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A Project Management Framework for Implementing AI-enhanced Data Analytics Projects

~~A Case Study of Virnex Group Oy~~

Metropolia University of Applied Sciences

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This is written at the end, as the very last written element in the thesis process.

The preface is a short personal introduction combined with a humble/kind acknowledgement to anyone who has helped you in the Thesis process (regardless of support type, whether constructive or critical, whether you liked it or not), starting from the case company, acknowledging all interviewees, gate-openers, workshop participants, key stakeholders, Metropolia faculty and students, and end with family, friends and peers.

This becomes a public document in Theseus so do be mindful and tactful in your writing. Reading a thesis Preface is a good way of testing a student’s maturity. Please avoid over-positive or over-critical emotions to overtake you at the end of the Thesis. The Preface shows your diplomatic skill in acknowledging the role of others in making you succeed - it sets the ground for you to build long-term bridges and your ‘personal brand’ in the case company, industry at large and toward Metropolia. Notice that in the small, global world in which we live in, everyone is connected, thus you cannot afford not to acknowledge someone who has visibly helped you.

Keep the tone personal, yet professional and mindful. This is your moment. Remember to sign this text below.

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May 1, 2024

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| --- | --- | --- |
| **Abstract** | | |
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| **Guide to Abstract writing:**  In the abstract, please succinctly address the following themes and keep to one page:   * description of the thesis objective and context - 1 paragraph * how the study was conducted (research methods, data) - 1 paragraph * what the key parts contained (theoretical and practical) - 1 paragraph * what was the outcome & what was the business impact (significance for the company) - 1 paragraph.   DO NOT refer to the structure of the 7-GATES here. | | |
| Keywords | | Data analytics, Artificial Intelligence, Project Management, Change management |

Contents

List of Tables *(if more than 10 items)*  
List of Figures *(if more than 10 items)*

[1 Introduction 1](#_Toc160533811)

[1.1 Business Context 2](#_Toc160533812)

[1.2 Business Challenge, Objective and Outcome 3](#_Toc160533813)

[1.3 Thesis Outline 4](#_Toc160533814)

[~~1.4 Project Management 5~~](#_Toc160533815)

[~~1.4.1 Change Management 5~~](#_Toc160533816)

[~~1.4.2 Risk Management 7~~](#_Toc160533817)

[~~1.4.3 Cloud Financial Management 8~~](#_Toc160533818)

[~~1.5 Artificial Intelligence 8~~](#_Toc160533819)

[~~1.6 Data Analytics 8~~](#_Toc160533820)

[2 Method and Material 9](#_Toc160533821)

[2.1 Research Approach 9](#_Toc160533822)

[2.2 Research Design 10](#_Toc160533823)

[2.3 Data Collection and Analysis 11](#_Toc160533824)

[3 Current State Analysis of Project Management, AI and Data Analytics at Case Organization 15](#_Toc160533825)

[3.1 Overview of the Current State Analysis 15](#_Toc160533826)

[3.2 Analysis 16](#_Toc160533827)

[3.2.1 Project Management 16](#_Toc160533828)

[3.2.2 Artificial Intelligence 17](#_Toc160533829)

[3.2.3 Data Analytics 17](#_Toc160533830)

[3.3 Key Findings 18](#_Toc160533831)

[3.3.1 Strengths and Weaknesses 18](#_Toc160533832)

[3.3.2 Selected Focus Areas 18](#_Toc160533833)

[4 Available Knowledge and Best Practice 20](#_Toc160533834)

[4.1 Project Management 20](#_Toc160533835)

[4.1.1 System Approach 21](#_Toc160533836)

[4.1.2 Organizations 22](#_Toc160533837)

[4.1.3 Change Management 25](#_Toc160533838)

[4.1.4 Risk Management 25](#_Toc160533839)

[4.1.5 Cloud Financial Management 39](#_Toc160533840)

[4.2 Artificial Intelligence 40](#_Toc160533841)

[4.3 Data Analytics 40](#_Toc160533842)

[4.4 Conceptual Framework 41](#_Toc160533843)

[5 Building Proposal for [Relate to Your Objective] for the Company 43](#_Toc160533844)

[5.1 Overview of the Proposal Building Stage 43](#_Toc160533845)

[5.2 Findings from Data 2 (pulling together CSA, CF and Data 2) 44](#_Toc160533846)

[5.3 Initial Proposal / Proposal Draft 45](#_Toc160533847)

[5.3.1 Element 1 of the Initial Proposal 45](#_Toc160533848)

[5.3.2 Element 2 of the Initial Proposal 45](#_Toc160533849)

[5.3.3 Element 3 of the Initial Proposal … 45](#_Toc160533850)

[5.4 Summary of the Initial Proposal 46](#_Toc160533851)

[6 Validation of the Proposal 47](#_Toc160533852)

[6.1 Overview of the Validation Stage 47](#_Toc160533853)

[6.2 Developments to the Proposal (based on Data Collection 3) 47](#_Toc160533854)

[6.2.1 Developments to Element 1 of the Initial Proposal 49](#_Toc160533855)

[6.2.2 Developments to Elements 2 of the Initial Proposal 49](#_Toc160533856)

[6.2.3 Developments to Elements 3 of the Initial Proposal … 49](#_Toc160533857)

[6.3 Final Proposal 49](#_Toc160533858)

[6.4 Recommendations /Action Plan, etc (if relevant) 49](#_Toc160533859)

[7 Conclusion 50](#_Toc160533860)

[7.1 Executive Summary 50](#_Toc160533861)

[7.2 Managerial Implications (Next Steps and Recommendations toward Implementation) 51](#_Toc160533862)

[7.3 Thesis Evaluation 52](#_Toc160533863)

[7.4 Closing Words 52](#_Toc160533864)

[References 1](#_Toc160533865)

[8 READING LIST 2](#_Toc160533866)

Appendices

Appendix 1. Title of the Appendix

Appendix 2. Title of the Appendix

# Introduction

Current businesses are more and more data oriented as data are generated from myriad of places and comes in many from and in large volume (Inmon et al. 2021).  ~~(Inmon, Levins, & Srivastava, 2021)~~ . This large data volume has been a major transformative force for internal process optimization and data driven decision making companies. More and more companies are investing heavily to understand own data. Also, data-lakes, data-warehouses and data analytics are offering possible solutions to the company needs. With this push towards greater insights from data, a relatively new field has evolved where Artificial Intelligence (AI) is integrated with data to obtain better understanding of existing data as well as possible future insights to data (for example, for sales forecasting or identifying potential customers). These factors have led to a surge in data analytics projects which are relatively different than a traditional Information Technology (IT) projects.

A typical IT project has “two main activity dimensions: engineering and project management. The engineering dimension deals with building the system and focuses on issues such as how to design, test, code, and so on. The project management dimension deals with properly planning and controlling the engineering activities to meet project goals for cost, schedule, and quality” (Jalote, 2002). Project management, like other branches of knowledge, has changed since the development of computer science and informatics. Organizations are advancing digital transformation and adopting enterprise architectures through which they have improved processes and information systems simultaneously (Pérez, Pérez, & Kacprzyk, 2022).

However, AI-enhanced data analytics projects significantly differ from traditional IT project because of their iterative nature, technical complexity, need of inter domain collaboration as well as uncertainty in outcomes. These challenges require an efficient and systematic project management approach that can potentially help mitigate risk, enhance efficiency, and ensure successful implementation. Additionally, AI and Machine Learning has become buzzword for executives who expect to solve the problems in an organization with successful AI implementation. Thus, managing executive expectations has become a major part of IT project Managers day-to-day work. Moreover, understanding organizational structures and their change management processes has become another issue that an IT project manager must constantly familiarize or reiterate to accommodate AI in an organizational process. Thus, a new type of knowledge is needed to help in such projects, that is Project Management of Artificial Intelligence implementation in the field of data analytics.

With all these additional components to project management, a traditional approach to project management is not considered optimal with one analysis suggesting that about one-third of projects have cost and schedule overruns of more than 125% (Jalote, 2002). A study conducted in USA in relation to project failures of software projects has found that only 17% meet their original targets, 50% must have target changed due to factors such as time constraints, budgets or reduced performance requirements, and the remaining 23% are cancelled. With average spending of 250 bln dollars in software development, approximately 20 bln are completely lost in cancelled projects (reference. Try to find a recent similar statistic!). With better understanding of overall process, a project manager is better equipped to handle these challenges. Proper management of people, social and cultural aspect of organization, change management and process management is needed to overcome these challenges and mitigate risks. Additionally, very few studies have been done in these field as it is evolving phenomenon, and no standard approach is available for a project manager to implement. - This is just your assumption!

In this thesis, the primary focus is placed on developing a ~~optimal~~ project management framework that can ~~effectively~~ help navigate the ~~unique~~ challenges posed by AI projects. By evaluating and understanding the existing frameworks and their applicability within the context of AI and data analytics projects, this thesis ~~research~~ aims to provide insights into project management approaches that best suit the complexities of AI and data analytics projects. This thesis ~~research~~ aims ~~to explore~~ how frameworks such as Agile, Waterfall, Scrum, and other established project management methodologies can be adapted, augmented, or combined to better suit the dynamic, often experimental nature of AI project development. NO, Sujan, you will not be doing anything of these!

~~Understanding and proposing effective strategies for~~ Developing a project management framework suitable for the case company could ~~significantly~~ contribute to enhancing project success rates, meeting stakeholder expectations, and optimizing resource utilization in the case company.

## Business Context

The case company of this thesis, Virnex Group Oy,is an Information Technology company operating in Finnish Information Technology Sector with two distinct areas of operation: *Digitalization consulting* and *Business software solutions.* Both areas of operation are directed towards improving organizational performance, completing IT projects, automating business process and data driven visualization of big/small company in different industrial sectors including public, government, finance, energy, forestry and so on. The main solution provided by the company are consulting experts in different field of technology who can help customer company in solving their day-to-day problems related to information technology be it as simple task of visualizing daily sales of the company or as complex as creating completely new tailormade software solution in cloud environment. (Virnex Group OY, 2023)

Operation themes in general include transitioning business to new business model using agile methodologies, help clients find, build, or adapt systems and tools that best serve their current business, enabling client’s business decision to be based on right, relevant data and understanding of data, provide best experts in related field to be a part of building a better, smarter, and sustainable world. (Virnex Group OY, 2023)

The company´s main office is in Lahti, Finland, and has around 100 employees. The revenue generated during 2022 was approximately 10 mln euro. Thus, the company is relatively small compared to other IT technology companies but has seen a massive growth during past three years as it was only officially founded before four years. Over the past few years, the number of employees has grown from 20 to about 100 and has served more than 200 different customers since its establishment.

