The total list of 28 factors is provided, and a top 10 can be created by the drag and drop functionality in the tool as can be seen in the screenshot (figure 11). In this screenshot the factor ambiguity is being dragged from the list to a top position.

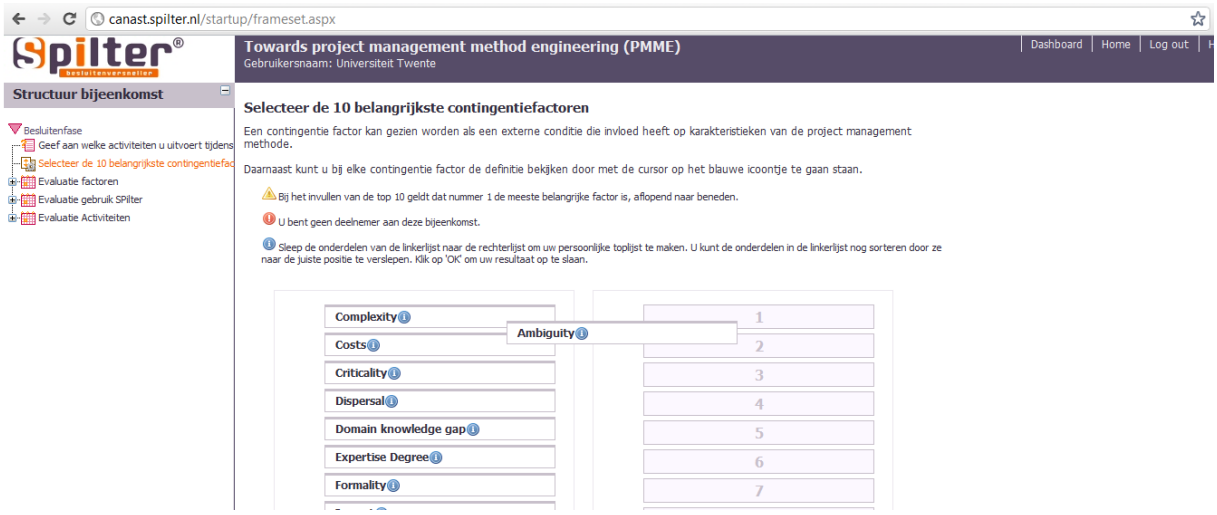


Figure 11: Ranking of contingency factors

Again, in order not to influence their decision making, the ranking by other practitioners is hidden for the respondent. To provide the practitioner with the information he needs, definitions are given in Dutch when the cursor is placed on the blue icon (see the screenshot).

The third phase is the evaluation phase, where the two previous steps are evaluated. Next to this, evaluation questions are posed on the use of SPilter.

4.1.5 Results

Invitations were sent to the same practitioners as who participated in the interview sessions. Of these eight practitioners, seven responded. This is a response rate of 87,5%. One project manager applied to a job offer at another company and left Nibag during the course of this research, which is the reason why he did not participate.

Since the first phase consisted of an open question on activities, diversity in response was expected. However being diverse in terminology, groupings could be made based on the meaning of the activity to reduce the total amount to a workable size. Next to this, some given answers were not even activities at all and were left out. Reasons and consequences of this will be discussed in the evaluation.

Initially, a list of 48 activities was derived based on 5-10 answers per practitioner. After elimination of some answers and grouping of activities, a total list of 13 project management activities was constructed to reflect the activities of the practitioners at Nibag. A translated version of these 13 activities is given in table 6 and are all based on their own terminology in order to keep it as close as possible to themselves.

Table 6: List of identified project management activities

Project Management Activities
Learning and evaluation
Close the project
Planning
Manage changes
Communication strategy
Stakeholder analyses
Issue management
Financial management
Document management
Risk management
Determine project goals
Quality control
Process management

Considering the time frame of this research, this list was not formally reviewed with all practitioners. Terminology and grouping was however informally discussed in order to be certain these activities resemble their project management activities in practice.

After the selection of project management activities, participants ranked the contingency factors on their perceived importance. Ranking a contingency factor number 1 indicates it is the most important factor in their opinion. Taking the average of all 7 inputs yields a ranking of the average position.

Statistics on the outcome of this phase are given in appendix E. The average position of each factor is graphically displayed in figure 12.

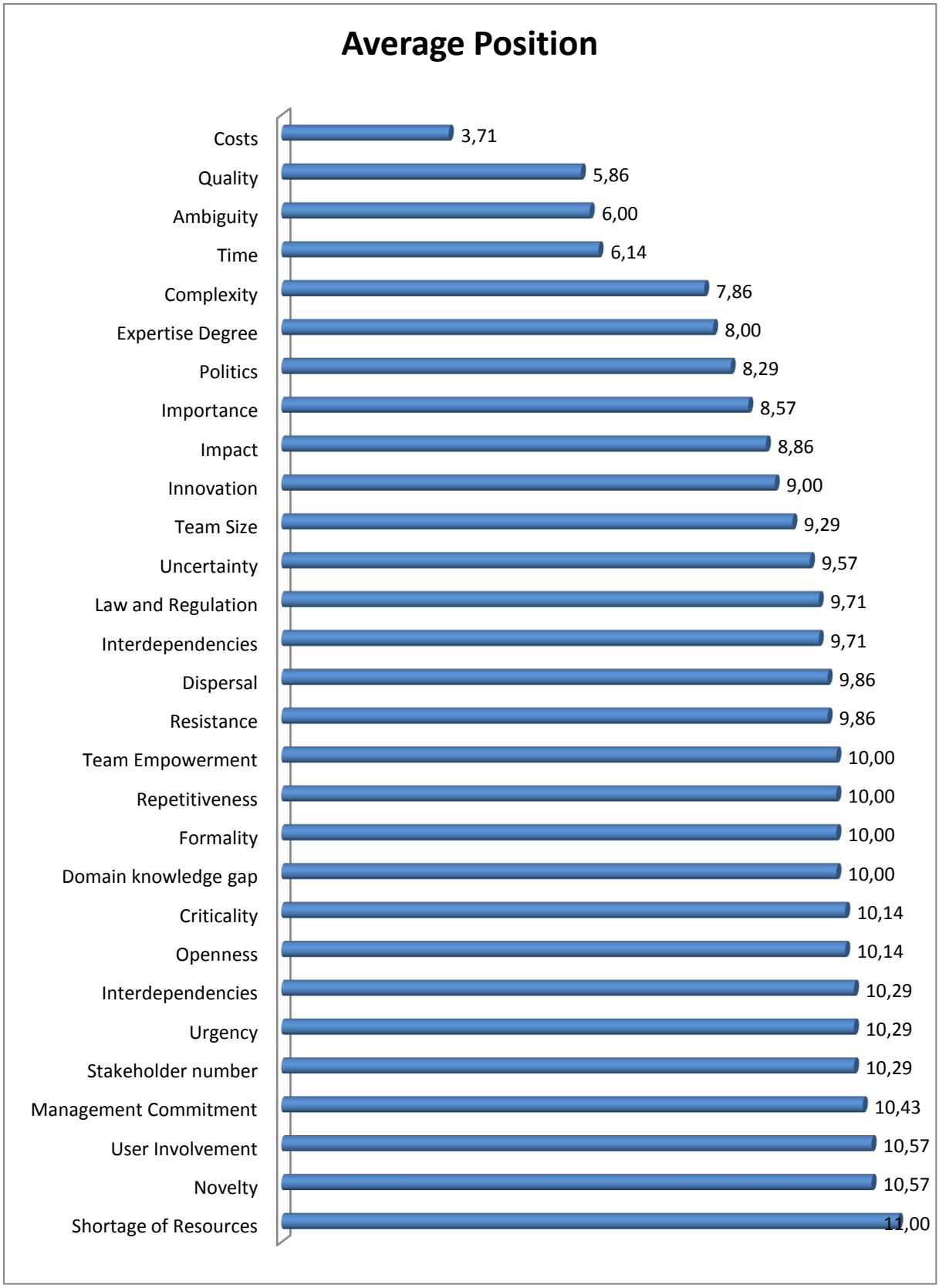


Figure 12: Graphical presentation of outcome

The top ten factors will be used in the creation of a deontic matrix, which will be explained in the next paragraph.

4.1.6 Evaluation

The use of SPilter to conduct the workshop proved to be very helpful. Due to the flexibility and ease of use of the tool the workshop was completed by the practitioners within a week, except for the person who switched jobs. Practitioners praised the tool for the speed of collection data and the clarity this gives in the analysis. Disadvantage was the lack of possibility to provide additional arguments, since some answers or not considered to be that black or white.

In the identification of activities, diversity of answers was collected. This was also to be expected, since this part was stated with an open question. Remarkable was terminology as 'time' and 'money', since these are variables on which a project manager steers its project but they are not activities at all. Furthermore, some activities were stated on different levels of abstraction. To give an example, one project manager identifies a 'budget planning' as an activity where another identifies 'planning' to be an activity he conducts. In terms of the different types of work units as identified in chapter 2.1, this is a distinction between activities and tasks. Although not possible in the given time frame, further investigation into the tasks that activities consist of is desirable yet out of the scope of this research. The diversity in terminology and the different levels of abstraction are also a confirmation of the earlier conclusion that the practitioners find it hard to think about their project management in a theoretical way. Due to the given time frame a thorough evaluation of these findings was not possible, but it is briefly discussed with some practitioners on its terminology and the 13 activities that were finally selected provide a good representation of their project management. In the evaluation phase of the workshop, practitioners indicated the level of difficulty in stating the project management activities as reasonable. Based on the theoretical issues and the levels of abstraction in project management activities (and tasks) future investigation would be desirable since it is out of the scope of this study.

Analyzing the results given in the previous paragraph, it is interesting to see the variety of selected contingency factors. Of all 28 possibly interesting factors, 27 have been selected at least ones as a top 10 factor. Two conclusions could be drawn from this fact. First, the great variety of importance of factors indicates the diversity in departments and their projects. Second, it illustrates the complexity of the decision making process in project management. Evaluating whether the 28 factors resemble their project contexts, practitioners think it is sufficiently covered.

Looking at the identified top 10, it is remarkable when we compare it with the semi-structured interview sessions. The contingency factor cost, top factor when looking at the results, was hardly identified in the interview sessions. On the other hand, criticality was indicated as important by a majority of the practitioners during the interview sessions, but is number 21 in the results. Evaluating these facts, we could state again that practitioners are not used to think of their project management in a theoretical way which could be the cause of this inconsistency. Another example is the level of formality. Without the provision of information, this factor was widely stated during the interview sessions. Looking at the top 10 however, it is not there.

