Tampere University

Jani Kahari

IDENTIFYING NEW PRODUCT DEVELOPMENT SUCCESS FACTORS IN A LARGE ENTERPRISE

ABSTRACT

Jani Kahari: Identifying New Product Development Success Factors in a Large Enterprise
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This thesis is commissioned by a large company located in Finland. The company, and especially the R&D unit this thesis is written for, has experienced strong growth over the past decade. The unit has evolved from a small team to a large R&D organisation in a short time span, but compared to the competitive landscape it is still small. Due to the rapid growth, there has been limited time and resources to properly analyse the environment new product development (NPD) is conducted in. This has resulted in the lack of explicit understanding over which factors affect the outcome of projects in this particular environment. In addition to this, there is a lack of tools to support the ever-growing need for project management and project portfolio management activities.

The objective of this thesis is to create an understanding of the environment in which NPD projects resides within the case R&D unit. Specifically, this means creating an understanding of which factors play a role in the outcome of any one NPD project within the case unit. The gained understanding is used as the basis for the creation of an NPD project- and portfolio management tool.

By adapting and applying the experiential learning oriented risk management method (ELO RM), along with knowledge of small group facilitation and success factors from the literature, lessons learned material is utilised to identify which factors have the largest role in the outcome of projects. The most important factors are further analysed and presented in a cause and effect chart, which shows the causal relationships between each of them. From the cause and effect chart, representatives selected which factors can be measured and influenced during NPD projects. The selected factors are considered to be project evaluation criteria, and 3-level anchored scales are specified for each criterion.

The results of this thesis is an NPD risk management tool, which measures identified project success criteria for this particular R&D environment. Along with this, the thesis gives insight into the factors and relationships which play a role in the outcome of NPD projects.

Keywords: experiential learning, new product development, risk management, project success, success factors

The originality of this thesis has been checked using the Turnitin OriginalityCheck service.

TIIVISTELMÄ

Jani Kahari: Tuotekehitysprojektien onnistumistekijöiden tunnistaminen suuressa yrityksessä
Diplomityö
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Toukokuu 2019

Tämän diplomityön tilaaja on suuri yritys, joka sijaitsee Suomessa. Kohdeyritys ja etenkin tuotekehityksen alainen kohdeyksikkö on kokenut vahvan kasvun viimeisen vuosikymmenen ajan. Osasto on kehittynyt pienestä projektiryhmästä suureksi tuotekehitysorganisaatioksi lyhyessä ajassa, mutta se on silti suhteellisen pieni kilpailuympäristössään. Nopean kasvun ja tähän liittyvien aika- ja resurssipuutteiden takia tuotekehitysympäristön analysointi on jäänyt vaillinaiseksi. Tämä on johtanut siihen, että organisaatiolla ei ole tarkkaa tietoa siitä, mitkä tekijät vaikuttavat tuotekehitysprojektien onnistumiseen. Sen lisäksi, tänä päivänä on puute työkaluista projektinhallinnan sekä portfolionhallinnan tueksi, joiden tärkeys kasvaa jatkuvasti.

Tämän diplomityön tavoitteena on luoda ymmärrys kohdeyksikön tuotekehitysympäristöstä. Tällä tarkoitetaan sitä, että luodaan ymmärrys siitä, mitkä tekijät vaikuttavat tuotekehitysprojektien onnistumiseen. Luotu ymmärrys hyödynnetään pohjana uusien tuotekehitysprojektien riskienhallintatyökalun luomiseen.

Soveltamalla kokemuspohjaiseen oppimiseen perustuvaa riskienhallintametodia (ELO RM), pienryhmäfasilitointia sekä kirjallisuudesta eriteltyjä projektin onnistumistekijöitä, voidaan tunnistaa mitkä tekijät vaikuttavat projektien onnistumiseen. Tärkeimmät tekijät analysoidaan ja niistä luodaan syy-seurauskartta, jossa saadaan tekijöiden suhteet toisiinsa näkyviin. Kohdeyksikön edustajat valitsevat syy-seurauskartasta tekijät, jotka ovat mitattavia ja joihin voidaan tuotekehitysprojektin aikana vaikuttaa. Nämä valitut tekijät nähdään projektin arviointikriteereinä ja jokaiselle kriteerille määritetään 3-tason ankkuroitu asteikko.