The company is planning for a major shift in implementing Artificial Intelligence into its internal processes as well as creating new solutions using AI, so that it could streamline own internal processes as well as generate additional revenue by selling solutions to other companies at the same time. Presently, there are multiple projects ongoing to enhance the current data analytics process of the company, as well as “ready-to-deploy” processes that could be implemented in a customer organization with minimal customization.

## Business Challenge, Objective and Outcome

The case company has invested in developing Virnex Intelligent Business Automation (VIBA) which is an automation solution that reduces manual work by using analytics, AI, Machine Learning, and data integration to make automated decisions. However, the use of AI in the process is currently quite limited. The company clearly wants to benefit from implementing AI to its data analytics offering. However, a systematic approach/ framework that could be implemented in such projects is currently missing, specifically in the domain of data security, compliance, risk management and change management. Part of these issues are not only limited to technical aspects but also to management processes of the company and its AI projects. On other hand, AI implementation projects are comparatively new for the company and its project managers in general. These processes have not been well standardized, so that traditional IT Project Managers have all faced different level of challenges in successfully implementing these projects. (It should come as a result of your CSA, Current State Analysis!)

The Objective is *to define a systematic approach / framework to improve project management process for AI-enhanced data analytics projects based on identifying project management challenges in AI implementation projects.*

The outcome is a systematic approach / framework to improve project management process for AI-enhanced data analytics projects.

## Thesis Outline

The scope of this thesis is limited to project management aspects of AI enhanced data analytics projects in the case company.

The thesis is written in seven sections and starts with Section 1, Introduction of the topic and the case company along with its business challenges. Section 2 describes the research design, approach, data collection and analysis methods. Section 3 focus on analyzing the current state of the AI-enhanced projects in the case company and identifying focus area for next steps. This is followed by Section 4, discussing relevant existing knowledge and best practice for doing AI-enhanced projects that ends up with a conceptual framework. The conceptual framework will guide developing the hands-on, applicable framework for projects management in AI-enhanced projects for the case company done in Section 5. Section 5 will focus on creating the initial project management framework for the case company. Section 6 will report on the results of validation of the initial proposal and creating the final proposal for the framework for managing AI-enhanced projects for the case company.

# Method and Material

This section describes the research approach and the materials used in this thesis. It also introduces the research methods used in the thesis work, and the research design and the data collection that were used for this study.

## Research Approach

~~Research is an organized inquiry to questions and solutions to problems and seeks to find explanations to unexplained phenomenon, clarify doubtful propositions or to correct misconceived facts. The suitability of research method used and selecting appropriate research method has a detrimental effect in overall quality of the research (Krishnaswami & Satyaprasad, 2010). Thus, understanding different research approach is a prerequisite for a successful research project.~~ (Not on the instructions)

Start by creating a short general description of research families and research approaches that can be used (based on sources/references), pointing to the core features of every research approach, and *without* mentioning your study yet (max. 1 page).

First, tell about *research families* by comparing basic / applied; qualitative / quantitative / mixed; field study / desk study.

Second, tell about the most typical *research methods* / techniques used in the applied research family (interviews, surveys, observations, document analysis, etc).

Third, continue by relating to your study. “In this study, *the xxx research strategy* was selected….” Tell which is selected for your study and why.

There are various *research families* such as pure and applied, qualitative and quantitative, field and desk studies, and each method has its own merits and limitations (Chandra & Harindran, 2017). Briefly discuss fundamental vs. applied, and desk vs. field.

As for *research methods*, quantitative and qualitative are common approach in research. *Quantitative* research methods utilize statistical analysis and are normally associated with large-scale analysis. *Qualitative* research methods use observations, interviews, focus groups, document analysis, and other text-based techniques. Punch (2014) defined qualitative research as ''empirical research where data are not in the form of numbers''. Empirical refers to the fact that research is based on experience and observation rather than on founded theory or hypothesis (Punch, 2014). Action research is an example of qualitative research. Action research is the method of research where study is made while intervention is ongoing and involves simultaneous intervention and observation of measurement of impact. (Chandra & Harindran, 2017)

As for *the research strategy*, other popular strategies include case studies, and more recently, Applied action research (in the sense of Kananen 2013). 1 paragraph about Kananen, see below.

In this study, xxx Qualitative research methods are used as the most suitable methods, including interviews and discussions with relevant stakeholders, questionnaires, and participant observations, along with relevant internal document analyzed via using Thematic/content analysis.

Note, when writing Section 2.1 Research approach, about your selected *research strategy* above*,* consider these TIPS when arguing for the use of Applied action research in your study (you will find these points and more in: Kananen, 2013, scans of his Sections 1-3):

* In the background of Applied action research “there is phenomenon, process or situation that one wants to be improved after development of change” (Kananen 2013, 13).
* It combines research and development parts which typically relates to continuous enhancement and improvement in organizations (p.20). The result of this enhancement of improvement is typically a change to the better (p.20).
* Applied action research “is not own methodology but a group of different research methodologies that are used according to a situation or an objective for development” (p.20).
* Applied action research is close to development work that is being conducted in organizations on order to improve operations” (p. 21). Objective of Applied actions research in working life may be: processes, activities, products, services, situations as subjects to continuous improvements in organizations (p.21). In this arrangement, the development work becomes research work since it is conducted according to the research conventions: data is carefully collected, documented, and analyzed using research methods, which means the methods that produce reliable and novel (for this context) results (p.22).
* Applied action research makes difference with Action research as it has fewer iterations (often, only one iteration), and is less focused on researching the change process while implementing the change. It is mainly concerned with the practical result with improvement to the better.

## Research Design

This section will describe different phases and process used in this thesis to reach the outcome – to develop a project management framework for AI-enhanced data analytics process for the case company. The research design used in this thesis is summarized in Figure 1 below.

*A diagram of a research process

Description automatically generated*

1. Research design of this thesis.

The first move in the Research design is to set the objective for the thesis. The next move is to conduct the current state analysis of the AI-enhanced projects ongoing or recently completed in the case company. For this end, a questionnaire will be created ~~based on the studies~~ for different stakeholders. Based on the questionnaire results, interview will be carried out to determine the current state of project management in AI and data analytics related projects in case company, and identify their current frameworks. These interviews will provide information about the project processes in place and challenges that different stakeholders are currently facing in relation to implementation of AI-enhanced projects.

Once the development areas are identified, the focus will be on exploring available knowledge and best practice how to address these changes and create a company-specific framework for such projects. Knowledge will be explored in the next step, “Available knowledge and Best Practice for Project Management in AI-enhanced Projects”, and will result in a conceptual framework, i.e. a generalized construct that will guide the development of a more specific framework tailored to the case company, which will be done in the next step.

The next move focuses on pulling together (a) the results form the current state analysis, the conceptual framework, and the new round of co-creating with the stakeholders. Based on all these inputs, the Initial proposal will be built.

In the last step, this initial proposal co-create with the stakeholders in the previous step, Finally, the suggested framework will be evaluated by the related stakeholders.

~~Further, existing project management approaches in AI and data analytics projects along with existing best practices in the field will be studied with special focus on the identified development areas. This would be followed by studying company internal documents on AI implementation, project management and data analytics. Based on these current state findings, a conceptual model of project management framework will be suggested.~~

## Data Collection and Analysis

Different data required for the thesis are described in research design and study involves three stages of data collection. These different stages and corresponding data are described in table below.

1. Details of Data collections 1-3 used in this study.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Participants / role** | **Data type** | **Topic, description** | **Date, length** | **Documented as** |
|  | ***Data 1, for the Current state analysis (Section 3)*** | | | | |
| 1 | Chief Technical Officer | Face-to-face Interview | 1. Current state 2. Organization Strategy  3. Current Management practices |  | Recordings & Field notes |
| 2 | Data-team Lead | Face-to-face Interview | 1. Data analytics process  2. Data governance  3. Data Security and compliance |  | Recordings & Field notes |
| 3 | Process Owner | Face-to-face interview | 1.Strength and weakness  2. Risk management strategy  3. Change management strategy |  | Recordings & Field notes |
| 4 | Project Manager 1 | Face-to-face interview | 1.Strength and weakness  2. Current risk management strategy  3. Change management strategy |  | Recordings & Field notes |
| 5 | Project Manager 2 | Face-to-face interview | 1.Strength and weakness  2. Current risk management strategy  3. Change management strategy |  | Recordings & Field notes |
| 6 | AI Expert | Face-to-face interview | 1.Implementing AI in data related projects  2. Issues related to AI implementation |  | Recordings & Field notes |
| 7 | Sales Manager | Face-to-face interview | Identifying customer requirements |  | Recordings & Field notes |
|  | ***Data 2, for Proposal building (Section 5)*** | | | | |
| 8 | AI Expert, Process Owner, Data-team Lead, Project Manager | Workshop and interviews | Qualitative feedbacks & idea formulation |  | Internal report |
|  | ***Data 3, from Validation (Section 6)*** | | | | |
| 9 | CTO, Process Owner, AI Expert, Project Manager | Group interview/ presentation | Validation, evaluation, final improvements |  | Recordings & Field notes |

As visualized in Table 1, first set of data was used for current state analysis, and included interviews with different stakeholders, discussion with internal team members, analysis of existing documents within the case company. Questionnaire for the interview was prepared beforehand for each participant based on responsibilities and the responses were documented as electronic field notes. The questions for interviews can be accessed from appendices.

The aim of interview was to identify the current state of project management, AI implementation and data analytics projects in the case company. The outcome of this stage was to familiarize with current practices in the company and identify the areas of strength and weakness in the field of project management, AI and data analytics. Further, the development areas were identified and prioritized for next stage. These outcomes along with existing knowledge related to identified development areas were further used to create the conceptual framework of the research.

Second set of data included workshop and group interview with selected stakeholders to build the initial proposal based on the outcome of first dataset. The aim of workshop was to address identified development areas and discuss different ideas on project management framework, industry standards and best practices.

Final set of data was used for validating initial proposal. Selected stakeholders were involved in group discussion and initial proposal was refined to create final proposal.