When we look at the statistics on the results in Appendix E, we can see from the standard deviation that there is a distinction between the upper half and the lower half of the table. Although the upper half fluctuates more, based on the higher standard deviation, these factors fluctuate predominantly

across the top positions. The lower half of the table fluctuates a lot less, based on the lower standard deviation, which indicate that top factors are clearly identified. This statement is also supported referring to the normalized weights of the contingency factors. Referring to the high standard deviation at the top of table 9, it can be concluded that the exact ranking within the top 10 is open for discussion and it is advisable that this is taken into account when evaluating the final matrix in pilot projects.

When practitioners were asked whether or not a top 10 is sufficient to cover the context, again 6 out of 7 agree. Next to closed questions, space was given for general remarks. Three interesting remarks are made here. First, two practitioners stated that it would be useful when contingency factors would be more concretely linked to tasks and techniques. This concerns the practical use for their project management. Second, just looking at contingency factors is concerned a bit too black and white in some circumstances. There are situations that need a more qualitative approach, according to one practitioner. Last, one practitioner stated that identifying the project context in this way would only provide a picture of that moment. The practitioner remarked that in some projects, the context is also subject to fast changes.

In the next paragraph we combine the identified activities and contingency factors in a deontic matrix.

4.2 Deontic Matrix

4.2.1 Introduction

A deontic matrix is a technique, which can be used for method construction (Seidita, Ralyté, Henderson-Sellers, Cossentino, & Arni-Bloch, 2007). It is a two dimensional matrix, where values link process components. The deontic values in the cells of the matrix, or possibility values, present the likelihood of each combination (Henderson-Sellers 2002). In this research project, the deontic matrix is used in order to indicate the appropriateness of a certain activity under different circumstances. Use of such a matrix won't need a prescribed methodology, nor is it the intent to oblige the practitioner to follow the outcome of the table. It is the intent to support the practitioner in his decision making. This is in line with the conclusion drawn in chapter 3, where it is stated that practitioners at Nibag are not willing to follow these types of obligations. Amount of possible values range from two to five, though in this research we will use five values following Henderson-Sellers (2002) for the reason to capture as much information as possible.

4.2.2 Approach

The information derived from the online workshop is used as input for both axes of the deontic matrix. The idea of this technique is first tested by showing a prototype (see figure 13) to each practitioner and capture their ideas on this approach.

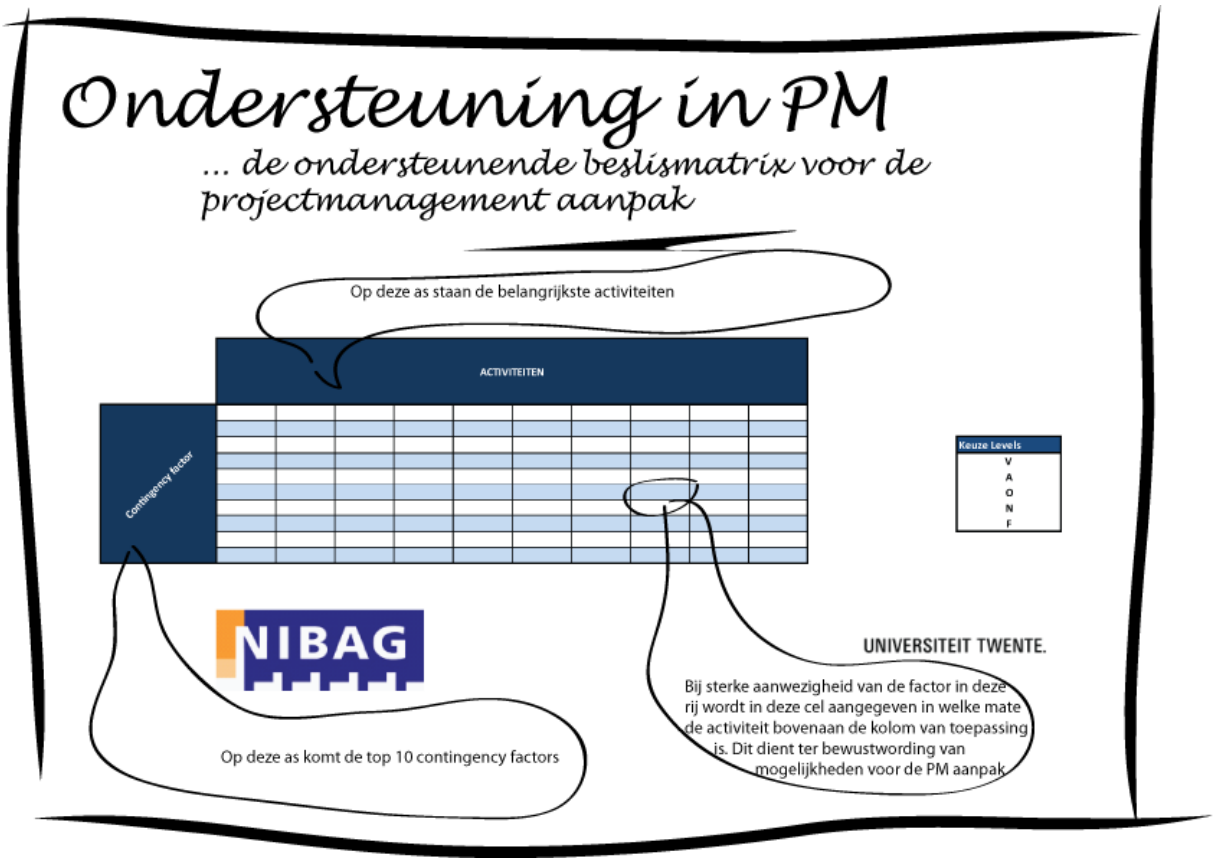


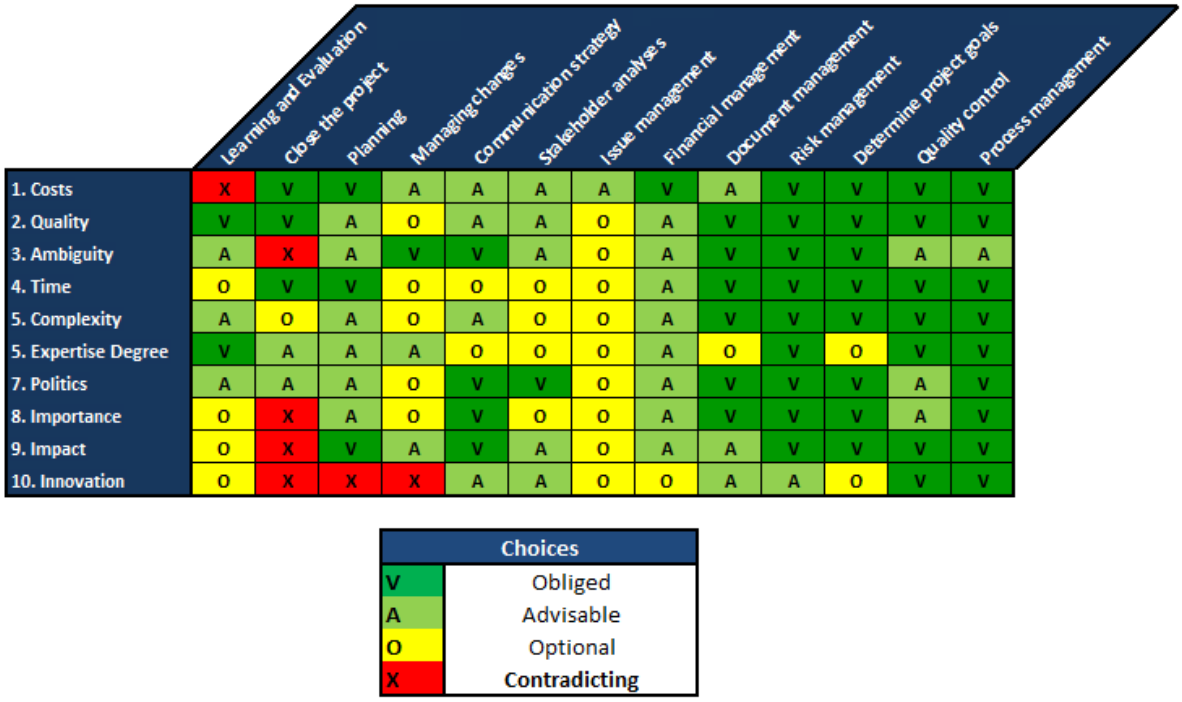
Figure 13: Prototype of the SPMME matrix

This prototype provides a basic picture of the concept of a deontic matrix. In Dutch, explanation is given on the axes and on the meaning of a cell. This was sent to practitioners by e-mail and/or provided in hard copy. They were asked to indicate whether or not it would be useful and what information is missing. In the feedback practitioners noted that it would be a helpful tool to them, but indicated that more operational information would by desired. First remark was that definitions on the contingency factors would be desirable. Second suggestion was to concretize this table further to their operational activities. This discussion on activities, tasks and techniques is already conducted and explained in paragraph 1.6. Based on their feedback, the matrix was extended with the definitions.

After feedback was derived, the deontic matrix was sent to practitioners as an Excel file in the first week of June. In the second tab that was added in the Excel file, the definitions of the contingency factors were stated. These factors were all defined in a way that a higher 'value' on the factor indicates a greater demand on project management. Practitioners were asked to indicate the likelihood of the activities in combination with a certain contingency factor.