Tämän diplomityön tulos on uusien tuotteiden tuotekehitykseen soveltuva riskienhallintatyökalu, joka mittaa tähän ympäristöön eniten vaikuttavia tekijöitä. Sen lisäksi, tuloksena on parempi ymmärrys siitä, mitkä tekijät vaikuttavat tuotekehitysprojektien onnistumiseen sekä tekijöiden suhteet toisiinsa.

Avainsanat: kokemuspohjainen oppiminen, tuotekehitys, riskienhallinta, projektien onnistuminen, onnistumistekijä

Tämän julkaisun alkuperäisyys on tarkastettu Turnitin OriginalityCheck -ohjelmalla.

PREFACE

This Master's Thesis is written to an R&D unit part of the case company, as a part of an effort gain an understanding of the new product development environment and to create effective project management and portfolio management tools.

This thesis marks the end of an important chapter in my life. A chapter where I have developed immensely as a person and gained many lifelong connections and close friends. This is a time I will cherish and remember with glee.

Firstly, I want to thank my employee for giving me the necessary time and space for writing this work, and for giving me an opportunity to write a thesis which aligned with my major. I want to thank my colleagues for the absolutely amazing work environment filled with eagerness and inspiration. I am also very thankful for all my colleagues that attended the workshops.

I also wish to give a special thank you to my thesis supervisor, Associate Professor (tenure track) Tero Juuti, for being ever so optimistic and for his guidance and instructions. His guidance is the most important *success factor* of this thesis.

Finally, I want to thank my partner, Johanna, for her unwavering help and support. I don't think this would have been possible without her.

Vaasa, 22nd May 2019

Jani Kahari

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1 INTRODUCTION

This chapter serves as an introduction to the thesis. It presents the background and motivation, the objectives and research questions, and the scientific methods used to answer these aforementioned questions. It also states the outline of the entire work.

Throughout time there have been countless projects and products that are considered to be successes. Successful projects include the International Space Station, CERN and the Eiffel tower, while most successful products include Apple iPhone, Toyota Corolla and Google search to name a few. Although all these listed projects and products can be perceived to be successes, hardly anybody knows about the processes and management that lead to their success. Is there a recipe for success, and if so, how is it possible to assure that future products or projects find it? Project management literature has talked about *project success*, and *success factors* for almost half a century, but the more important question is which *success factors* affects a company's product development environment the most? Surely the factors affecting the success of a large construction project are different from creating the next big digital platform? This raises an important question: how is it possible to identify which *success factors* are the ones affecting any particular environment the most and can these be utilised?

1.1 Background

The thesis is commissioned by a large enterprise located in Finland, henceforth known as the case company. The company employs a total of 1500 people, and has a turnover of about 300 M€, with around 20 subsidiaries globally. The product portfolio of the case company consists mostly of products designed and produced in-house for a professional and industrial market within the surface finishing sector.

This thesis is made for a particular R&D unit within the case company. The company and unit promotes an innovative atmosphere and focuses on delivering quality, high-technology products for its customers. The unit has since its founding in 2010 experienced strong growth with an annual turnover expected to exceed 60 M€ at the year of writing, but the unit is still relatively small and new compared to the competitive landscape of its products. The R&D unit works in a multi-project environment with around 20 simultaneous projects, of which about 10 can be considered new product development (NPD). The unit also has many supporting functions within it, such as product life-cycle,

compliance and after sales. The author of this thesis is employed at the case company and works within the specific R&D unit as a development engineer at the time of writing.

The fast growth has resulted in limited resources to properly analyse the environment NPD is conducted in. In addition to this, there is a lack of tools for project management to use when assessing how well any particular project is going, with the exception of a project process model. The growth has also led to a surge in parallel projects which increases the importance of tools to view the health of the ongoing projects portfolio, which there are none of today.

To increase the effectiveness of project management, and thus increase the competitiveness of the unit, there needs to be an understanding of what factors affect the outcome of projects. Effective project management tools for managing a large number of parallel projects also add to the competitiveness, which hopefully leads to a competitive edge in the product landscape.

1.2 Scope, objectives and research questions

The objective of this thesis is to create an understanding of the environment in which NPD projects resides within the case organisation. This is done by creating an understanding of which factors, and the relationship between these factors, play a role in the outcome of any one NPD project within the case unit. The created understanding of the environment will be used as a basis for the creation of a project management tool supporting a singular project, as well as project portfolio assessment. To achieve these objectives the author will implement state-of-the-art methods found in the literature.