During current state analysis, internal documents were also analyzed which is mentioned in Table X below.

1. Internal documents used in the current state analysis, Data 1.

|  |  |  |  |
| --- | --- | --- | --- |
|  | Name of the document | Number of pages/other content | Description |
| A | Case company’s IT Governance  Handbook.doc | 22 pages | IT Governance,  Operational Processes, Sourcing |
| B | ARIS – Tool | 13 diagrams | Diagrams for Operational  Processes |
| C | Specific information security  requirements for cloud services.doc | 5 pages | Security requirements for cloud provider |
| D | Group Information security  manual.doc | 25 pages | Information security principles,  Information security classification |
| E | New Server and Software  Order.doc | 2 pages | Process description |
| F | New Server and Software Order  Diagram | 1 diagram | Process diagram |

Most of the documents included existed…………

The findings from the current state analysis are discussed in Section 3 below.

# Current State Analysis of Project Management, AI, and Data Analytics at Case Organization

This section presents the analysis of current state of project management, artificial intelligence implementation and data analytics maturity in case organization. The purpose of analysis is to identify the strength and weakness of organization in relation to domains in question.

“This section discusses the results from the current state analysis”. Note, your Thesis may have Literature review and best practice first. Adjust the sequence of your sections so that they will reflect your Research design.

## Overview of the Current State Analysis

This short section (1-1,5 pages max.) contains a brief description of *how* your current state analysis was conducted. This section helps the readers see how you planned and implemented your current state analysis, in a systematic way.

Start by telling what was the goal of your CSA and how many steps the current state analysis included. Continue by presenting what and how it was done, step by step (First, … Second, … Third…), explaining the rationale guiding this choice. Aim to clearly present the logic, procedures and choices in your CSA before diving into the substance of your analysis.

Important. Avoid any repetition with data collection descriptions in Section 2. Instead, focus on presenting *the logic* of your current state analysis. This short description helps to avoid contaminating your report with details of your data collection, analysis procedures and other technicalities. Starting from Section 3.2, the text should focus on reporting *the results* of your current state analysis.

Report on the results of the current state analysis typically starts with *a description* of the process / issue being investigated. This description “sets the scene” and explains the context of the process / issue at hand in sufficient depth. The description is followed by the presentation of *the analysis results*.

It can be a good idea to divide these parts into separate section, for example: Section 3.2 Description of the Current Resource Planning Process, and Section 3.3 Analysis of the Current Research Planning Process (as an example).

The description typically starts as a text introducing the process / issue / organizational context to the reader. It typically contains either *a process map* (existing in internal documents or created by yourself based on your investigation),or otherwise presenting the results of your analysis in a systematic manner (in *tables, diagrams, figures, calculations*) in such appropriate level of detail that make drawing reliable conclusions possible. Split this description into sub-section, if needed:

Your description of the process of issue being investigated may be split into several pars, for example, (a) description of the process, (b) roles and responsibilities, (c) available tools, (d) interfaces to other units etc.

## Analysis

This text is often **divided into relevant categories / findings** (visible in sub-sections) that present the analysis results by groups/categories of findings. **Utilize data/evidence** to illustrate your analysis and ground your findings.

### Project Management

Which categories you choose, you will decide based on the results of your analysis. The data will “tell” you through the most frequently raised themes, topics, issues, complaints, etc. that will come into light as a result of your analysis. Here, it is important to keep a logical approach to grouping your findings, so that your categorization will be reliable.

Importantly, remember that your analysis should be based on data. Therefore, remember to refer to the sources of data (internal documents, surveys, interviewee 1, respondent X, etc.) The data should evident in both, its “raw” format (as citations) and also in the processed form (in tables, charts, graphs).

Every time when you use a table of a figure, introduce it in the text by saying: “Table 1 below shows xxxxx.” Notice the place of the table heading (*above* the table).

1. Virtual studies completed by Metropolia students in the academic year 2018-2019 (based on the analysis of internal documents). Copy-paste this heading above your next table! Numbering will continue automatically.

|  |  |
| --- | --- |
| Field of study | Studies completed, ECTS |
| Culture | 131 |
| Technology, Communication and Transport | 552 |
| Health Care and Social Services | 175 |
| Business and Administration | 52 |
| Not bound to a field of study | 18 |
| Metropolia total | 928 |

“As shown in Table 1, xxxxx.” Always add the explanatory text after a figure or table. It should guide the readers through the key elements of a table of figure and help the readers to understand why you use this illustration.

### Artificial Intelligence

Use the Quotation style for an indented quotation. In the last sentence immediately before the quotation, introduce this quotation (as you introduce a table of a figure). “This is illustrated in the following quote by Interviewee 1”:

If a direct quotation is several lines long, indent the quotation and use single (1.0) line spacing. Do not use quotation marks then. Always provide a reference to the source. If the direct quotation is shorter than two lines, include it in the body of the text in quotation marks, and provide a reference to the source. *(Interviewee 1)*

After an indented direct quotation, continue the text. There must always be text between the quotation and a new heading.

### Data Analytics

Continue with a reasonable number of sub-sections to make your report on the analysis results structured and systematic. Follow the guidance above for the layout of your text.

Next sub-section ends the current state analysis by providing an overview of the main strengths and weaknesses identified in the current state analysis in Section 3 (or any other type of relevant conclusions on your findings).

## Key Findings

There must always be text or a new subheading below each heading. This section summarizes the results of the current state analysis pointing to the main strengths and weaknesses (as an example) identified in the process/issue under investigation. (You may use another approach to summarizing your results; choose it according to your goals and analysis methods).

### Strengths and Weaknesses

Start by pointing to the strengths identified in the process / issue being investigated. Create a structured text (First, … Second, … Third,…) where the identified strengths will be summarized and presented in a systematic, logical manner, and explained in sufficient detail.

Continue to creating a similar summary of weaknesses (First, … Second, … Third,…). Prioritize when presenting both strengths and weaknesses and explain which perspective you take (organizational, departmental, etc).

Note, noting new should appear in this sub-section (nothing that was not discussed above in detail)! Here, you just summarize all the findings that were discussed above.

It can be also helpful to make **a table** **with all the identified strengths and weaknesses** at the end of this section.

### Selected Focus Areas

End this section by identifying which 1-3 weaknesses are those one(s) that you intend to hereafter focus on in your study. **This selection of weakness(es) informs your choice of literature in Section 4** and the kind of proposal you will build in Section 5.

In other words, you make a vital choice here, by selecting your focus areas! It should result in a strong fit between the main sections of your thesis: **your selected focus areas from SCA** should inform > **the main themes selected for ´available literature & best practice´** and should inform > **the main elements of your proposal**.

End with a link to Section 4.

# Available Knowledge and Best Practice

This section discusses the available literature, studies as well as best practices on field of AI implementation, data analytics as well as project management with focus on change management and risk management. At the end of the section, a conceptual framework for improvement is drawn based on best practices.

## Project Management

Project management in context of IT project is different than other projects as nature of projects, characteristics of project team members and diverse nature of technology involved affects the success of project. These factors along with uncertainty added by implementation of AI, adds major challenge for a project manager. Understanding this uniqueness, a project manager will have a common starting point to follow despite the type of project.

IT projects are very diverse projects and might involve anything from installing software’s to creating state of art AI implementation in cloud environment. Also, almost all industries and business functions depend on some form of IT infrastructure / process / product for performing their daily activities. Due to this diverse possibility, IT projects are very unique as it not only requires IT specific knowledge but also domain specific knowledge of different industries where it is being implemented.

People involved in IT projects have diverse cultural background as well as skillset. With job titles ranging from developer, product owner, technology lead, network engineer, cloud architect and so on, each role requires different specialized skillset to perform the task successfully. Commonly, people are technical experts in one or more area and move up the management ladder. Also, it is uncommon for these specialists to remain in same company or project for long period of time. Thus, adding additional challenge for the project managers to manage available resources efficiently.

For successful implementation of an IT project, different sets of technology are required ranging from different hardware, software, databases, security and so on. These different technologies need to be orchestrated together for successful project. However, because of this diverse technology, it is difficult for the project team members to communicate efficiently and understanding other person role in the team. For example, it would be rather difficult for a database engineer to understand the different aspects of work of a network engineer. Thus, it would be a challenging environment for a project manager to bring together these diverse set of people and technologies and drive towards project goal. Also, technologies are rapidly changing, and new technologies are emerging that would have significant impact in the project by shortening time to develop, produce and distribute the product and services. Adapting to these new technologies would require a good process to manage the lifecycle of project and hence another challenging aspect for the project manager.

IT industry are forerunners in implementing globalization and virtual teams specifically after post-covid (2020 AD) era allowing IT projects to run throughout the day in different part of the world. These factors although are highly beneficial for a company, have added additional challenge for project managers specially in communicating and creating common work practices across the cross-functional team.

With these known issues, this research will look into systematic approach to project management, organization culture and formations and will focus on change and risk management as part of project management.

(Schwalbe, 2014) page 64-69

### System Approach

Projects by definition are part of broad organizational environment and project managers need to consider projects within the organizational context. Project manager thus need to take a system approach which is a holistic view of project and understand how it relates to larger organization and includes using system philosophy, systems analysis, and system management.

System philosophy is the model of visualizing processes as systems. Systems are set of interacting components that work within an environment to fulfill some purpose. System analysis is a problem-solving approach that requires defining scope of system, identifying components and evaluating its problems, opportunities, constraints and needs. Once analyzed, alternative solutions for improving current situation, optimum solutions are examined against entire system. System management addresses the business, technological and organizational issues associated with creating, maintaining, and modifying a system.

Addressing these three areas of systems management can have a huge impact on selecting and managing projects successfully. Figure XX, illustrates the three sphere model for system management.

A diagram of a business organization

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1. Three-sphere model for systems management (Schwalbe, 2014)

These three spheres represent different issues that a project must address for successful project completion within the organization. Any potential effects on one sphere will have its effect on other thus, a holistic approach will help project managers integrate business and organizational issues into planning hence enhancing project success.

(Schwalbe, 2014) pages 45-46

### Organizations

For successful IT project, it is important for project managers to have a better understanding of people and organization. Organizational issues are often the most difficult aspects of project management and hence gets widely overlooked.

To understand and organization, four different prespectives are proposed by Bolman and Deal called frames are proposed which are structural, human resource, political and symbolic.