4.2.3 Results

The matrix was sent to 7 practitioners, since one practitioner switched jobs during the period of this thesis. A deadline of two weeks was provided and 6 out of 7 practitioners filled in the matrix. This is a response of 85,7%. In Excel, all matrices were combined and this yields the deontic matrix as given in appendix F. As could be expected, very diverse answers were given in each cell and this was analyzed on similarities. These were used to construct the following matrix:

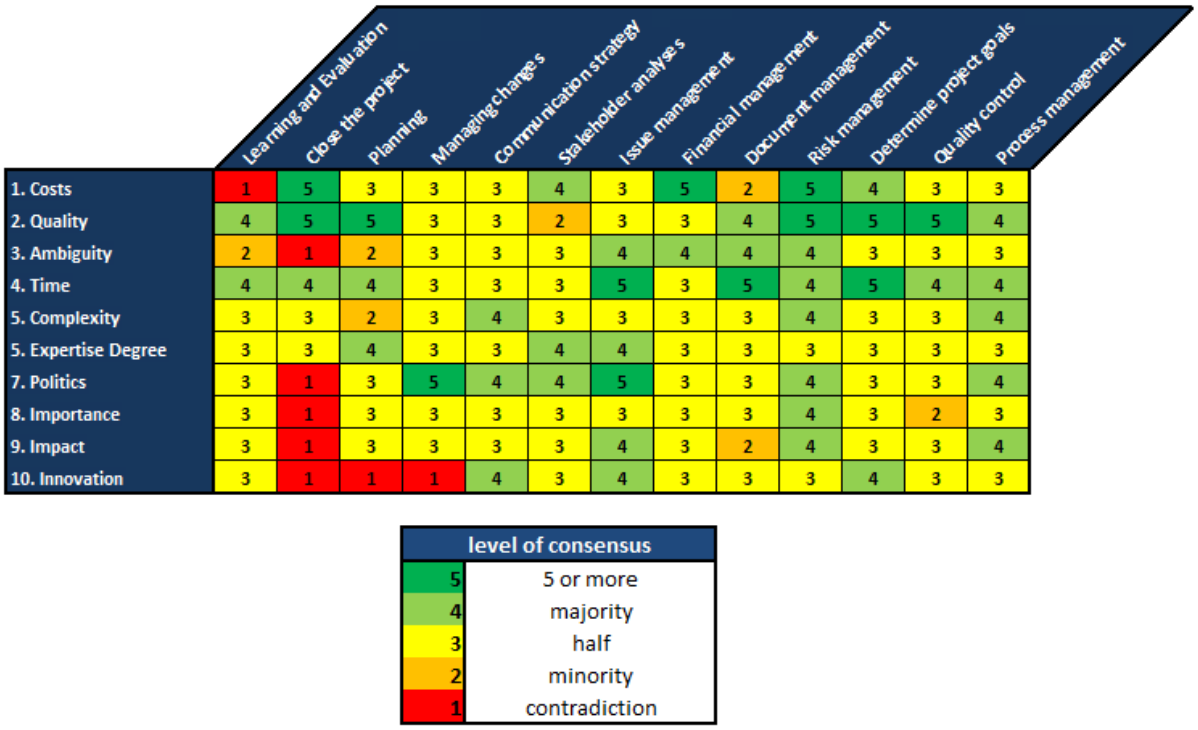


	Learning and Evaluation	Close the project	Planning	Managing changes	Communication strategy	Stakeholder analyses	Issue management	Financial management	Document management	Risk management	Determine project goals	Quality control	Process management
1. Costs	X	V	V	A	A	A	A	V	A	V	V	V	V
2. Quality	V	V	A	O	A	A	O	A	V	V	V	V	V
3. Ambiguity	A	X	A	V	V	A	O	A	V	V	V	A	A
4. Time	O	V	V	O	O	O	O	A	V	V	V	V	V
5. Complexity	A	O	A	O	A	O	O	A	V	V	V	V	V
5. Expertise Degree	V	A	A	A	O	O	O	A	O	V	O	V	V
7. Politics	A	A	A	O	V	V	O	A	V	V	V	A	V
8. Importance	O	X	A	O	V	O	O	A	V	V	V	A	V
9. Impact	O	X	V	A	V	A	O	A	A	V	V	V	V
10. Innovation	O	X	X	X	A	A	O	O	A	A	O	V	V

Choices	
V	Obliged
A	Advisable
O	Optional
X	**Contradicting**

Figure 14: Matrix indicating likelihood levels

The heuristics that are applied to arrive at this matrix are as follows. Answers are considered contradictory when the likelihood was indicated to be obliged/ advisable and at the same time not advisable/forbidden. In this case, the cell is marked with a cross and the cell is given a red color. In all other cases, the answer that was given most is indicated in the cell. When an equal amount of same answers was given, the highest level is used in this matrix. In situation were answers were equally spread (meaning V,V,A,A,O,O), the average was taken to be advisable. This figure provides insights in activities that are interesting to look at under certain circumstances. The diversity in answers is however not visible from this figure. Consensus on the answers, or level of agreement, is displayed in figure 15.



	Learning and Evaluation	Close the project	Planning	Managing changes	Communication strategy	Stakeholder analyses	Issue management	Financial management	Document management	Risk management	Determine project goals	Quality control	Process management
1. Costs	1	5	3	3	3	4	3	5	2	5	4	3	3
2. Quality	4	5	5	3	3	2	3	3	4	5	5	5	4
3. Ambiguity	2	1	2	3	3	3	4	4	4	4	3	3	3
4. Time	4	4	4	3	3	3	5	3	5	4	5	4	4
5. Complexity	3	3	2	3	4	3	3	3	3	4	3	3	4
5. Expertise Degree	3	3	4	3	3	4	4	3	3	3	3	3	3
7. Politics	3	1	3	5	4	4	5	3	3	4	3	3	4
8. Importance	3	1	3	3	3	3	3	3	3	4	3	2	3
9. Impact	3	1	3	3	3	3	4	3	2	4	3	3	4
10. Innovation	3	1	1	1	4	3	4	3	3	3	4	3	3

level of consensus	
5	5 or more
4	majority
3	half
2	minority
1	contradiction

Figure 15: Matrix indicating consensus on the deontic values

In order to derive this figure of consensus, the following heuristics have been applied to the data from appendix F. A '*5*' indicates that 5 or more of the same answers have been given in one cell. This indicates a consensus of at least 83,3%. A '*4*' was given when still the majority answered equally, indicating that 4 out of 6 provided similar answers. The same holds for 3 and 2, where the numbers indicate the amount of similar answers. A '*1*' is given to the cells where contradicting answers were found, as explained earlier. These figures indicate that the higher the number, or the greener the color, the higher the level of agreement between practitioners.

4.2.4 Evaluation

Filling in the matrix proved a difficult task for the practitioners. They indicated that it was a tough assignment and they were not used to the abstract way of thinking about their projects and the specific linking of a single contingency factor to an activity is not easy. However lacking space for providing nuances, the practitioners indicated it made them think hard on their own activities and this was very helpful to them. In the remaining part of this evaluation, we will analyze the outcomes of both matrices and their implications for the practitioners. Finally we will give suggestions about the way this matrix can be used.

When the data was collected, a choice had to be made on the way to present it. Criteria that were applied to the choice of presentation were ease of reading and provisioning of information. When making use of this matrix, it has to provide quick insights in which activities need a more thorough look. This is the rationality for applying colors.

The need of providing information relates to different aspects. First, it has to give insight in the likelihood that a certain activity needs a closer look. Because diversity in answers was provided, we chose to apply democratic heuristics. This does not mean that it is the most optimal way information can be provided, but it can be used for further evaluation. This further evaluation is necessary, since

the level of agreement is in general not high. Nevertheless, it provides insights in the opinion of experts surrounding the contingency factors and their influence on project management.

Second need for information is about the amount of consensus. Since this tool is developed in order discuss and optimize project management, the amount of consensus offers the organization a tool for discussion. A red color indicates that there are contradicting answers. This means that where one practitioner thinks an activity is obliged in a certain context, another practitioner thinks it is not advisable to do. The color orange and yellow should also receive attention, since level of agreement on the likelihood is not high (50% or less).

Analyzing the first matrix, the 'choice matrix' from figure 14, vertically as well as horizontally yields some valuable insights. With vertical analysis we mean from the perspective of an activity. The activities risk management, quality control and process management are obliged or advisable under every circumstance. Financial management and planning is obliged or advisable in almost any situation except when it concerns a very innovative project. Another important remark from a vertical perspective is that especially with 'close the project' some contradicting answers have been given. When analyzing this matrix horizontally, it is clear that opinions differ most concerning innovative projects. Another important notion is that when the project context scores high on costs, quality, ambiguity or politics, almost all activities are considered to be advisable or obliged.

Looking at the second matrix, the 'consensus matrix' from figure 15, provides valuable insights into the level of agreement among the practitioners. From a vertical perspective it can be concluded that practitioners agree most on the risk management activity, whereas closing the project is widely disagreed upon and further discussion among practitioners is needed. Remarkable is that the most disagreement is among the three activities on the left: learning and evaluation, closing the project and planning. Worth noting is also that concerning issue management and process management practitioners seem to have a reasonable level of agreement. Analyzing the consensus matrix horizontally immediately highlights the importance of looking into innovative projects. Also in need of further evaluation are projects that score high on ambiguity. Projects scoring big on the factors time and quality seems to have the highest levels of agreement.

Combining both matrices also provides some interesting conclusions. Where risk management was identified as being an obliged activity in almost any circumstance, it is also an activity where the level of agreement is high. Furthermore, identifying that time and quality pose high demands on project management, they are also highly agreed upon.

The combined insights provide guidance on how to proceed with the development of the SPMME matrix and how it can be used by the company at this moment. These conclusions are presented as concluding remarks in the next chapter.

4.3 Concluding Remarks

In this chapter we have worked towards the design of an artifact that can assist project managers in their decision making. First step was to identify activities and to create a ranking of most relevant contingency factors according to practitioners at Nibag. By making use of SPilter, this decision making process was simplified and made answers quickly assessable for analysis. The output of this process was used as input in the creation of a deontic matrix. Finally, results have been presented in the form of two matrices which can assist the company in further professionalization of their project

management. Posing these matrices to vertical and horizontal analysis provide valuable insights to the company for both development of the tool and current use.

First, combined insights from both matrices show that risk management and process management are very important project management activities in almost all circumstances and that the majority of practitioners reached consensus. Next, issue management is considered to be an optional activity by the majority in most of the circumstances. Second, the activity closing of a project and the contingency factor innovation should receive close attention concerning the contradicting answers that were given by practitioners.

In line with the conclusions above, the combination of matrices can be used as follows. Activities that are concerned to be obligatory by a majority of practitioners could be further developed with the identification of tasks and best practices in order to improve knowledge sharing. This is important since these activities have the highest priority. Thereafter, meetings among practitioners are necessary to clarify the most contradicting opinions. In these meetings further points of discussing can be taken into account as well to further develop this tool.

This process of use and development is important and receives closer attention in the next chapter where guidelines will be given on the implementation.

Implementation

5

In this chapter guidelines for an implementation plan are presented for the deployment of the first steps towards Situational Project Management Method Engineering at Nibag. First, the initial use of the matrix will be explained as well as the developments towards more elaborated SPMME. This perspective on the potential of the tool has an impact on the implementation process and this is presented based on identified soft aspects of the change process. Hard guidance on the implementation process is given by proposing a SPMME implementation cycle. It should be noted that this chapter is meant as an additional advice to Nibag and that change management and implementation could be studies in itself concerning the importance, depth and difficulty of these subjects.

"In all science, error precedes the truth, and it is better it should go first than last."

- Hugh Walpole -

5.1 Use and potential

The developed SPMME matrix can be used as a decision aid for the project manager at Nibag. Whenever new projects are acquired by the practitioner, the matrix serves as a quick scan on which activities should be taken into account. To provide an example, imagine the situation that Nibag Security is asked to guide a fire security project for a government institution. The responsible project manager identifies that quality is a very important factor and that the political situation in the institution is unclear. Furthermore, the statement of the goals of the project is ambiguous. In this situation, the project manager can look at the decision tool and identify the relevant project management to take into account. To get here, first more consensus is needed and this matrix should be optimized. The process will be explained in paragraph 5.3.