To achieve the results two research questions will be presented, the first one being: *What are the success factors for projects in this particular business environment?*

To support this question a second one will be presented: *What are the methods to identify these success factors?*

This thesis will also explore how a case organisation may utilise the success factors and create project risk management tool based on them.

The scope of this thesis is limited to studying which factors play a role in the success of NPD projects within one particular R&D unit part of the case company. The study does not take the environment of other R&D units, nor does it take other types of projects other than NPD, into account. The scope is also limited to the study of the environment, and to the creation of a project management tool. The deployment and validation of the tool is outside of the scope due to time restrictions.

1.3 Research strategy & methods

To answer the research questions, both theoretical and empirical research is required. To solve the research questions, a constructive research approach is selected. The constructive research approach centres around the creation of a construction, which is the entity that produces the solution to explicit problem (Kasanen, Lukka and Siitonen 1993). The starting point of any constructive approach is a practically relevant problem, which has research potential. This is followed by obtaining a general and comprehensive understanding of the topic at hand. Once all the necessary background information is gathered, a construction is created. (Kasanen, Lukka and Siitonen 1993) The aim of the construction is to be relevant, simple and easy to implement. With this approach, it is essential that the theoretical novelty value and the functionality of the created construction are demonstrated. (Kopra 2012) The central elements, which the constructive research approach is built upon, is presented in figure 1.1 below.
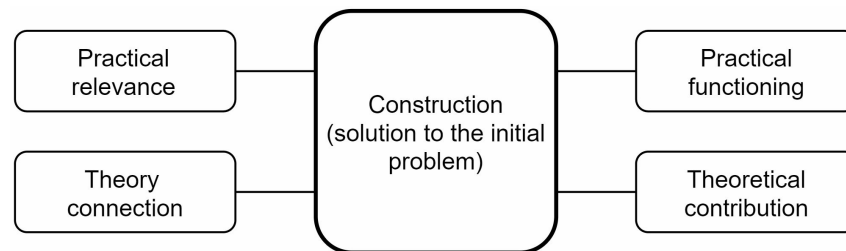
Figure 1.1. *The central elements of the constructive research approach (Kasanen, Lukka and Siitonen 1993).*

The practical problem in this thesis is to find a way to identify which factors play a role in the success of projects in the case environment, so that they may be utilised in the managing and in the creation of management tools for projects within it. The construction is built by creating a theoretical foundation. To create the theoretical foundation a literature review is conducted. The review begins with the exploration of what project success is; how is it defined and what factors affect it. This is followed by examples and the definitions of what success factors and success criteria are in the literature. It is continued with the presentation of the main method to be used, known as the Experiential Learning Oriented Risk Management (ELO RM) method. To support the use of the aforementioned method and to construct an implementation, a facilitation method, and what factors affect the facilitation is presented. Finally, as an integral part of the ELO RM method, the champion-tools are presented. The champion-tools contain success factors previously identified from literature in a format that is usable later in the implementation of the theories. The toolkit also contains a template, for which the resulting tool of this thesis can be built upon. The chapter ends with the presentation of the construction, which shows how all the theories are implemented. The functionality of the construction is demonstrated in the empirical study. The novelty of this study comes from transferring the tacit knowledge the members of the unit organisation possesses, into a visible, and usable form. Novelty value is also gained from the implementation of the ELO RM method, as it will serve as a

case for future studies.

The literature review creates the foundation for the empirical study. Qualitative research methods are used to generate empirical data. The data is collected by the author facilitating workshops where meeting minutes, documented conversations, author's own notes and results are kept.

In this study, the first research question, *what are the success factors for projects in this particular business environment?* is answered with the results of the construction. The answer to the second research question, *what are the methods to identify these success factors* is the construction itself.

1.4 Outline

The purpose of this document is to present the research problem and approach, literature review, empirical data, data analysis, results and the outcomes of the thesis. The first chapter serves as the introduction to the thesis, and presents the background and the research objective, questions, selected approach and methods. The second chapter presents the literature review and various theories utilised in this study. The chapter shows the method, the factors that affect the results, and how the theories are implemented in this work. The third chapter presents the empirical data gathered in the implementation of the previously mentioned theories. The chapter begins with walking the reader through the structure of workshops used to gather data, and presents each workshop as a separate case, ending the chapter with a summary. The fourth chapter is dedicated to the data-analysis of the gathered data, and the construction of the results. The fifth chapter discusses the outcomes, and shows how their novelty, relevancy and reliability. The sixth and final chapter concludes the thesis, answers the set research questions and presents how the case company will implement the outcomes, and what future research will be done in regards to this.