The structural frame deals with organization structure and focuses on different roles and responsibilities to meet the goals set by top management. It focuses on coordination and control. Human resource frame focuses on harmony between organizational needs and needs of people. It recognizes the potential mismatch in needs and wrks to resolve potential problems. Political frame deals with organizational and personal politics within an organization which can be in form of competition among individuals or group of individuals for power and leadership. Symbolic frame focuses on symbols and meanings of events in an organizations. This relates to company culture like how people dress, how CEO behaves publicly and so on. Uderstanding these frames helps project manager effectively navigate the complexities within an organization and ensures successful project completion. (Schwalbe, 2014) and (Bolman & Deal, 2017 [6th edition])

Organizational structure is another aspect affecting the project outcome. General classification of organizational structures are functional, project and matrix. A functunal structure is the hierarchy based on the function or speciality like engineering, manufacturing, IT who report to the CEO. Project structure is also hierarchical and program managers report to CEO. Project staffs have variety of skills required to complete projects within the program. Matrix structure is where personnel often report to both a functional manager and/or project manager. Matrix structure depends on amount of control exerted by project managers.

(Schwalbe, 2014)

Organizational culture which is a set of shared assumptions, values and behaviors that characterize the functioning of an organization is a a major factor to be taken into account while managing projects. Organizational culture are framed by organizational behaviours and have set of characteristics. These characteristics are:

* Member identity: The degree to which employees identify within an organization.
* Group emphasis: The degree to which work activities are organised around groups or teams rather than individuals.
* People focus: The degree to which management decision take into account the effect of outcomes on people within the organization.
* Unit integration: The degress to which units withina n organization are encouraged to coordinate with each other.
* Control: The degree to which rules, policies and direct supervision are used to control and oversee employee behavior.
* Risk tolerance: The degree to which employees are encouraced to be innovative and risk seeking.
* Reward criteria: The degree to which rewards like promotions and salary increases are allocated according to performance.
* Conflict tolerance: The degree towhich employees are encuraged to air conflicts and criticism openly.
* Means-ends orientation: The degree to which management focuses on outcomes rather than techniques and processess used to achieve result
* Opens-system focus: The degree to which the organization monitors and responds to changes in the external environment.

(Robbins & Judge, 2023 [19th edition])

Understanding these characteristics within an organization is important for successful project management as organizational culture where employees identify more with organization, work activities emphasize group, strong unit integration, high risk tolerance, performance- based rewards, high conflict tolerance, open-system focus and balanced focun on people, control and means tend to have successful project implementations.

(Schwalbe, 2014) page 47-52 and (Robbins & Judge, 2023 [19th edition])

### Change Management

#### Change Management Models

There are several change management models available that can be incorporated in an AI implementation and data-analytics related project. Three of the most used process are analyzed here in the thesis.

##### ADKAR Model

ADKAR is acronym for Awareness, Desire, Knowledge, Ability and Reinforcement and describes successful change at individual level and outlines goals of successful change as leaders have to manage organizational change starts with understanding how to manage a single subordinate. It is goal-oriented model that allows change management teams to focus activities on specific business result and was used as too for determining whether communications and trainings were having desired results during organizational change.

ADKAR model can be summarized in table XX below:

|  |  |
| --- | --- |
| Awareness | • Effective and targeted communications  • Leaders sharing the why and the vision  • Ready access to information |
| Desire | • Leaders demonstrating their commitment  • Managers and supervisor advocating the change  • Subordinates participation and involvement |
| Knowledge | • Effective training with the proper context  • Education for during and after the change  • Job aides and real-life application |
| Ability | • Coaching by managers, supervisors  • Hands-on exercise, practice and time  • Elimination of any potential barriers |
| Reinforcement | • Celebrate successes, individually and as a team  • Rewards and recognition that is meaningful  • Feedback on performance and accountability |

1. Action steps for each ADKAR building block (Tang, 2019)

Strength of ADKAR model is in capturing business and process dimension of change and individual dimension of change as well as providing clear management checklist to manage change. Limitations of this model include lack of leadership and principles of program management to create clarity and provide direction to change.

(Tang, 2019) page 49

##### Lewin’s Three Stages Change Model

Lewin’s three stage change model is based on changing the shape of a block of ice and includes phases of unfreezing, changing, and refreezing. This subsequent process of change elaborates varying outline sequence upon the essential stages of change. (Hussein et al referenced by tang 2019, Hussain, S. T., Lei, S., Akram, T., Haider, M. J., Hussain, S. H., & Ali, M. (2018). Kurt Lewin’s change model: A critical review of the role of leadership and employee involvement in organizational change. Journal of Innovation and Knowledge, 3, 123–127. ).

In first stage of unfreezing, organization is prepared to accept necessary changes and breaking down existing status quo. This helps leadership to build new ways of operation by developing a message of need for change and challenging existing beliefs, values, attitudes, and behaviors. By re-examining these issues, leaders can create a controlled crisis which can build a strong motivation for new equilibrium without which necessary participation necessary for change would be difficult (Hussein et al referenced by tang 2019).

In changing stage, subordinates start to resolve their uncertainty and look for new ways to do thigs and act in ways that support new change. This transformation takes time to implement as subordinate start to embrace new direction and participate in change proactively. However, they need to understand benefits of change for them to accept the change and contribute to make change successful. A potential pitfall is the assumption that everyone will accept the change as it is necessary and benefit organization (Hussein et al referenced by tang 2019).

In refreezing stage, changes are taking shape and subordinates have embraced new ways of working and organization is ready to refreeze. This stage needs to assist subordinates as the organization institutionalizes the changes which can be viewed through stable organization chart, consistent job description and so on which means they are incorporated to everyday business to make sue changes are used all the time. Subordinates in other hand feel confident and comfortable with new ways of working with new sense of stability. It is the most important stage as without it subordinates get caught in the transition trap where they are not sure how things should be done so nothing gets done to fill capacity (Hussein et al referenced by tang 2019).

This process is visualized in figure XX.

A diagram of a change

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1. Lewin’s three stages change model (Hussein et al referenced by tang 2019)

Additionally, Lewin has identified internal and external forces driving change as well as force restraining changes. For a successful change, forces driving the changes should be greater than the force restraining changes.

Internal forces for changes might be a general sense that the business could “do better”, desire to increase profitability and other performance measures, the need to recognize to increase efficiency and competitiveness, conflict between departments, need for greater flexibility in organizational structures, concerns about ineffective communication, de-motivation or poor business and so on. Whereas external forces for change usually are increased demands for higher quality and levels of customer service, uncertain economic conditions, increased competition, higher cost of inputs, legislation and taxes, political interests and so on. Thus, external forces are usually the driving forces for the change and thus, the organization should be prepared to face the demands of changing external environment. Restraining forces tend to make changes harder and despite positive outcomes, changes are always resisted in varying degree.

Lewin’s model is useful for leaders as they can track change effort process and reminding leaders that there are inherent cultural issues in unfreezing and refreezing processes. (Lewin 1949 referenced by Tang 2019, Lewin, K. (1949). *Field theory in social science*. New York, NY: Harper & Row.)

Additionally, there exists a “coping cycle” which helps leaders track potential emotional impact of changes on subordinates and is used extensively in leadership to explain morale of subordinates as they shift through change process. Figure XX shows the coping cycle with emotions includes denial, anger, bargaining, depression and finally acceptance.

A diagram of a problem

Description automatically generated

1. The coping cycle (Kubler-Ross, 1969 as referenced by Tang 2019)  
   Kubler-Ross, E. (1969). *On death and dying*. New York, NY: Routledge.

##### Kotter 8-Step Change Model

Kotter model for understanding and managing change is aimed at strategic level of change management process and is interpreted as “vision” for the change process. Table XX summarizes different steps proposed by Kotter for change management.

|  |  |
| --- | --- |
| Establishing a sense of urgency | Urgency motivates subordinates and generates a sense of realism with respect to change efforts goals. It is also essential to achieve the right chemistry and mix amongst team members, paying close interest to levels of emotional commitment |
| Forming a powerful guiding coalition | Forming a powerful guiding coalition is the most concerned in the gathering of the powers that be, senior management and key influences within an organization, encouraging teamwork and unity throughout the process |
| Creating a vision | The creation of this vision serves as a roadmap for the change effort, developing strategies on how one is to undertake each phase of the change |
| Communicating the vision | Leader should involve key influencers from as many facets of the change process for their individual buy-in, communicating clearly and thoroughly throughout the process |
| Empowering others to act on the vision | It involves eliminating change obstacles, anticipating and looking ahead, focusing on the change systems and structures declining change. Risk taking is also encouraged in the form of activities and ideas |
| Planning for and creating short-term wins | Breaking up the over change initiatives into smaller manageable fragments that can be measured for completion and success.  Leaders should be rewarded for their efforts leading to the overall change initiatives |
| Consolidating improvements and producing  still more change | Focus is centered on change systems, policies, procedures that hinder the vision, hiring, promoting, and developing subordinates who can implement the vision Institutionalizing new approaches Clarifying connections between |
| Institutionalizing new approaches | Clarifying connections between new behaviors and organizational success. Leadership development and succession is also of significance |

1. Kotter Change management steps in organization (Tang, 2019) page 53 referring Kotter in Kotter, J. P. (1995). Leading change: Why transformation efforts fail. Harvard Business Review, March–April, 1–8.

#### Successful Change Management

This topic discusses on key factors for a successful change implementation. Lauer 2021 in his book Change Management has described nine different success factors for a successful change implementation. Some of these success factors are leadership, vision, communication, participation, integration, re-education and evolution.