When consensus on the matrix is reached, it can be extended with tasks and techniques. In this step *the smallest units of work worth of assigning and can either be finished or unfinished* can be identified and the way to conduct these units of work, the techniques, be described. Together, this gives the project manager a complete overview of activities to take into account, the tasks that should be conducted in order to complete the activity and the techniques to perform the tasks in a specific project situation. Potentially, this structure could be used as a centre of knowledge sharing on project management within Nibag. This development would cause big changes in the organization and should not be underestimated. Although individual studies can be conducted on change management, we will provide some highlights to the organization to serve as a foundation in the implementation plan. We would like to stress that more research by the company in these change processes is highly recommended.

5.2 Change management

In dealing with this type of change projects, for example with Enterprise Systems (ES) implementation projects, the process should always be seen in its holistic form (Katsma, 2008). This means giving attention to all aspects of the organization, where Katsma uses Leids Octahedron as an aspect model of the organization.

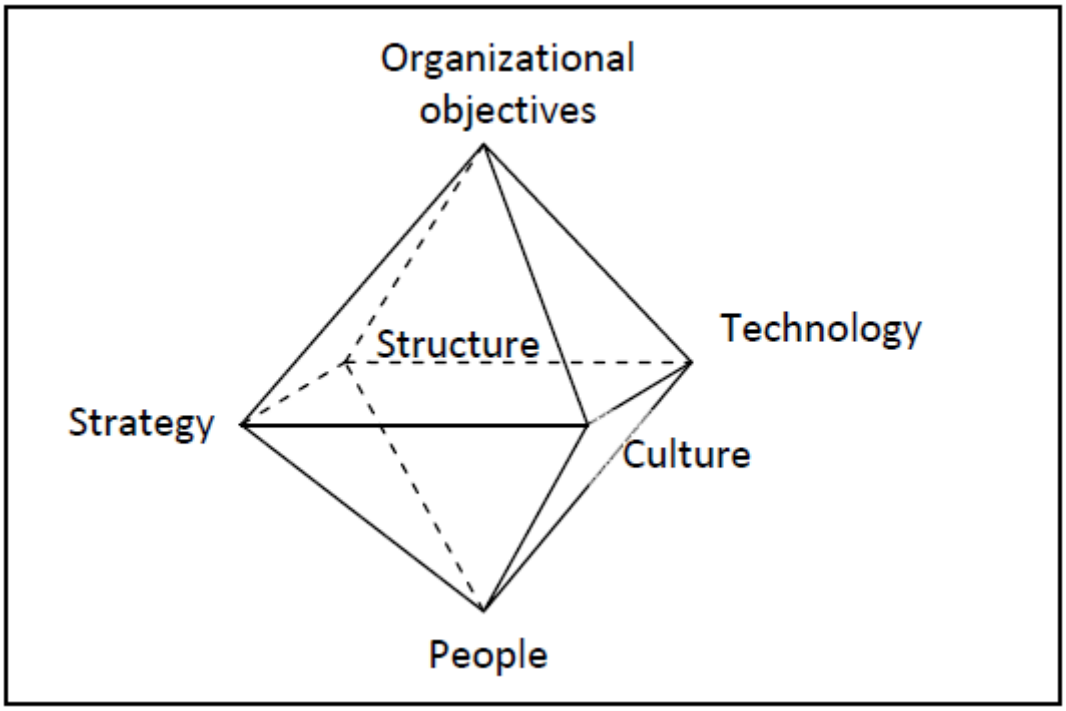


Figure 16: Leids Octahedron(J.J. Boonstra & Vlist, 1996)

Harison and Boonstra (2009) note that technochanges often take a limited perspective instead of taking a coherent overview of the total change process, the holistic view. Based on empirical research, Katsma (2008) notes that in these change processes especially the attention to the softer aspects is missing. As the harder aspects of the change process will be discussed in the next paragraph, the remaining part of this paragraph will discuss the soft aspects as introduced in the octahedron.

The **organizational objectives** stated in the year-plan 2010 (Nijkamp, 2010) are standardization and improvement of the quality of processes. Furthermore, Nibag aims at effective and efficient communication. The developed matrix has the potential to help realizing these objectives. First, aiding in identifying relevant activities and providing information on tasks and how these should be conducted will improve the quality of the processes since this can be based on best practices. Although no standardized project management methodology is provided, the procedure to engineer the method and the best practices on the identified work units are a step closer towards standardization. Second, the identified contingency factors provide a language for the practitioners to describe their project context based on generally accepted terminology. More important, problems arising in certain situations can be traced back to specific factors and this raises efficiency and effectiveness in communication. It is important in managing the change that objectives as well as the organizational **strategy** are always kept in mind and are guiding for the change process. This gives direction for the parties involved and will increase commitment, also from top management. Communication of the effects of implementing the SPMME matrix and the way it contributes to the organizational objectives is important in this process. The first step in this has already been conducted, since practitioners have been involved in this research in every step. **Structure** of the organization, or structure in departments, is not directly affected by this implementation.

The **culture** in this organization has been identified in the problem bundle as problematic. As indicated discussing the scope of this research, it is not a focal point in this study but taken into account in this research process. To make SPMME successful and to aid other practitioners, knowledge sharing is critical. Next to this, practitioners need to have an open mind to look for ways to improve their project management. As identified during the interview sessions and during the period of this thesis inside the company, it became clear the company is not used to this way of working. This has also been underlined by the practitioners and has shown gradual improvement during the research period. This is especially needed for sharing of personal experiences and contextual information, indicating that further steps are needed in order make implementation succeed. Techniques that can be used to improve this culture towards knowledge sharing are for example expert meetings, change tasks or an incentive system based on knowledge sharing.

Technology is an important or even an essential aspect considering previously explained potential of SPMME and knowledge sharing. At the moment, Nibag is developing plans to migrate their IT environment. Possibilities that are being researched are a migration towards the cloud, acquiring new IT systems in-house or a combination of both. This will be combined with the introduction of a new enterprise system and an intranet. These technological advancements offer great potential to the implementation of SPMME and should be taken into account. Especially extending the SPMME matrix with tasks and techniques in combination with intranet is a great opportunity for the organization. To concretize these possibilities, Nibag practitioners can share experience on activities, tasks and techniques. This knowledge can be saved as best practices and shared via the intranet, linked to the SPMME matrix. Furthermore, even project templates can be created and saved with the best practices in order to standardize the way of working to an even greater extent and optimize efficiency. A prototype of this idea, which is called the Nibag Project management Tool (NPT) in this prototype, is presented in the following figures.

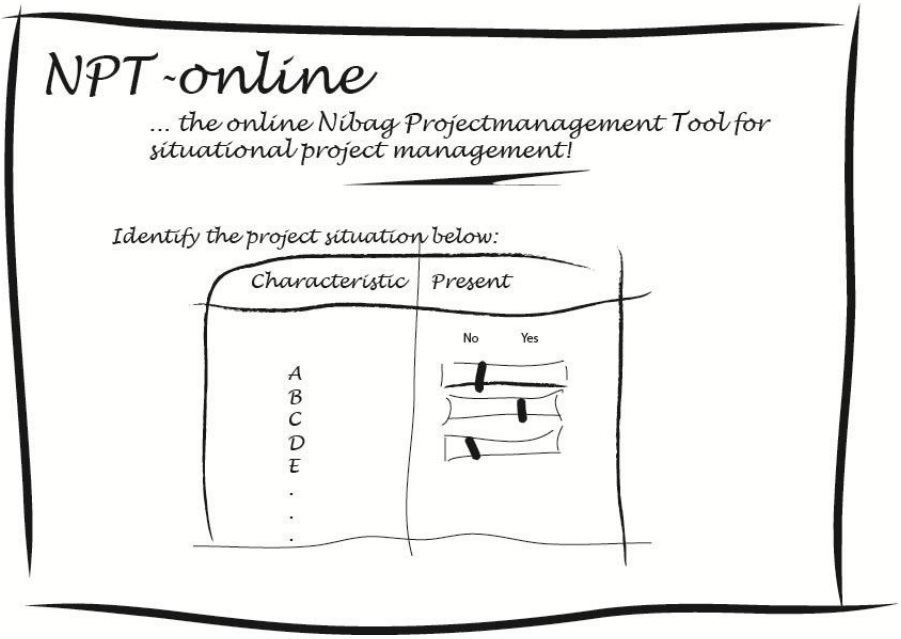
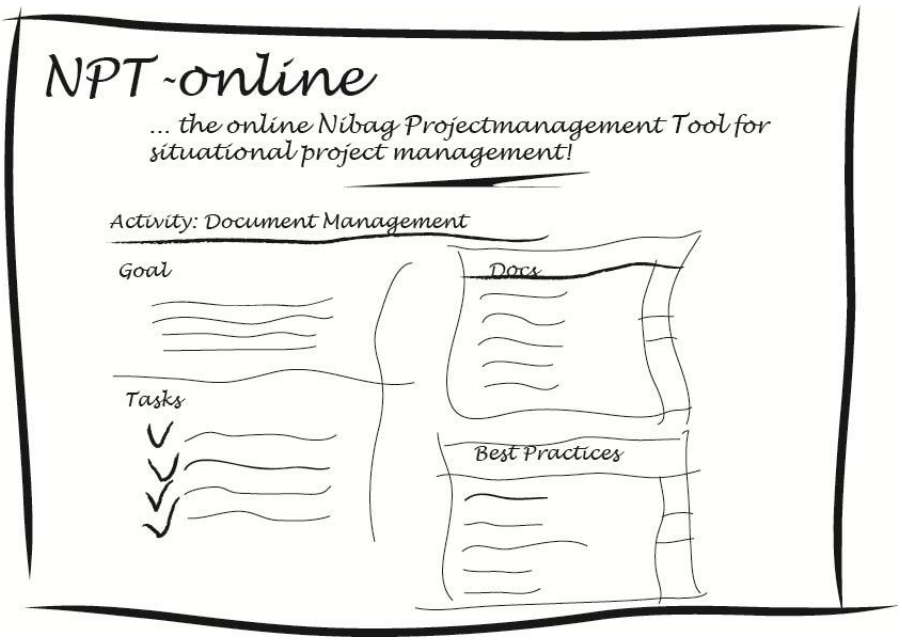


Figure 17: Prototype project identification on intranet

Figure 17 shows a screen where the context can be identified by selecting the relevant contingency factors to the project. This input can be linked to the information from the SPMME matrix resulting in

the selection of the most crucial project management activities. These identified activities can then be investigated further when more information is needed. The next figure provides an idea of an activity knowledge screen.