Leaders are usually the initiators of change process and possess certain characteristics required for a successful change management. To start the process, leaders usually trigger initial motivation and generate willingness to change, provide sufficient orientation to change process, maintain motivation in ongoing change process as well as efficiently manage the transformation process. A leader is seen as someone who takes into account the legitimate interests of all involved thus plays a central role in overcoming resistance. Leader is often visionary and can convey a sense of purpose for the company and its employees which is seen as a critical component of overall change management process. (Lauer, 2021) page 84-92

Vision refers to an ambitious state of the organization that can be realized in future with appropriate effort. Vision provides clear direction for change which creates orientation as well as motivation for subordinates. An effective vision has conciseness and individuality in relation to the organization, motivational effect on employees, ethically correct and clearly formulated. (Lauer, 2021) page 107-113

Communication is the major success factors of change management. It not only creates transparency and orientation but also serves to resolve conflicts and resistance. Communication also reinforces the process with positive feedback and promotes social inclusion. However, it is important to notice that communication should be target group oriented and language style should be adjusted accordingly for its effectiveness as well as in timely manner for all parties. It should also be as high-level as possible to have a clear impact. (Lauer, 2021) page 119-124

Participation or involvement of as many employees as possible in process of change helps to increase the motivation and decrease resistance. It also helps to create equal knowledge base for participants and communicate different sets of knowledge between participants. For effective participation serious and sustainable involvement is required and if possible, to include everyone. However, this approach might not be effective in large organization thus target group-oriented involvement, planning inclusion in advance and seeking professional support helps to overcome the challenges of change management through participation. (Lauer, 2021) page 145-150

Integration refers to strengthening cohesion and increasing productivity of newly created groups. In context of change management, it could refer to new departments, projects, or teams. It plays a major role in context of mergers and acquisition than it does for a internal organizational change. Integration helps in conflict reduction, increased efficiency, motivation and cooperation of the group. However, for successful integration basic openness, non-dominance of a group, non-partisanship of management, new group rule creation and involvement of external experts might be required depending on the context. (Lauer, 2021) page 163-165

Re-education covers personnel development measures that are implemented within an organization and aims to achieve better preparation or additional requirements that arise from the change. Personnel development aims changing individual competencies across knowledge, skills, and behavior of an individual and depending on planned change some area should be focused more than other. Re-education helps the change management by supporting necessary cultural change, reduction of qualification deficits and increased motivation of those involved. (Lauer, 2021) page 173-175

Evolution refers to change in small steps and are based on permanent learning process of the company enabling permanent adaptation to changed environment. Evolution helps in change through sum of individual learning steps and is based on making small frequent changes rather than one big change. Evolution helps in avoiding emergence of crisis and reduction in productivity loss in context of change. (Lauer, 2021) page 215-218

### Risk Management

<https://learning.oreilly.com/library/view/quality-software-project/0130912972/ch18.html#ch18lev1sec5>

Risk can be defined as an uncertainty about the achievement of a project’s target worth. It is a phenomenon of the future, and so a prospective project will have measurable level of risk, for a completed project this will be zero or “close to zero” (Zwikael & Smyrk, 2019) page 105. Risks can be expressed as specific instances of an event-impact model as visualized in figure XX below:

A diagram of a risk process

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1. The event-impact model of a project risk. (Zwikael & Smyrk, 2019) page 106

A threat is a form of triggering event (like project manager resignation) which triggers the chain of subsequent events and have a consequence. These consequences then further lower the worth of project. (Zwikael & Smyrk, 2019)page 106

Since, implementing AI in a project has a very high uncertainty, the risk in the project is rather significant where a threat like data accessibility could have potentially very high impact on overall project.

Risk in an AI implementation projects can be proactively recognized and mitigated using risk mitigation process. Risk mitigation process involves threat identification which is the process of identifying and describing the events that could harm the project. These identified threats are then analyzed by setting a value for parameter of a threat like likelihood, severity and expected damage. Finally, a mitigation process is formulated that lowers the expected damages for the given threats. These mitigation processes are usually “Preemptives” which reduce the likelihood of emerging threats and “Contingencies” which reduces the severity if the damaging impact of realized threat. (Zwikael & Smyrk, 2019) page 110-114

#### Risk Management Models

There are several models of risk management available that can be incorporated in an AI implementation and data-analytics related project. Two of the most commonly used process are analyzed here in the thesis.

##### Barry-Boehm’s Risk Management Model

Barry-Boehm’s risk management model was proposed in “Software Risk Management” published by IEEE Computer Society Press in 1989. This process consists of two activities of risk assessment and risk control. Risk assessment is further divided into risk identification, analysis, and prioritization whereas risk control is divided into risk management planning, risk resolution and risk monitoring. This model is visualized in figure XX below.

(Software Risk Management quoted in (Futrell, Shafer, & Safer, 2002))

A diagram of risk management

Description automatically generated

1. Barry Boehm’s Risk Management Model (Software Risk Management quoted in (Futrell, Shafer, & Safer, 2002))

Risks can be identified using checklist, decision-driver analysis as well as problem decomposition. This ensures that all previously known risks are identified for the project. Identified risks are analyzed using modeling performance and cost along with analyzing network, decision and quality factor. It allows project managers to produce “what-if” scenarios based on performance and cost variables which are estimated based on the knowledge of domain. After these risks are analyzed, their relative potential for occurrence and impact on the project is determined using risk prioritization. It allows team to focus on critical few risks that will have greatest potential for causing project failure.

Risk is controlled with risk management planning which includes tools of buying information, risk avoidance which is finding a way to restructure project to avoid risk, risk transfer which involves transferring of risk to another organization (for e.g. insurance), risk element planning and risk plan integration. Risk element planning and risk plan integration work together by decomposing the risk into individual part where each risk elements can be separately addressed and resolved.

Risk resolution can be accomplished through prototypes, simulations, benchmarks, analyses, and staffing. It usually involves additional tools and capabilities and have tremendous payback in risk reduction and mitigation but would require investment in tools and training to realize the benefits. Finally, risk monitoring can be accomplished through milestone tracking, top ten risk tracking, risk reassessment and updating corrective action.

Thus, combination of these tools would help project manager to implement complete risk management process within a project.

(Software Risk Management quoted in (Futrell, Shafer, & Safer, 2002))

##### Software Engineering Institute Risk Management Model

Another approach to risk management is proposed by Carnegie Mellon University’s Software Engineering Institute based on Shewhart-Deming cycle. This model provides information and feedback, internal and external to project on risk activities, current risks and emerging risks.

A diagram of a diagram

Description automatically generated

1. Software Engineering Institute’s Risk Management Model (Futrell, Shafer, & Safer, 2002)

From figure XX, it can be visualized that the model consists of five distinct processes.

1. Identifying the risk
2. Analyzing the risk
3. Planning risk mitigating actions and its implementation
4. Tracking risk indicators as well as mitigation actions
5. Control for deviation from risk mitigation plans

Communication is central to the process and is involved throughout each process.

##### Project Management Institute Risk Model

Project Management Institute (PMI) is the leading organization of project professionals and provides internationally agreed guidelines on project management process. It publishes *A Guide to the Project Management Body of Knowledge* called *PMBOK Guide* that includes traditional as well as innovative practices in the field of project management.

Risk management process developed by PMI has formulated following process for risk management:

1. Risk Identification

The risks related to the project are identified along with sources of risks, risk events as well as characteristics of risks.

1. Risk Quantification

Identified risks are then quantified using qualitative as well as quantitative analysis, to determine the opportunities and threats.

1. Response Planning

It includes development of risk management and contingency plans along with mitigating measures.

1. Monitoring and Control

It included development of correction plan along with monitoring or risks as well as implementation of action plan.

This process is summarised in figure XX below:

A diagram of a project management

Description automatically generated

1. Project Management Institute Risk Management Model (Futrell, Shafer, & Safer, 2002)

These different process aims to create a comprehensive risk management process where each individual processes has its own objective. Table XX below summarizes different processes involved in a typical project and outputs of each process (Schwalbe, 2014) page 446

|  |  |
| --- | --- |
| Process | Output |
| Plan Risk Management | Risk Management Plan |
| Identify Risks | Risk Register |
| Perform qualitative risk analysis | Project documents updates |
| perform quantitative risk analysis | Project documents updates |
| Plan risk responses | Project management plan and documents updates |
| Monitor risks | Work performance information, change requests, project management plan updates |

1. Project risk management process (Schwalbe, 2014) page 446

These different steps involved in PMI model for risk management is described in detail below.

###### Plan Risk Management

Planning risk is the process of deciding how risk management activities are approached and planned in project. It documents the procedures for managing risks throughout the project. The risk management plan should be developed early in the project and should be continuously reviewed to accommodate evolving risks as well as review risk tolerances of various stakeholders. (Schwalbe, 2014) page 447

A diagram of a plan risk management

Description automatically generated

1. Plan Risk Management: inputs, tools and techniques and outputs (Project Managememt Institute, 2017)

Table XX lists the topics for risk management plan for project.

|  |  |
| --- | --- |
| Topic | Questions |
| Methodology | * How will risk management be performed on this project? * What tools and data sources are available and applicable? |
| Roles and responsibilities | * Which people are responsible for implementing specific tasks and providing deliverables related to risk management? |
| Budget and schedule | * What are the estimated costs and schedules for performing risk-related activities |
| Risk categories | * What are the main categories of risks that should be addressed on this project? * Is there a risk breakdown structure for the project? |
| Risk probability and impact | * How will the probabilities and impacts of risk items be assessed? * What scoring and interpretation methods will be used for the qualitative and quantitative analysis of risks? |
| Revised stakeholders’ tolerance | * Have stakeholders’ tolerance for risk changed? * How will those changes affect the project? |
| Tracking | * How will the team track risk management activities? * How will lessons learned be documented and shared? * How will risk management processes be audited? |
| Risk documentation | * What reporting formats and processes will be used for risk management activities? |

1. Topics addressed in risk management plan (Schwalbe, 2014) page 447

Apart form risk management plan projects also include contingency plans, fallback plans and contingency reserves. Contingency plans are predefined actions that the project team will take if identified risk event occurs. Fallback plans are developed for risks that have high impact on meeting project objectives and are used when attempts to reduce the risk does not work. Contingency reserves are the provisions held by the project sponsor to reduce the risk of cost or schedule overrun to acceptable level and are for known risks whereas it is called management reserves for unknown risks.

There are different sources of risks associated to IT projects and specially in AI implementation projects. Some major identified risks in these projects are market risks, financial risks, technical risks, people risks and process risks. In addition to these, it is also important to identify potential risks according to project management knowledge areas like integration, scope, time, cost, quality, human resource, communication, procurement, and stakeholders (Schwalbe, 2014) page449-452.

###### Identifying Risks

Identifying risks, the process of understanding how potential events might hurt or enhance project. Schwalbe suggests different methods for identifying risks based on PMI model of risk management.

Risk identification process is started by reviewing project documentation and related information along with different assumptions affecting the project. After identifying these potential risks, different information-gathering techniques can be used to identify the risk further.

A diagram of a business plan

Description automatically generated with medium confidence

1. Identifying Risks: inputs, tools and techniques and outputs (Project Managememt Institute, 2017)

Brainstorming is a technique by which a group attempts to generate ideas or find solution for specific problem by amassing ideas spontaneously and without judgement. It helps to create comprehensive list to address which can be further categorized to manageable parts.

Delphi technique is an approach to gathering information that helps prevent negative group effects found in brainstorming by deriving a consensus among a panel of experts making predictions about future development. It is a systematic, interactive forecasting procedure based on independent and anonymous input regarding future events and uses repeated rounds of questioning and written responses including feedback to responses in earlier rounds and avoiding possible biasing effects.

Interviewing is a fact-finding technique for collecting information from people with similar experience. Leading questions are prepared and used as guide for conducting interview. However, it must be noted that it is not uncommon for people to identify problems or opportunities without really understanding it so possible bias needs to be considered in this approach.

Root cause analysis is another method to identify potential risks and involves identifying root cause of the problem to identify appropriate solutions. A root cause may underlie more than one variance, defect or risk and can be used as a tool for identifying root causes of problem and solving them.

Other techniques that could be used to identify risks are SWOT analysis, use of checklists, analysis of assumptions and diagram creation.

After the risks has been identified, a risk register which is a document that contains results of various risk management processes is created and is a tool for documenting potential risk events and related information.

The risk register could include following items:

* Identification number for each risk event
* Rank for each risk event
* Name of a risk event
* Description of risk event
* Category of risk event
* Root cause of risk
* Triggers for risk
* Potential responses
* Risk owner for risk
* Probability of risk occurring
* Impact to project
* Status of risk

A sample risk register is presented in appendix XX.

(Schwalbe, 2014) page 452-456

After this risk are identified and documented in risk register, qualitative risk analysis is performed to understand the most important risks.

###### Perform Qualitative Risk Analysis

Qualitative risk analysis involves assessing the likelihood and impact of identified risks to determine their magnitude and priority.

Probability/Impact matrix is a method of listing relative probability of a risk occurring and the relative impact of the risk occurring to identify the risks that needs attention. Each identified risks are labeled as risks being high, medium or low in terms of probability of occurrence and its impact if it occurs

INSERT PROBABILITY/IMPACT PIC HERE

From figure XX above, probability of occurrence of different risks and its potential impact could be easily visualized. Also, it may be useful to create separate probability/impact matrix to make sure both positive and negative risks are adequately addressed.

Top ten risk item tracking is another method of risk analysis which maintains an awareness of risks throughout lifecycle of project through monitoring. It involves periodic review of the project’s most significant risks which includes summary of status of the top ten risks in the project. The summary includes each items current and previous ranking, number of times it appears on list over period of time and a summary of progress made in resolving the risk item since previous review.

INSERT example top ten risk tracking PIC HERE

A diagram of a performance analysis

Description automatically generated

1. Perform Qualitative Risk Analysis: inputs, tools and techniques and outputs (Project Managememt Institute, 2017)

The main output of qualitative analysis is an updated risk register with ranked risks for the probability and impact of the risk event. Additional information is added for risk events such as identification of risks that need more attention in near term or those that can be placed on a watch list which is a list of risks that have low priority but are still identified as potential risks.

(Schwalbe, 2014) page 457-461

###### Perform Quantitative Risk Analysis

Quantitative risk analysis involves data gathering, analysis, modeling techniques and expert judgement. Different methods of quantitative risk analysis include decision tree analysis, simulation, and sensitivity analysis among others.

Decision tree is an analysis technique used to help select best course of action when future outcomes are uncertain and incudes calculating Expected Monetary Value (EMV) which is the product of a risk event probability and the risk event monetary value. EMV provides an estimate for the total dollar value of a decision thus higher EMV corresponds to better results.

Simulation uses model of a system to analyze its expected behavior or performance and are based on some form of Monte Carlo analysis which simulates the model outcome many times to provide a statistical distribution of the calculated results. A typical use case for simulation to predict the probability of finishing the project by certain date or the probability that cost will be less than certain value.

Sensitive analysis visualizes the effects of change of one or more variables on an outcome. Different project variables could be changed and then its impact on overall outcome of project can be visualized allowing the decision making process more robust. It is used for example to determine break-even points based on different assumptions.

A diagram of a performance analysis

Description automatically generated with medium confidence

1. Perform Quantitative Risk Analysis: inputs, tools and techniques and outputs (Project Managememt Institute, 2017)

The main outputs of quantitative risk analysis are updates to risk register such as revised risk rankings or detailed information behind those rankings. It also provides information related to probabilities of achieving project objectives.

(Schwalbe, 2014) page 461-466

###### Plan Risk response

When risks are identified and quantified, an appropriate response to each risks are developed which includes options and defining strategies for reducing negative risks and enhancing positive risks.

Different response strategies for negative risks could be risk avoidance, risk acceptance, risk transfer and risk mitigation. Risk avoidance is done by eliminating the main cause of risk. It might not be possible to eliminate all risks but certain risk events could be eliminated. Risk acceptance is accepting the consequence of risk within the tolerance level. Risk transference is transferring the consequence of risk and responsibility for its management to third party. This would for example include buying insurance or additional warranty purchase that would lower the risk in the project. Risk mitigation is reducing the impact of risk event by reducing the probability of its occurrence.

Different strategies for positive risk responses are risk exploitation, risk sharing, risk enhancement and risk acceptance. Risk exploitation refers to making sure that positive risks occur. Risk sharing is allocating ownership of the risk to another party. Risk enhancement refers to changing the size of the opportunity by identifying and maximizing key drivers of the positive risk. Risk acceptance is when project team does not take any action towards the risk.

A diagram of a project management process

Description automatically generated

1. Plan Risk response: inputs, tools and techniques and outputs (Project Managememt Institute, 2017)

The main output of risk response planning are risk related contractual agreements, updates to project management plan and project documents along with updates to risk register. Response strategies might also include identification of residual risks which are risks that remain after all of the response strategies have been implemented and secondary risks which are direct result of implementing risk response as well as contingency plans and reserves.

(Schwalbe, 2014) page 467-467

###### Implement Risk Response

Implementing risk response is the process of implementing planned risk response and helps to address project risk exposure, minimize threats and maximize opportunities.

A diagram of a risk response

Description automatically generated

1. Implement Risk Response: inputs, tools and techniques and outputs (Project Managememt Institute, 2017)

###### Monitor Risks

Monitoring risk is the process of monitoring the implementation of risk response plan, tracking identified risks, identifying and analyzing new risks and evaluating risk process effectiveness throughout the project. It enables project decisions to be based on current information about overall project risk exposure and individual project risks.

The process uses performance information generated using project execution to determine effectiveness of implemented risk response, changes of risks, status of identified project risks, new risk, and evaluation of overall risk management approach.

A diagram of a monitoring risk

Description automatically generated with medium confidence

1. Monitor risks: inputs, tools and techniques and outputs (Project Managememt Institute, 2017)

The main output of monitoring risks are updates to project management plan and project documents along with updates to risk register with information on individual project risks generated during monitoring process. This includes, adding new risks, updating outdated risks or realized risks and updating risk response.

(Project Managememt Institute, 2017)

Controlling risks is the process of executing risk management processes to respond to risk events and ensuring that risk awareness is an ongoing activity performed by the project team.

### Cloud Financial Management

Whenever you take up new issues, follow **a** **DDA approach**:

1. **Define** the term (e.g., digitalization / user experience, etc) by comparing 2-3 definitions from high quality (scientific) sources. **Start with** **defining** your concept/phenomena!

2. **Describe** its features, give examples. Discuss what is known on the issue and present a merged, coherent view on this concept/phenomenon.

3. **Analyze** *in relation to your* topic (this is the place for your opinions, evaluations.   
NOTE that all your recommendations (“should” and “must”) are done only at the end (!) of your thesis based on your own results and completed study, in **the final sections** (Proposal and Recommendations). Not in Section 4. Not based on literature (without conducting own study).

Reference the content accurately to the source (Grönroos 2012, 25).

Link every subsection to the next one. Build a ‘bridge’.

## Artificial Intelligence

## Data Analytics

The style of the text in Section 4 is an *academic* text based on processing scientific texts, business literature and best practice sources (standards, white papers, blogs, etc) with necessary references to point to the origin of the cited / paraphrased / indicated sources (Yin 2009, 25; Jack and Jones 2020, 35; Saunders at al. 2016, 31).

The style of the text is *not* repetition of the sources, but a focused *discussion* (based on the sources) about the latest available knowledge of Element 1, Element 2, Element 3… In this discussion, your goal is to update the current level of knowledge (dispersed across various sources) into a condensed picture of **selected** *best* available knowledge, for use as a **relevant** guidance in building your Proposal.

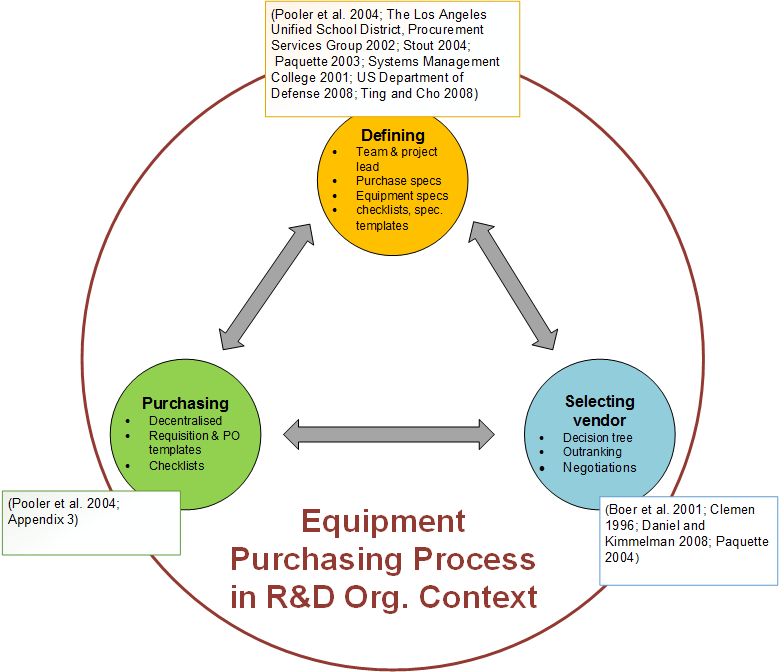
Here is some **general advice** for writing Section 4 (from: Huhta and Grabovskaia 2017, “Guide for Writing a Master’s Thesis”):