Figuur 18: Prototype activity knowledge screen

Figure 18 shows a screen containing the knowledge on the activity 'document management'. Based on the project situation identified with figure 17, document management was found to be important and more information was desired. On this knowledge screen information can be found on the goal of the activity, templates that can be used in the form of documents, best practices and the relevant tasks to this activity. These tasks are clickable and a knowledge screen on tasks could be presented providing the same information on task level and indicating the most suitable techniques. This knowledge should be acquired through knowledge sharing initiatives.

Considering this information being crucial as well as competition sensitive combined with the thought of migrating IT into the cloud, data security should be taken into account. Technology might also be of assistance in recognizing patterns in project contexts in order to increase optimization to the next level. It can be imagined that patterns exist in a way that specific project situations occur often. By using technology to analyze the situation patterns, this data could be used to optimize the way of working in those recurring contexts.

Introduction of this new technology can also be used as a catalyst to drive change in culture (Markus, 2004). The idea is that implementing IT with considerable impact simply requires the practitioners to change. Discussing technology and culture highlights the importance of the **people** in change management. Project management is knowledge intensive and most of this knowledge resides within the people, also called the tacit knowledge. Creating and maintaining support is crucial in implementing this change and in making this knowledge explicit. During this research we have provided a head start by involving the people who will work with SPMME, which are the 'people' we talk about, in every step of the design. At first they were involved in problem recognition during the interviews. Providing their ideas on relevant factors and giving suggestions on possible solutions made them committed. Next to this, they have been involved in the design phases in order to make

the design part of them. In moments of evaluation this has proven to be fruitful. In order to maintain or increase their level of commitment it is however very important to keep them involved. But even more important, to extent the tool the tacit knowledge that resided in the minds and hearts of the practitioners needs to be made explicit.

Concretizing this for Nibag, a SPMME task force should be generated were people are taken out of the line organization. This group should work on testing the matrix in real practice and further development of the tool. Additionally they should gather information on pressure points that exist in the organization. To reach these goals, the task force should exist out of project managers that have a clear image of the work processes, have considerable knowledge on project management and above all have a high social impact in the organization. When new technologies are applied that are going to impact the work of the rest of the people in the line organization, it is important that the task force is extended to include other employees as well. It is not unthinkable that even these people in the task force do not have all the needed knowledge to extent the model with specific information. In that case it might be considered to make use of external consultants with for example specific project management knowledge.

At the end of this paragraph, it should be noted that communication of the goals, the problems and the way the issues from employees are tackled is critical in making this change process a success.

5.3 SPMME implementation at Nibag

The SPMME matrix designed in this research is a first step in working towards Situational Project Management Method Engineering. Since the matrix is in this phase a conceptual work, it is important to be tested in real life and evaluated accordingly. In the previous paragraph some soft aspects of this process have been discussed. Here the hard aspects are presented in the form of an implementation cycle.

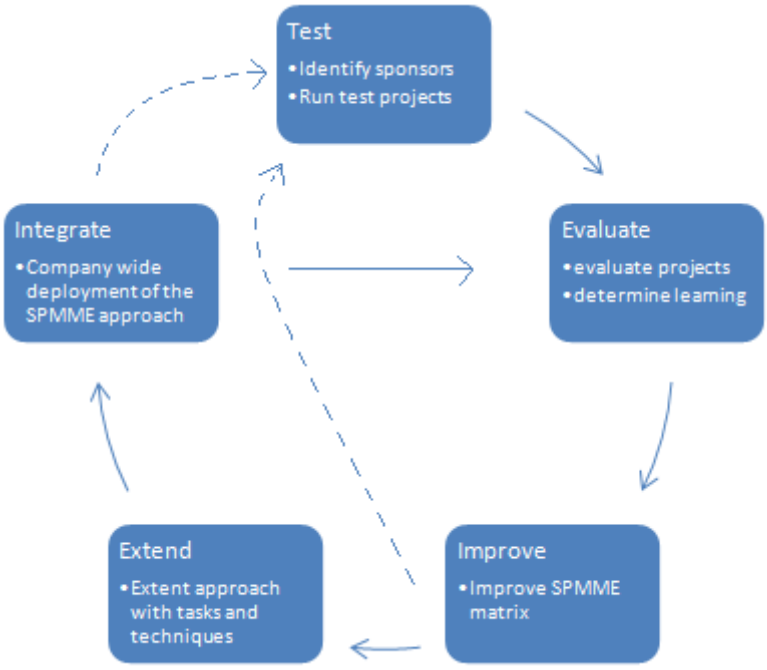


Figure 19: SPMME implementation process

5.3.1 Test

Referring to the implementation cycle, a first small cycle (test -> evaluate -> improve -> test) has to be conducted on the discussion of the matrix as created in the previous chapter. Resulting from that evaluation in 4.3 is that a discussion session between the practitioners is needed to reach a higher level of consensus on the identified points of concern. Especially the factors and activities where contradicting answers have been given or there was just a minor agreement should receive close attention. This session can be lead by the task force, which consists of the sponsors and a method engineer. Sponsors of this project have been identified to be Jacco Bakker and Pim Boswerger. Evaluation criteria to select these two sponsors were their theoretical background concerning project management, experience, their support for SPMME and their social influence within the company and could therefore be the heart of the task force. The importance of sponsors is a focal point in change management literature and important as a facilitator in organizing participation(Katsma, 2008). This task force can evaluate the outcome of the sessions and improve the matrix.

Before deploying the improved SPMME matrix throughout the organization (which means to the other project managers), it is important that it is first tested in real practice. First phase is to test the SPMME matrix on two finished exemplary projects, one bad and one successful. This testing can be done by the two identified sponsors.

5.3.2 Evaluate

When the pilot projects have come to an end, a new evaluation session with the task force is conducted. During this session the usage of the matrix can be discussed on whether or not it gave more insights into the situation of the projects. It should be evaluated how it improved the way the projects were managed and elaborated on where it can be improved. What would also be interesting to evaluate, is the ease of assessing the project situation and identification of the extent to which factors occur.

5.3.3 Improve

The evaluation sessions will yield valuable insights on the usage of the matrix, but will certainly yield some points of improvement as well. Together with the sponsors, the method engineer has to adjust the matrix to these new acquired insights. When there are some radical improvements made, it is important that these are first tested and evaluated, before the cycle is continued (as can be seen in the implementation cycle). When improvements are of more incremental nature this step is not necessary, hence the dotted line in the cycle.

5.3.4 Extend

After the first tests have been done, tasks and techniques can be identified in order to extend the matrix to a larger process framework. Here it is important that the other project managers are consulted as well, in order to capture as much knowledge as possible. Best practices on tasks and techniques should be constructed in this phase. In this step, usage of technology is crucial as knowledge sharing across two locations (Uden and Oldenzaal) is will hardly succeed without. In the development of this technology as discussed in paragraph 5.2, the task force has to keep an eye on the requirements and the support for this new technology. Communication and top management support are crucial elements in this phase.

5.3.5 Integrate

When the matrix is thoroughly tested and extended with tasks and techniques, it is ready to be deployed to the other project managers as well. It is advisable to test this idea in some pilot projects, in order to capture new and valuable insights from the other project managers. At first, some radical improvements will be found. Ones fully deployed and supported in the organization, the step of testing minor improvements might not be conducted. This is indicated in the cycle with a dotted line.

5.3 Concluding notes

To conclude this chapter on implementation, we note that the part on change management is introductory. Although giving a view on some change management principles, it is far from complete and in order to be used effectively it is important for Nibag to further investigate as well. Particularly when looking at plans for future IT investments and the earlier statement that this could be used as a catalyst for change. Nevertheless, this part could serve as a good foundation for Nibag to build their implementation plan on.

Discussion

6

This chapter presents the finalizing remarks on this research. First, the conclusions based on the conducted study are presented. By answering the sub-questions that were formulated in the beginning of this research, an answer is derived to the main research question. Then advices are formulated in the form of propositions to the company. Thereafter, contributions to practice as well as to the scientific community are noted. After discussing the internal and external validity, this chapter will end with discussing limitations of the study and ideas for future research.

"In the strict formulation of the law of causality—if we know the present, we can calculate the future—it is not the conclusion that is wrong but the premise."

- Werner Heisenberg -

6.1 Conclusion

This study started by observing the need in the organization for an aid in tailoring project management to the context of the project in order to raise efficiency and uniformity in the organization. In order to work towards an artifact that will help the practitioners, sub-questions were formulated to guide this research. In this conclusion, these questions are briefly answered in order to draw conclusions on the complete research project.

SQ1. What is the **current situation** in the company concerning project management?

To get a grip on the current situation in practice, semi-structured interviews were conducted with selected practitioners. The aim was to identify the current approach to project management and to identify problems with the current ways of working. During these interviews it became clear that the approaches to project management were preliminary ad-hoc and the desire was there to professionalize this.

SQ2. What can be identified in **scientific literature** to serve as a theoretical framework?

Initially, the state of research in project management was researched and served as a theoretical background for this study. Important findings were that this field of research seems to have abandoned the idea of a "one-size-fits-all" approach to project management, an extension of contingency theory has been applied to project management in the form of the Project Contingency Theory and that the idea of contextualizing the project management approach is far more developed in IS research. Specifically the idea of Situational Method Engineering served as a foundation for the development of a design.

Second, a systematic literature review was conducted in fields of IS, project management and allied disciplines. In this literature review 26 contingency factors were identified as relevant to this research. These factors were combined with insights gained from the interview sessions and this resulted in 28 contingency factors defined in the practical context.

SQ3. What does the **desired situation** in the company look like?

The interview sessions with 8 practitioners gave insight in the company culture. Tightly prescribed ways of working will not be accepted and is no solution for the great diversity of projects the company conduct. A decision aid for their project management approach should be easy to use and provide guidelines for tailoring their project management to the specific situation of the project.

SQ4. What does the **artifact** for contextualizing project management look like?

After the theoretical foundation was created, the design phase of the artifact for SPMME was started. By using the innovative software SPilter, a top 10 ranking of contingency factors was created as well as a selection of project management activities at Nibag based on the input of 7 practitioners.

The outputs of this process were used as an input for the construction of the matrix. Data on the deontic values were derived from the practitioners and two matrices were created. First, a matrix was derived indicating the likelihood of the project management activities in a certain context. Heuristics for creating this matrix were explained. A second matrix indicating the consensus on these values was constructed which indicated that there are points for discussion.

SQ5. How are the elements of the **artifact** evaluated?

Throughout the design of the artifact, evaluation moments were created in order to increase support at the practitioners. The elements of the SPMME matrix were constructed in this participatory manner, so feedback could be deployed in each next step in the design.

SQ6. What can be **learned** from the designed artifact and how does it need to be **implemented** at Nibag?