* First, decide your **focus** (remember, it should link well with your CSA results/Objective)
* Develop **your own ‘story line’/logic** how you present and discuss these topics and their details (and follow *your* logic, not the sources)
* Select only **relevant ideas** which would prove/support/ illustrate your logic (do not repeat the sources/ do not report all the ideas from them). **Discard** and **minimize all the other elements!**
* **Merge these relevant ideas** (mix them) to present your logic, but keep references visible to sources, to indicate where the most significant ideas come from. This will create “discussion” between the sources.
* Start with **definitions** and proceed to detail.
* Finally, always check yourself: ***Does my text/logic******link to my topic?*** *Or I am diverging to some other direction?*

## Conceptual Framework

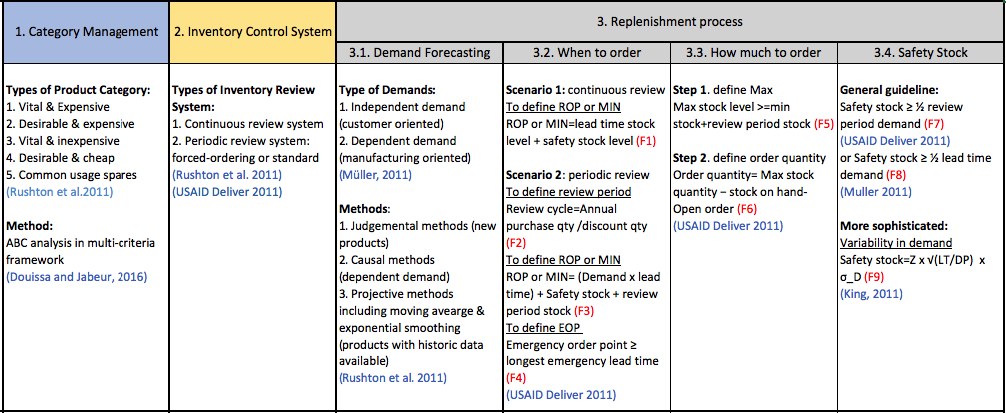
This sub-section should contain **a visual/picture/table** representing your Conceptual framework including: (a) the 1-3 key *themes* discussed above in Section 4, expanded with (b) the *selected tools, concepts and other sub-elements* relevant for your study, and finally (c) clear *references* to the key sources that contributed to your conceptual framework.

These three levels of the Conceptual framework (main themes; selected tools & sub-elements; and key references) are visible in the example by Satu Ryhänen (2015) below.



1. Conceptual framework (example from: Ryhänen 2015. Defining the Equipment Purchasing Process for R&D Organization. Metropolia UAS).

For a process building with many relevant details, the Conceptual framework can have a form of a table, as in this example from Zhing Chang (2017) below.



1. Conceptual framework (example from: Zhang 2017. Proposing the Inventory Management Framework for Make-to-Stock Products. Metropolia UAS).

In the example shown in Figure 3, the new Inventory management process is presented as having three steps: first, the Category management, second, the Inventory control system, and third, the Replenishment process (with 4 sub-steps inside), according to best practice and literature suggestions. This logic is visible in the three parts of the Conceptual framework (each part containing relevant concepts and tools that may be helpful for creating the Proposal, in Section 5).

After giving the visual, add a structured text describing your conceptual framework (First, … Second, … Third element… of the conceptual framework).

End with a link to Section 5.

# Building Proposal for [Relate to Your Objective] for the Company

This section merges the results of the current state analysis and the conceptual framework towards the building of the Proposal based on internal co-creation and discussions (which make Data collection 2).

## Overview of the Proposal Building Stage

Remind the reader of the goal of this section and its contents. “This section presents the steps in the Proposal building for this study.” Tell what is the focus for the improvement / development efforts in the proposal building (1 paragraph).

Remember to create a strong fit between the main sections of your thesis: **your selected focus areas in SCA** should inform > **the main themes selected for ´available literature & best practice´** which should inform > **the main elements of your proposal**.

Make links to Sections 3&4 showing that the Proposal relates to and builds from: (a) selected focus areas from the Current state analysis and (b) the Conceptual framework. Tell briefly that relevant best practice was found from available literature (1 paragraph).

Continue by giving a brief description of how the proposal building was conducted, step by step (First, … Second, … Third…) and what was the rationale guiding this choice. Aim to clearly present the logic, procedures and choices in your Proposal building before diving into the substance of your Proposal.

Important. Tell that the stakeholders were involved in the proposal building (co-creation). Tell that they came up with suggestions for the proposal (discussed in Section 5.2, below). Avoid any repetition with Section 2. Instead, focus on presenting *the logic* of your proposal building.

Keep this to 1 page maximum.

## Findings from Data 2 (pulling together CSA, CF and Data 2)

Here, focus on reporting the main *inputs* from your stakeholders (Data 2). The main inputs for the proposal building will include: (1) Data 1 (findings from CSA, *very briefly* repeated form earlier reporting), and (2) CF (input from literature, *very briefly* repeated form earlier reporting), as well as (3) Data 2 (from this co-creation round; reported in detail). Inspired by these inputs, your Proposal will be built.

Data Collection 2 concentrates on identifying suggestions from the key stakeholders. What your key stakeholders propose **should be done to develop/fix these issues**? Report the input from stakeholders (as a summary of key points). Relate these inputs, first, to the selected focus area from CSA and, second, to the inputs from literature and best practice. Table 4 below shows the inputs for the proposal (example).

1. Key stakeholder suggestions (findings of Data 2) for Proposal building in relation to findings from the CSA (Data 1) and the Conceptual framework.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | *Key focus areas from* ***CSA*** *(from* ***Data 1****)* | *Inputs from literature (****CF****)* | *Suggestions from stakeholders for the Proposal, summary (from* ***Data 2****)* | *Descriptions of their suggestions (in detail)* |
| 1 | No return policies are defined in the current contract document. | Here you briefly summarize what literature & best practice suggest to be done. | a) Revise the return policies internally and define them clearly in the current contract. | The CEO of the case company suggested to revise the return policies first, and add their clear description to the contract (also check them legally); and suggested that the sales person should be made responsible for presenting the terms for the consignment warehousing clearly, and ensuring understanding, when making a contract with the customer *(Example of description).* |
| b) Assign as responsibility to the Sales at the contract signing stage | SCM department stakeholders suggested to assign the responsibility for revising the return policies to Sales |
|  | TIP. (When discussing with the stakeholders, come back to CSA and check what weaknesses and improvements were mentioned/can be found from their earlier data/ criticisms, and check them again with the stakeholders) |

“As seen from Table 4, xxx.” Briefly summarize the inputs from stakeholders for each selected focus area (identified in CSA). It will demonstrate how they were addressed in the proposal building. Add details in the description column to open up the key suggestions, in relation to the CSA focus areas or/and the CF elements (use a few ‘juicy’ citations to illustrate the stakeholders’ suggestions, when appropriate. This is recommended in order to continue as evidence-based research, in line with CSA).

Alternatively, this summary of inputs from Data 2 can be presented separately, under each element of the Proposal.

When the key inputs are made visible, the Proposal is pulled together as the Proposal draft.

## Initial Proposal / Proposal Draft

You can either present each element of the proposal separately, or present one picture of your Proposal. In any case, create good, detailed texts for each element.

Remember to create a strong fit between your main thesis sections: **your selected focus areas in SCA** should inform > **the main themes selected for ´available literature & best practice´** and should inform > **the main elements of your proposal**.

### Element 1 of the Initial Proposal

### Element 2 of the Initial Proposal

### Element 3 of the Initial Proposal …

## Summary of the Initial Proposal

Summarize your proposal in a 1-page visual/picture/table showing all the elements of your Proposal clearly. Add a structured text (summary) describing it.

End with a link to Section 6.

# Validation of the Proposal

This section reports on the results of the validation stage and points to further developments to the initial Proposal. At the end of this section, the Final proposal and xxxx (recommendations, action plan, etc) are presented.

## Overview of the Validation Stage

This section reports on the validation results of the proposal developed in Section 5. Validation refers to e.g. piloting, testing, try-out, or other evaluation, e.g. expert judgement of your proposal (this input makes your Data 3). There are different degrees of maturity in your validation, i.e. validation can be weak or strong. Aim at the strong validation (testing/piloting/try-out, or evaluation by several experts with best knowledge).

Remind the reader of the goal of this section and of its contents. Consider structuring Section 6 using the same logic as Sections 3.1 or 5.1. Make a clear description of how the validation phase was conducted, step by step (First, … Second, … Third…) and what was the rationale guiding this choice.

Avoid any repetition with the description of Data 3 in Section 2. Instead, focus on presenting *the logic* of your validation. Ensure that you make a link to Section 5, i.e. you are validating the proposal developed in Section 5 **in detail.**

Keep this to 1 page maximum.

## Developments to the Proposal (based on Data Collection 3)

Data collection 3 concentrates on identifying improvements / developments that resulted from testing/piloting/try-out, or proposed by the validation experts/ key stakeholders to the Initial proposal in Section 5. What the experts say should be further developed in the Initial proposal? Data Collection 3 is strictly focused on the Proposal contents and seeks to finalize it based on the expert/company feedback.

Start with a table summarizing *the inputs* from the experts / key stakeholders (Data 3) collected in the validation stage, similar to the table in Section 5 that summarized inputs for the proposal building. Or otherwise demonstrate the inputs from stakeholders (in the evidence-based manner, including at least 2-3 citations from Data 3). Table 4 below shows the inputs from the validation round (example).

1. Expert suggestions (findings of Data 3) for the Initial proposal.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | *Element 1 of the Initial proposal* | *Parts commented in Validation* | *Description of the comment/ feedback by experts (in detail)* | *Development to the Initial proposal* |
| 1 | Return policies to be defined in the current contract by Sales at the contract signing stage, with the main focus on the bulk consignment contracts (based on 3 templates). | a) Revise the return policies internally and define them clearly in the current contract. | The experts suggested to make the final round of revision of the return policies with the lawyer. | Here you briefly summarize what was changed/ added. |
| b) Assign as responsibility to the Sales at the contract signing stage | The experts suggested to assign the responsibility for signing the contracts to those Sales reps who work with consignment contracts. | Here you briefly summarize what was changed/ added. |
| b) Key attention is paid to the bulk consignment contracts (based on 3 templates). | Confirmed. |  |
| d) create 3 ready templates for use. | The experts suggested to check the proposed templates with the lawyer. This is to ensure legality before making the first contract with the customer*.* | Here you briefly summarize what was changed/ added. |

“As seen from Table 5, xxx.” Summarize the inputs from the experts. Add details in the description column to open up the key developments (use a few citations to illustrate the experts´ comments, when appropriate. This is recommended in order to continue as evidence-based research, in line with other sections).

Alternatively, inputs from experts can be discussed separately for each element of the Proposal. The logic of presenting these inputs can be the same as in Section 5, Proposal.

As an example, see how Artur Uttu (2018) has presented his proposal elements and validation: <https://www.theseus.fi/handle/10024/147906>

### Developments to Element 1 of the Initial Proposal

### Developments to Elements 2 of the Initial Proposal

### Developments to Elements 3 of the Initial Proposal …

After discussing the developments to the Initial proposal, this section ends with the Final proposal presented in one overview.

## Final Proposal

## Recommendations /Action Plan, etc (if relevant)

# Conclusion

1-2 sentences of meta-text, telling what Section 7 contains.

## Executive Summary

This is a critical sub-section in the thesis. Many readers *only* read the abstract and the executive summary. Remember that your CEO and most readers will start with this section. Focus on your results (mainly) vs. repeating what you have done (briefly).

Start by reminding the reader of **the objective** of the thesis. Continue with the key, relevant information about the business context, i.e. why this topic is important.

Move onto the key steps in the research process and the thesis logic. Tell what the thesis analyzed and found **from the CSA** and what it explored and selected **from the available knowledge and best practice**. Tell how **the proposal** came about.

Remember to devote at least 0,5 good page to **the detailed description of your** **proposal/ results**. Notice that this makes *the main part* of your Summary.

Tell briefly, and in modest terms, that the proposal was validated/ tested/ piloted... and approved for implementation.

Conclude with an overall, ultimate contribution to the case company in one succinct paragraph with one key point that ties the Thesis together.

---------------------------------------------------------

In brief, the idea with the SUMMARY is that it is very similar to your ABSTARCT but with a deep focus on RESULTS, for example:

1. paragraph: objective and business challenge, context of the thesis

2. paragraph (briefly!):  how done, methods and data,

3. paragraph: CSA results + conclusions, areas for literature search, outcome

4. IMPORTANT: here goes a good half page on your results/proposal. Notice that this part makes the main part of the Summary!

5. paragraph: validated, tested, feedback (in humble terms)

6. paragraph: business impact (what good it makes for the company, if implemented)

= Altogether, the Summary makes maximum 2 pages.

## Managerial Implications (Next Steps and Recommendations toward Implementation)

Write *either* the Managerial implications here in Section 7.2, or give Recommendations as part of the proposal in Section 6.4. Here, you can also suggest ‘Next steps’ towards implementation of your proposal.

For writing Managerial Implications, think from the company perspective, what should be done to put this proposal into practice? Avoid giving orders to the company, avoid calling the company "they" (it puts you in a sad opposition immediately). Produce a structured text: First,.. Second,.. Third... Beyond a few paragraphs, you can show your practical wisdom: what is it, in practice, what the managers should consider in relation to this proposal.

For writing ‘Next Steps’, briefly argue why next steps are needed. Introduce some tangible next steps/ recommendations how to put your proposal into practice. State them clearly (First,.. Second,.. Third...).

Consider to support your reasoning with argumentation. Use a professional, neutral tone. Make sure that whoever reads this section is onboard with your recommendations.

## Thesis Evaluation

Start by evaluating the Thesis vs. its initial objective. Reflect on how this Thesis addresses it. We expect a critical and honest evaluation of your thesis. Avoid telling us how great your thesis is and why this is so. This might well be the case, but we expect a realistic and neutral reflection of your thesis process, its limitations, and what might have been done better *(please DO NOT mention the time as your key constrain).* Evaluate the quality of this work. Mention also the areas that should have been done differently.

IMPORTANT. More than the study outcome, we look here for the maturity and transparency of your reasoning and reflection. **In Section 7**, though you showcase your results and make your thesis shine as advised, you should do this **humbly.**

Avoid any sign of arrogance, vanity or ego-centricity in the thesis (e.g. "This project was a success", “This thesis reached its objective”). This easily slips in at the final stages, as authors are proud of their outcome. Instead, **tell *the substance* about your results**, others will evaluate you based on your outcomes. Please take special care of this section and take all such disturbing signs out so that the final product is excellent in terms of content & attitude. Remember that this text will serve as your reference point for years.

Finally, please spend time (at least one-two weeks) **reading through the entire thesis!** Polish your **Reference list.** Finalize your **proof-reading of the entire thesis, in its integrity.** If you do not understand yourself, no one else will. Check your **clarity**, make sure you produce **well-structured** descriptions of your analysis. This is the time to be ruthless to your own text. Remember grades are not out yet, thus this is your moment to grab the final moments of the Gate process.

## Closing Words

Consider ending with 0,5 page of e.g. closing words. If you end with Section 7.3, the thesis ends with a discussion on thesis quality. Consider making it more attractive. A fine dinner does not end with a spoon, but with an espresso that closes the dining experience. Think of that expresso for your thesis.

References

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# READING LIST

project management

Quality Software Project Management: <https://learning.oreilly.com/library/view/quality-software-project/0130912972/?sso_link=yes&sso_link_from=metropolia-university>

Fundamentals of Project Management: <https://ebookcentral.proquest.com/lib/metropolia-ebooks/reader.action?docID=3001873>

PMBOK: <https://learning.oreilly.com/library/view/a-guide-to/9781628251845/?sso_link=yes&sso_link_from=metropolia-university>

Bolman and Deal: Reframing Organizations : Artistry, Choice, and Leadership

<https://ebookcentral.proquest.com/lib/metropolia-ebooks/reader.action?docID=4883027>

Here, you provide full bibliographic details of the references **used and quoted** in your thesis. Note, the Reference list does not count in the main body of your text; it starts with page 1. Use the “author-date” referencing system (**Harvard referencing style**, APA) either in its “international” variant, or in a “simplified” Finnish version.

**Examples v.1 (this is the “simplified” Finnish variant of Harvard Referencing style. RECOMMENDED. Check the first link for more examples!):**

HUMAK University of Applied Sciences 2020. HUMAK Citation Guide: Examples of different sources. Retrieved 15/09/2021. <https://humak.libguides.com/citationguide/examples>

Ojasalo, Katri & Moilanen, Teemu & Ritalahti, Jarmo 2018. Development work methods. New skills in business. 5th edition. Helsinki: Sanoma Pro.  - Example of a reference to a paper book.

Hiltunen, Elina & Hiltunen, Kari 2014. Techno Life 2035. How does technology change our future? (e-book). Helsinki: Talentum. Retrieved 22/09/2020. <https://www.cambridgescholars.com/download/sample/62480> . - Example of a reference to an e-book.

Statistics Finland 2018. A fifth of the companies exploit big data (online publication). 30.11.2018. Retrieved 22/09/2020. <https://www.stat.fi/til/icte/2018/icte_2018_2018-11-30_tie_001_fi.html> .   
- Example of a reference to a web-site.

**Examples v.2 (this is the “international” variant of Harvard Referencing style. It os also possible to use this variant. Check the first link for more examples!):**

UWE Bristol Harvard (2016). Referencing Guidance. Bristol: University of the West England. Available from: <http://www1.uwe.ac.uk/students/studysupport/studyskills/referencing/uweharvard.aspx#blogs> (Accessed 25 October 2019).

Fliess, S. and Kleinaltenkamp, M. (2004). Blueprinting the Service Company: Managing Service Processes Efficiently. *Journal of Business Research.* Vol. 57, Issue 4, pp. 392-404. - Example of a reference to a journal article.

Grönroos, C. (2000). *Service Management and Marketing: A Customer Relationship Management Approach*. 2nd ed. Hoboken, New Jersey: John Wiley & Sons. - Example of a reference to a paper book.

Rouvinen, P. and Ali-Yrkkö, J. (2013). *Implications of Value Creation and Capture in Global Value Chains.* ETLA Reports No 16, 19 August 2013.Helsinki: ETLA, The Research Institute of the Finnish Economy. Available from:<http://pub.etla.fi/ETLA-Raportit-Reports-16.pdf> (Accessed 25 October 2019). - Example of a reference to an e-book.

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**In-text references (how these referred to in the text, similar in both variants):**

…text text text. These development work methods can also be applied to other types of projects, for example, to service development projects (Ojasalo, et al. 2018, 240). Similar methods are also known to gain insights into the future (Hiltunen & Hiltunen, 2014, 100-110).

**A Sample Risk Register**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Identification No. | Rank | Risk Name | Description | Category | Root cause | Triggers | Potential responses | Risk owner | Probability | Impact | Status |
| R1 | 1 |  |  |  |  |  |  |  |  |  |  |
| R2 | 2 |  |  |  |  |  |  |  |  |  |  |
| R3 | 3 |  |  |  |  |  |  |  |  |  |  |

**Title of the Appendix**

The contents of the appendix are placed here. Below are the instructions for removing and adding appendices in a way that maintains the headers and footers in their correct form.

Instructions for removing an unwanted appendix:

1. Select the entire page(s) that form the appendix and delete the contents by hitting the Delete key.
2. As you are in the beginning of the empty appendix page (see the image below), double-click the header of the empty page and press Link to Previous button in the ribbon. The following dialogue window opens:



Click Yes.

1. If necessary, make hidden format information visible by pressing .
2. Delete the section break immediately before the appendix to be removed (see image below).



Instructions for adding a new appendix:

1. Place the cursor at the end of the last appendix.
2. Select Page Layout from the menu bar. From the ribbon, select Breaks/Section Breaks/Next Page. This causes a new appendix to appear, but the appendix number in the header is not yet correct.
3. Double click the header of the new appendix with the wrong appendix number. If the option “Link to Previous” is selected, click the corresponding button to deselect it.
4. Replace the appendix number with the correct number.

Note that the appendices need to be updated in the table of contents manually.

**Title of the appendix**

The contents of the appendix are placed here.