Looking at the two designed matrices, specifically the consensus matrix, it can be concluded that there is a great variation in opinions. Although consensus is reached in a part of the matrix, internal evaluation will be needed to learn more about the diversity in answers. Especially concerning the contradicting values that were given in some cells of the matrix. As also indicated by the practitioners, it was a difficult task to fill in the matrix and to think of their project management in this theoretical way. Nevertheless, it can be concluded it is a step forward in achieving professionalization of the approaches to project management. Furthermore, extension of the matrix with task and techniques in combination with to be introduced technology provides a great opportunity.

In the construction of the implementation guideline, a holistic perspective was taken. Looking at the company culture it can be concluded that especially the soft aspects in the implementation process should get close attention.

By briefly answering the sub-questions that have been formulated, we can now provide an answer on the main research question:

"How to tailor the project management method based on the project context in small to medium sized enterprises?"

Based on the research that is conducted it can be concluded that the SPMME matrix is a way of tailoring the project to its situation. With this statement, it should be noted that thinking of project management in a theoretical way proves to be hard for practitioners. This is reflected in the level of consensus on provided deontic values. We can therefore further conclude that internal development of the tool is needed. Next to the practical development of the tool we can conclude that, based on the early state this field of research is in, more scientific research is needed as well.

6.2 Recommendations

Based on the conclusions we provide the following recommendations to Nibag:

- The SPMME matrix should be used by practitioners at Nibag, because this matrix provides insights in important activities under specific circumstances of their project. This is relevant,

since we recognized the complexity of their decision making and hence support in decision making concerning the project management approach is desirable.

- The second recommendation follows from the consensus matrix where it can be concluded that there is a great diversity in opinions on the deontic values of the SPMME matrix. It is therefore recommended to create a task force, consisting of project managers that have a clear image of the work processes, have considerable knowledge on project management and above all have a high social impact in the organization. They should organize a meeting in order to clarify this variety of answers with the other project managers. This is an important step since the tool is all about the sharing of knowledge and the value of matrix is based on the experience of the practitioners.
- A third recommendation is based on the preliminary state of the design. Since the field of research is in its early days and a new artifact was to be designed, further development is needed. It might be that the selected top 10 of contingency factors will not describe the context to a sufficient extent or that additional information is needed with the matrix in order to be of practical use. Therefore we advise the company to thoroughly test this matrix in a pilot setting.
- A fourth recommendation is to extent the matrix with tasks and techniques. This will operationalize the SPMME matrix and makes it of even more practical use for the project managers. Use of new technology, for example an intranet, is crucial to make this knowledge explicit and available for all practitioners.
- Fifth recommendation concerns the implementation process of the SPMME matrix. As concluded on the chapter on the deployment a holistic view to implementation is advisable. Based on earlier research, soft aspects concerning this type of change yields are often overlooked. It is especially the people that need attention and involvement of the practitioners in the further development of the tool is highly recommended.
- Finally, in line with recommendations two and five is the company culture. At the moment the culture is far from ideal to optimally conduct knowledge sharing. Momentarily, practitioners are not used to the transfer of knowledge and theoretical thinking on their project management approaches. Although this is gradually improving, attention is advised in order to optimize the company culture. Several techniques are suited to this end and a combination of further development of the SPMME matrix and optimizing culture is a possibility to efficiently use time and resources.

6.3 Contributions

In this paragraph, the contributions of this research are explained. The research started in the first chapter by denoting the relevance of the study in a theoretical as well as in a practical sense. For this reason, we will start by denoting the contributions for the field of research and then discuss the contributions to the work of the practitioner.

6.3.1 Contributions for research

This study makes some importance contributions to the field of research in project management. Particularly by extending Project Contingency Theory to the field of Situational Method Engineering.

First, the PCT is a recent development in project management research. The literature base was found to be narrow. With the systematic literature review conducted in this research, in a combination of several disciplines, a considerable list of relevant contingency factors was identified.

This list can be used in further research in order to analyze levels of abstraction or identification of dimensions.

Second, project management research is more developed in IS research. Developments that could help project contingency theory another step forwards. Insights derived from applying Situational Method Engineering aspects can be used as a first step toward further cross fertilization.

Finally, the research base on PCT was found to be only based on analysis of prior literature. In this research, the idea of PCT has been empirically evaluated and this can be used in future research.

6.3.2 Contributions for practice

Apart from important contributions to theory, this study makes some important contributions to practitioners at Nibag and also for practice in general.

First, despite all research that already has been conducted the failure rate of projects still remains high. Failure that in turn leads to additional costs, complaining customers and dissatisfaction among practitioners. By working towards a method to make project management better fit to the context, this study helps in reducing the failure rate of projects in general.

Second, next to the development of the SPMME matrix, guidelines for deployment of this method are given. Since the development of the method is just in its preliminary phase, further development and guidelines on this process are important.

Third, although the development of the SPMME matrix is based on insights from practitioners of Nibag only, the methodology to arrive at this matrix is clearly explained and could be followed by other companies as well.

Finally, organizations that are looking for guidelines in implementing the idea of SPMME could use the given ideas for deployment as well. Although the content is specified for Nibag, the conceptual framework can be adjusted and tailored to their specific needs.

6.4 Validity

The validity of this research is discussed by distinguishing the internal and external validity.

6.4.1 Internal Validity

Internal validity is about the extent to which the results of this study are valid for the research population. Specifically the extent to which the results are valid for the practitioners at Nibag.

In this type of research, a qualitative study, the internal validity is not assessable in a quantitative way. In this type of research, assessing internal validity is about the extent to which the thoughts and actions of the researcher can be followed. To increase the internal validity, we have therefore tried to describe every step in this research and explain the procedures we have followed. Although this increases the internal validity to some extent, there are some threats that have limited the internal validity.

First, we have chosen the semi-structured interview as the research method for deriving information from practice. Although having the advantage of providing rich contextual information, methodological disadvantage is its freedom in structure of the interview and subjectivity in its

analysis. This is a thread to the internal validity, since it makes conducting these interviews in the same way again very hard.

Second, we have chosen in our research to work with an alphabetic list of contingency factors where possible forms of abstractions, dimensions and relations between factors have not been examined. Although we do recognize the possibility of levels of abstraction and the influence of relations between contingency factors, this was due to the time frame left out of the scope.

Finally, a validation of identified activities has not been conducted. This is due the time frame as well as the state of design that the SPMME matrix is in. Further development is still needed and in this phase the derived list of activities will do.

However these recognized threats to the internal validity, we have tried to optimize the validity by guiding the reader in our methodology and by the involvement of the practitioner in every step of the design.

6.4.2 External Validity

External validity is about the extent to which findings resulting from this study can be generalized. Generalization in design research is difficult concerning the situated nature. This research is about designing an artifact *"… be it an organization, a policy, or a work practice as instantiated in the interface between an inner and an outer environment*" (Boland, 2002) and here the inner and outer environment are company specific. Although being situated, generalizations can be made on the problem, the solution and the learning points as proposed by Sein et al. (2011).

First, the problem of professionalizing and contextualizing the project management approach is not company specific. Concerning the high failure rate of projects and the identified improvements that can be made by tailoring a project to its situation, this problem can be generalized to SMEs in general if not to larger companies as well.

Second, although the proposed matrix is created based on specific insights from practitioners in the company, the concept that is generated with a deontic matrix existing of contingency factors and project management activities can also be generalized to other organizations. They should however find out which contingency factors are most important in their situation and deontic values need to be derived based on their specific expertise. The created matrix in this research would nevertheless still be useful for companies that have similar characteristics as Nibag.

Finally, learning points derived from evaluation and ideas for extension of the SPMME matrix can also be generalized to all other organizations facing problems in contextualizing their project management approaches.

6.5 Limitations and future research

In the discussions above, some limitations on this research concerning internal and external validity have already been noted. Next to this, considering the time frame, testing of the SPMME matrix in pilot projects was not a possibility. This creates a major limitation considering the possibility to evaluate the usability of the SPMME matrix.

Further limitation is the scope of this research, since only activities have been considered. Great possibilities in capturing knowledge and aiding practitioners are there when extending this matrix

with tasks and techniques as well. Finally, no study has been conducted to the needs of the customer. Approaches in certain contexts will be perceived differently by individual customers and their view on the project management approach could yield to valuable insights for the created matrix and to SPMME.

As can be seen, limitations and ideas for future developments are closely related. Considering research opportunities, the following can be identified:

- The identified contingency factors could be researched on the level of abstraction, existence of possible dimensions and relationships between them.
- Empirical testing of the created SPMME matrix is an interesting opportunity in the further development of situational method engineering in the project management context.
- Use of the deontic matrix is only one of the possibilities in creating a situational tool. In order to optimize the idea of SPMME, use of other techniques should be researched as well.
- Research from the client perspective is interesting to derive their view on project management approaches and this will create additional value for the practitioners.
- Finally, following the same research approach in organizations with differing characteristics from Nibag might yield some new findings that could provide valuable new insights.

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APPENDIX

APPENDIX A	INFORMAL LITERATURE SCAN
APPENDIX B	LITERATURE REVIEW METHODOLOGY
APPENDIX C	STUDIES INCLUDED IN RESEARCH
APPENDIX D	INTERVIEW
APPENDIX E	STATISTICS ON THE RANKING OF CONTINGENCY FACTORS
APPENDIX F	INPUT SPMME MATRIX

APPENDIX A: INFORMAL LITERATURE SCAN

In order to get a picture of the field of research in project management, an 'informal' literature review was performed. This was used to explain the theoretical relevance of this project. Here I will explain the methodology that was followed in order to review relevant articles. Firstly, the search database of Scopus ("Scopus," 2010) was selected to scan some top journals in an efficient manner. Second, key words were selected that will cover my general interest in this stage of the project. Third, queries for search were created and executed in the search database. The queries that were used are:

Query 1: TITLE-ABS-KEY(project management AND prince 2)

Query 2: TITLE-ABS-KEY(prince 2 AND construction)

Query 3: TITLE-ABS-KEY(project management AND construction)

Refined: TITLE-ABS-KEY(project management AND construction AND methodology) AND (LIMIT-TO(PUBYEAR, 2010) OR LIMIT-TO(PUBYEAR, 2009) OR LIMIT-TO(PUBYEAR, 2008)) AND (LIMIT-TO(SUBJAREA, "ENGI") OR LIMIT-TO(SUBJAREA, "BUSI") OR LIMIT-TO(SUBJAREA, "MULT"))

Query 4: TITLE-ABS-KEY(prince 2 AND review)

Query 5: TITLE-ABS-KEY(prince AND review)

Query 6: TITLE-ABS-KEY(project management AND literature review AND state) AND (LIMIT-TO(PUBYEAR, 2010) OR LIMIT-TO(PUBYEAR, 2009) OR LIMIT-TO(PUBYEAR, 2008))

Query 7: TITLE-ABS-KEY(project management AND literature review AND state) AND (EXCLUDE(PUBYEAR, 2010) OR EXCLUDE(PUBYEAR, 2009) OR EXCLUDE(PUBYEAR, 2008))

Query 8: TITLE-ABS-KEY(project management AND literature review) AND (LIMIT-TO(PUBYEAR, 2010) OR LIMIT-TO(PUBYEAR, 2009))

Query 9: TITLE-ABS-KEY(review) AND SRCTITLE(project management) AND (EXCLUDE(PUBYEAR, 2010) OR EXCLUDE(PUBYEAR, 2009))

Afterwards, the International Journal of Project Management was scanned for relevant articles.

Next, the results were scanned on title and abstracts to select the most relevant ones. A first selection of 53 articles was created in this fashion and the most closely related articles to my topic of interest were quickly scanned on their contents.

APPENDIX B: LITERATURE REVIEW METHODOLOGY

In this part the methodology used to conduct the literature review is described. The steps that were conducted to arrive at a relevant set of articles for thorough review are:

a) Selection of relevant top journals
b) Assuring top journal coverage by database selection
c) Selection of key words
d) Selection of selection criteria
e) Making search queries
f) Prioritization
g) Flowchart

In the next small sections these steps will be further explained. It should be noted that however this is stated as several steps in sequence, it is an iterative process. Were refinement of the research question also leads to new insights for the literature review. This can be graphically displayed as follows.

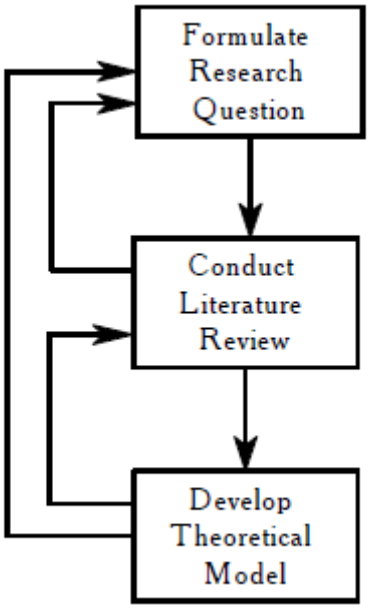

Figure 20: iterative process

Selection of relevant top journals

In reviewing scientific literature within the time frame of a Masters assignment, it is impossible to review all available literature. So the goal of this part is to make sure that at least all relevant top journals is covered, at minimum, to reduce the chance on missing important theoretical insights. As a basis for this review, the selection of (Kwak & Anbari, 2009) was used. They took the FT40 (Financial Times top 40 journals in Business) to review the most important literature of allied disciplines to Project Management. They reviewed this list on relevance to project management and eliminated 24 journals. A list of the remaining 16 journals was then extended with two practice-oriented journals. This list of 18 journals did not include the journals that focus on Project Management as a discipline, since their interest was towards the allied disciplines. For the coverage of relevant journals in this research however, it is important to add the specific journals as well. By adding the specific journals

related to PM research mentioned by (Kwak & Anbari, 2009), a list of 26 journals is created that will at least be covered in this literature review and can be seen in the following table. The eight specific project management journals are indicated with an asterisk (*).

Table 7: Top 26 journals Project Management

Top 26 Journals in Project Management
AOM Perspectives/Executives
AOM Journal
AOM Review
Operations Research
Management Science
Organization Science
Information Systems Research
Interfaces
Harvard Business Review
California Management Review
Sloan Management Review
Longe Range Planning
IEEE Transactions of Engineering Management
Journal of Operations Management
MIS Quarterly
Strategic Management Journal
Administrative Science Quarterly
Journal of Small Business Management
Project management journal (*)
International journal of project management (*)
International journal of managing projects in business (*)
Journal of construction engineering and management (*)
Journal of management in engineering (*)
Construction of management and economics (*)
Technovation (*)
R&D management and research policy (*)

Another field, closely related and well developed in project management, included in this research is IS Management. Therefore, the top 25 journals in this field of research is additionally covered to get a grip on relevant literature in the field of IS Management as well (Schwartz & Russo, 2004). The list of these journals is presented below.

Table 8: Top 25 IS Journals

Top 25 IS Journals
MIS Quarterly
Communications of the ACM
IS Research
Journal of MIS
Management Science
IEEE Transactions (various)
Harvard Business Review
Decision Sciences
Decision Support Systems
Information and Management
European Journal of IS
Sloan Management Review
ACM Transactions (various)
Data Base
Organization Science
Information Systems Journal
Academy of Management Journal
Communications of the AIS
IEEE Computer
Journal of Strategic IS
Administrative Science Quarterly
Academy of Management Review
International Journal of E-Commerce
ACM Computing Surveys
Accounting, Management & IT

a) Assuring top journal coverage by database selection

In order to gain coverage of these journals, the scientific literature databases Scopus ("Scopus," 2010) and Web of Science ("Web of Science," 2010) were scanned on their coverage of these journals. Neither of the two databases covers the total list of 26 journals identified above. A combination however does provide the coverage. Scopus covers 24 out of 26 of the journals, and the other two journals (Project Management Journal and the International Journal of Managing Projects in Business) can be covered using a specified query in Web of Science or by performing a hand search. It should be stressed out that the search query in Scopus does not focus on these 24 papers alone, but it will search in the entire database of Scopus in order to reduce the chance of missing out on important papers in other journals. However, by combining the two the coverage of the most relevant 26 journals is guaranteed. In conducting the literature review, the option to hand search both journals not covered by Scopus was preferred.

Schwartz and Russo (2004) indicate how to get appropriate coverage for the journals in the field of IS Management, and Scopus can be used to gain coverage of 24 out of the top 25 IS Journals. The journal Communications of the AIS is not covered in Scopus and is therefore hand searched.

b) Selection of keywords

Based on the main research question and the sub questions that need to be answered in this study, the following selection of key words was made. Project contingency factors, project contingency theory, project management contingency, project method selection, project method engineering, situational method engineering and method engineering AND project management.

c) Selection criteria

When using the key words expressed above, the resulting papers are not all useful. Next to this, with an eye on the time frame, it is not efficient to scan all these papers. Therefore selection criteria were used in order to reduce the number of results into the more relevant ones to this research. When there were too many results, the criteria used were:

- Year: only the most recent publications were reviewed (after 2005)
- Subject area: only the most relevant areas were scanned (Business and management, engineering)

d) Search queries

In order to conduct the search process in an efficient manner, search queries were used involving the above mentioned criteria when needed. This is an iterative process of trial and error to get to a useful amount of results.

e) Prioritization

After results were derived from the queries used, the amount of potentially relevant papers needed to be reduced to an amount that could be methodologically scanned. The results were therefore prioritized on their title and abstracts, in order to select the most relevant ones to the subject at hand.

f) Flowchart

In order to graphically summarize the review process, the following flowchart was created. This gives the reader a systematical presentation of the way the most relevant papers were selected.

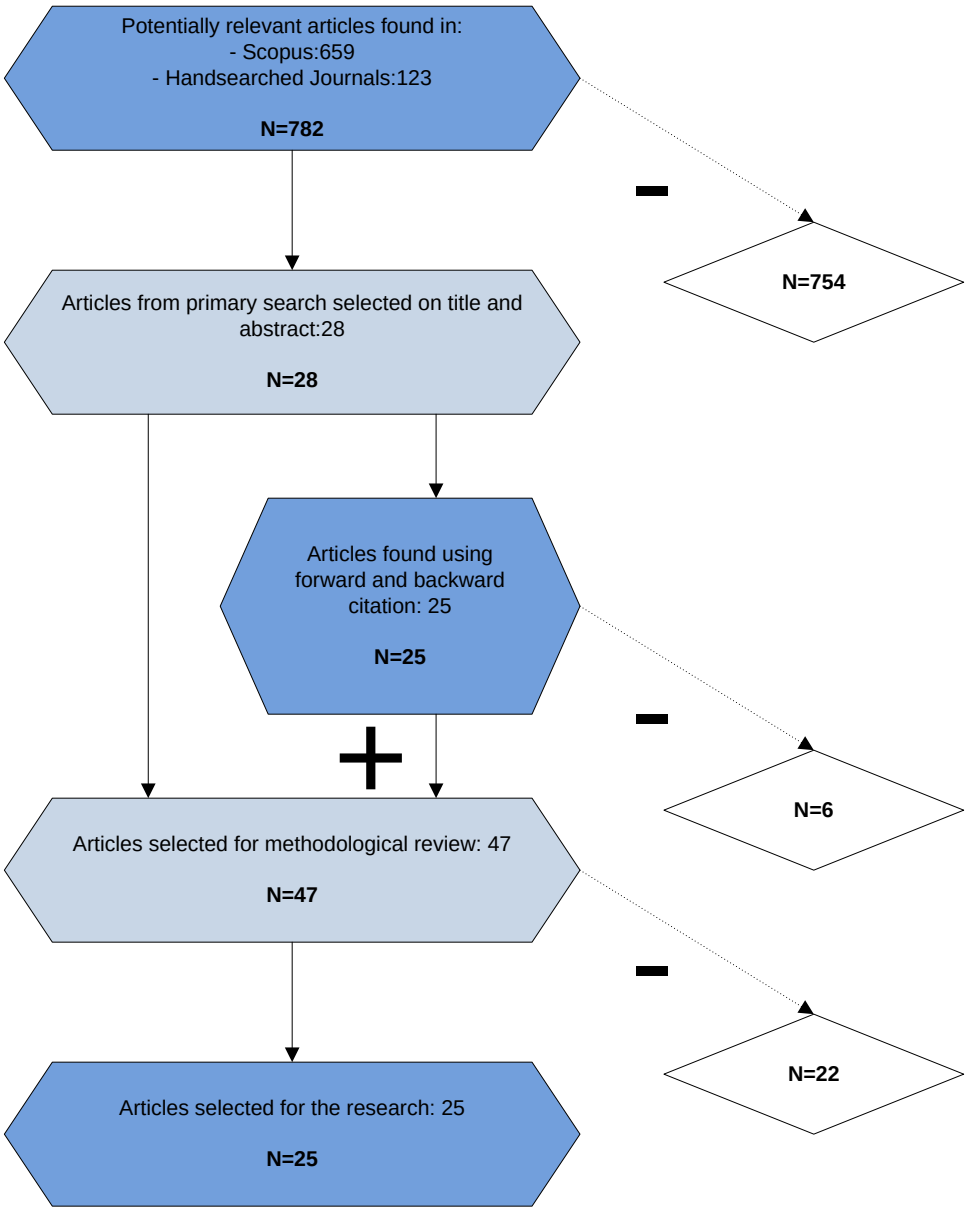

Figure 21: Flowchart visualizing literature review

First, the number potentially relevant articles are shown for each of the sources. This number is a result of the use of the selected key words and criteria to get a usable amount of potentially relevant articles. Next, this number is scanned on title and abstracts and only the most interesting ones have been selected. Using forward and backward citation, more interesting papers have then been identified and a total amount of 47 papers was then more thoroughly reviewed. At the end, a total of 25 articles were added in this report. This list can also be found in appendix C. The amounts of articles that have been removed from the selection per phase are indicated on the right side of the figure.

APPENDIX C: STUDIES INCLUDED IN RESEARCH

Table 9: List of papers included in the research

NR	Authors
1	(Howell, et al., 2010)
2	(van Donk & Molloy, 2008)
3	(Canonico & Söderlund, 2010)
4	(Srivannaboon, 2006)
5	(Sauser, et al., 2009)
6	(Rungi, 2009)
7	(Stal-Le Cardinal & Marle, 2006)
8	(Kornyshova, et al., 2010)
9	(Henderson-Sellers & Ralyté, 2010)
10	(Bucher, et al., 2007)
11	(Ralyté, Deneckère, & Rolland, 2003)
12	(Shenhar & Dvir, 1996)
13	(Van Slooten & Schoonhoven, 1996)
14	(Punter & Lemmen, 1996)
15	(Pich, Loch, & De Meyer, 2002)
16	(Shenhar, 2001)
17	(Ter Hofstede & Verhoef, 1997)
18	(J. R. Turner & Müller, 2003)
19	(Kornyshova, et al., 2007)
20	(Karlsson & Ågerfalk, 2004)
21	(Rolland & Fujita, 2009)
22	(Brinkkemper, 1996)
23	(Harmsen, 1997)
24	(van Slooten & Hodes, 1996)
25	(Little, 2005)

APPENDIX D: INTERVIEW

In the period of January-February 2011 interviews have been conducted with practitioners at Nibag. As explained in the thesis, these were semi-structured interviews. In order to give more insight in the followed methodology, topics used in the interviews are presented here. These topics were identified prior to the interviews and serve as guiding, semi-structuring, the interview. Interviews were conducted in Dutch, but the translation of topics will be provided. Although topics are mentioned below, due to the nature of a semi-structured interview, it is possible that questions were not posed. Next to this, the weight of this interview was on contingency factors and the time discussing subjects was therefore not evenly spread.

- Could you explain the project management approach?
    - Try to think of your last project and more specifically, the management part.
    - Could you indicate the phases you apply?
        - Is this always the same?
        - Could you indicate the activities in each phase?
        - Are there types of problems you encounter in certain phases?
    - Could you indicate which type of documents you use per phase?
        - This concerns management documentation, not technical documentation
        - When no phases are used, then indicate the documents generally used
        - Are there templates used for this end?
        - Are there also documents which are only used in specific types of projects?
        - What are criteria for applying these different documents?
    - What are the principles applied during the project management?
    - Are there any other problem areas concerning project management? Perhaps difficult topics often encountered, or critical aspects during the project.
    - Could you indicate the strengths of your approach?
- Could you indicate how you got to your project management approach?
    - Was this created from scratch?
    - Was a method prescribed by Nibag?
    - Did you create the approach yourself, or was this created based on discussions with other project managers?
    - Which factors lead to this approach or do you think are relevant for this?
    - Is the approach you currently apply fixed, or is this adjusted to the situation?
    - If adjusted, what are the criteria applied to adjust the approach? Which factors of the project context are relevant, or would be relevant?
    - On which elements of project management do these criteria/factors have effect?
        - Phases?
        - Documentation?
        - Activities?
    - On what time during the project is this determined? Or continuously?
    - `Which factors are hard to determine? And on what way are they identified?
    - What do you do concerning evaluation and registering learning?
- What is your perspective on project management company wide?
    - Are there certain problems relating to different ways of working across the organization?

        - From an internal perspective?
        - From the client perspective?
    - Are there internal meetings to discuss different approaches?
- What is your view on a generic approach to project management, which can be adjusted to the context?
    - What is your opinion?
    - Do you have ideas for the use of such a model?
    - What do you think are disadvantages of such an approach?
    - What could be advantages?
- Questions or suggestions?

APPENDIX E: STATISTICS ON THE RANKING OF CONTINGENCY FACTORS

In this appendix the statistics on the ranking of the contingency factors are summarized. Factors are ordered based on their rank, which is determined by the average position as given by the practitioners.

Table 10: Statistics on the ranking of contingency factors

Factor	Av. Position	Av. Score	St.dev.	Participants	Normalized Weight
Costs	3,71	7,29	3,33	7	13,25
Quality	5,86	5,14	3,94	7	9,35
Ambiguity	6,00	5,00	4,38	7	9,09
Time	6,14	4,86	3,31	7	8,83
Complexity	7,86	3,14	4,09	7	5,71
Expertise Degree	8,00	3,00	2,93	7	5,45
Politics	8,29	2,71	3,33	7	4,94
Importance	8,57	2,43	3,37	7	4,42
Impact	8,86	2,14	3,48	7	3,90
Innovation	9,00	2,00	2,45	7	3,64
Team Size	9,29	1,71	2,76	7	3,12
Uncertainty	9,57	1,43	2,77	7	2,60
Law and Regulation	9,71	1,29	1,83	7	2,34
Interdependencies	9,71	1,29	2,05	7	2,34
Dispersal	9,86	1,14	2,80	7	2,08
Resistance	9,86	1,14	2,80	7	2,08
Team Empowerment	10,00	1,00	2,45	7	1,82
Repetitiveness	10,00	1,00	2,07	7	1,82
Formality	10,00	1,00	1,60	7	1,82
Domain knowledge gap	10,00	1,00	2,45	7	1,82
Criticality	10,14	0,86	1,46	7	1,56
Openness	10,14	0,86	2,10	7	1,56
Interdependencies	10,29	0,71	1,75	7	1,30
Urgency	10,29	0,71	0,88	7	1,30
Stakeholder number	10,29	0,71	1,75	7	1,30
Management Commitment	10,43	0,57	1,40	7	1,04
User Involvement	10,57	0,43	1,05	7	0,78
Novelty	10,57	0,43	1,05	7	0,78
Shortage of Resources	11,00	0,00	0,00	7	0,00

APPENDIX F: INPUT SPMME MATRIX

In this figure, the input of the respondents has been combined.

	Learning and Evaluation	Close the project	Planning	Managing changes	Communication strategy	Stakeholder analyses	Issue management	Financial management	Document management	Risk management	Determine project goals	Quality control	Process management
1. Costs	N,V,A,V,O,A	V,V,V,V,A,V	V,A,V,V,A,A	A,A,V,V,O,A	A,O,A,O,O,A	A,A,A,O,O,A	A,V,O,O,A,A	V,V,V,V,A,V	V,A,A,O,O,V	V,V,V,V,O,V	V,V,V,O,A,V	V,O,V,O,A,V	V,A,A,V,A,V
2. Quality	V,V,A,V,A,V	V,V,V,V,O,V	A,V,A,A,A,A	A,A,V,O,O,O	A,A,A,O,O,V	A,V,A,V,O,O	A,A,O,V,O,O	A,V,A,A,A,V	V,A,V,V,O,V	V,V,V,V,O,V	V,V,V,V,O,V	V,V,V,V,A,V	V,V,A,V,A,V
3. Ambiguity	O,V,A,O,A,V	O,A,V,N,O,V	O,A,V,V,A,O	O,V,V,V,A,O	O,O,V,V,A,V	O,O,V,V,O,V	O,V,O,V,O,O	O,A,A,V,A,A	O,V,V,V,O,V	O,V,V,V,A,V	O,V,V,O,A,V	O,A,A,O,A,V	O,A,A,V,A,V
4. Time	V,O,A,O,O,O	V,V,V,O,A,V	A,V,V,V,A,V	O,V,A,V,O,O	O,V,V,A,O,O	O,V,V,A,O,O	O,V,O,O,O,O	A,V,A,O,A,O	V,V,V,V,O,V	V,V,V,V,O,A	V,V,V,V,O,V	V,A,V,V,A,V	V,V,A,V,A,V
5. Complexity	V,V,O,O,O,V	V,V,O,O,O,A	A,V,O,V,O,A	O,V,O,V,A,O	A,V,O,A,A,A	A,V,O,A,O,O	O,V,O,V,O,A	A,V,O,O,A,A	V,V,O,V,O,V	V,V,O,V,O,V	V,V,V,O,A,A	V,V,O,V,A,A	V,V,O,V,A,V
5. Expertise Degree	O,V,A,V,A,V	O,A,O,O,A,A	O,A,O,A,A,A	O,V,O,A,A,A	O,A,O,O,A,V	O,A,O,V,O,O	O,V,O,O,O,A	O,A,O,O,A,A	O,A,O,V,O,V	O,V,A,V,O,V	O,V,O,O,A,V	O,V,O,V,A,V	O,V,O,V,A,V
7. Politics	A,A,O,O,A,O	A,A,O,N,O,A	O,V,A,O,A,A	O,V,O,O,O,O	A,V,V,V,A,V	A,V,V,V,O,V	O,V,O,O,O,O	O,A,A,O,A,V	O,V,A,V,O,V	O,V,V,V,O,V	O,V,V,V,A,A	O,V,A,O,A,A	O,V,V,V,A,V
8. Importance	O,V,O,O,A,V	O,V,V,N,A,V	O,V,V,V,O,O	O,A,V,O,A,O	O,V,V,V,A,A	O,A,V,V,O,O	O,A,O,V,O,A	O,A,V,O,A,A	O,A,V,V,O,V	O,V,V,V,O,V	O,V,V,V,A,A	O,V,V,O,A,A	O,V,V,V,A,V
9. Impact	O,A,O,O,A,V	O,A,V,N,A,V	O,V,V,V,O,A	O,V,V,A,A,A	O,V,V,V,O,A	O,V,V,V,O,O	O,A,O,O,O,V	O,A,V,O,A,A	O,A,V,V,O,A	O,V,V,V,O,V	O,V,V,V,O,A	O,V,V,O,A,V	O,V,V,V,A,V
10. Innovation	O,V,O,O,A,V	O,A,O,N,A,O	O,A,O,N,O,O	O,V,O,N,A,O	O,A,A,V,A,A	O,A,O,A,O,A	O,V,O,O,O,N	O,A,O,O,A,N	O,V,O,V,O,V	O,V,O,V,O,V	O,V,O,O,O,A	O,V,O,V,A,V	O,V,O,V,A,V

Levels
V = Obliged
A= Advisable
O= optioneel
N= Not advisable
F= Forbidden

Figure 22: Input SPMME matrix

“If we knew what it was we were doing, it wouldn’t be called research, would it?”

- Albert Einstein -