2 THEORETICAL BACKGROUND & STATE OF THE ART

This chapter presents the theoretical framework for this thesis. The chapter begins with exploring what a project success factor is and what type of success factors can be found in the literature. It then continues with presenting a method for gathering and utilising relevant success factors as a risk management tool in NPD projects. To gather empirical data, the presented method makes use of workshops. The following chapter has two main goals. Firstly, to gain an understanding of which factors affect the workshop-setting, and secondly, to present a method for capturing lessons learned from the target group. Next, to support the use of the NPD risk management method, the Champion Tools are presented. The chapter ends with presentation how the theoretical framework is adapted, i.e. what the construction of the thesis looks like.

2.1 Project Success Factors

To be able to answer any of the set research questions there is a need to define what a success factor is. To understand success factors, one must first define project success. Wit (1988) makes a distinction between project success and project management success. If these two are the same thing depends on whether they have the same objectives or not. (Wit 1988)

Project success is defined as the following: "The project is considered an overall success if the project meets the technical performance specifications and/or mission to be performed, and if there is a high level of satisfaction concerning the project outcome among key people in the parent organization, key people in the project team and key users or clientele of the project effort (Wit 1988)." This can seem ambiguous, as technical performance, specifications and satisfaction of stakeholders' expectations are not necessarily the same thing. It can be argued that this definition highlights the subjectivity and possible differing impression of success by different stakeholders. (Gericke 2011) Cooke-Davies (2002) summarises project success as how well a project outcome is measured against the overall objectives of the project.

In the case of *project management success*, project management literature advocates for three major objectives, which are: a project must be managed on time, it must be done so

within budget and it must meet set quality and/or performance specifications. (Wit 1988) These three objectives are also known as the *iron triangle* or the *project management triangle* (Gericke 2011). There is also a general understanding that there may have to be some trade-offs between these three criteria. In other words, achieving all these three criteria is not necessarily a requirement for project success. (Wit 1988)

Wit (1988) argues that this way of determining project success is too simple as a project may be viewed as a success despite having a poor success in project management. This leads to the conclusion that there should be a distinction made between the success of the project and the success of the project management as these two are often inter-twined. Wit (1988) adds that good project management can contribute to the success of the project, but is unlikely to prevent a project from failing. The author (ibid) brings the North Sea oil development projects in the 1970s as an example of how projects that suffered from substantial cost and time overruns (project management failures) still were considered a success due to the surge in oil prices in 1973 and 1979, which made them very profitable.

Instead of viewing project success on these three criteria, one can view project success on the base of the main motive behind it. Since a project has several stakeholders that may all have different objectives for it, there is an issue on which objective overrides others. Engineers or designers most likely prioritise technical aspects of the solution i.e. "it should work", while management may view it from a business perspective i.e. "it should pay off". (Gericke 2011; Wit 1988) Considering the example of the North Sea oil development mentioned earlier, one can assume their goal were of an economic nature i.e. "it should pay" as they were considered successes. It is essential that the dominant factor is clarified at an early enough stage. The relationship between project times and overriding objectives are presented in table 2.1 below (Wit 1988):

Table 2.1. Relationship between project types and overriding objectives according to Wit (1988).

Motive	Project	Overriding objective	Primary discipline
Necessity	Thames barrier	It should work	Engineering
Opportunity	Nuclear power plant, oil field development	It should pay	Economics
Prestige	Eiffel tower, Sydney Opera House	It should exist	Politics
Research	CERN project	Reaching a solution	Science

In addition to project motives, there is a certain amount of subjectivity involved in evalu-ating project success. Wit (1988) adds that studying completed projects, or intermediate

or post-completion audit is a good practice to reflect on what went right, and what went wrong in any particular project. Although this will not give absolute answers to the success or failure of a project.

White and Fortune (2002) conducted an empirical study on the topic of project management practices in the form of a questionnaire. A total of 995 project managers from a total of 620 organisations were chosen to participate, but only 236 surveys were returned. The questionnaire consisted of 18 questions with a mixture of yes/no, scale, multiple choice and open questions in the following areas:

- information about the respondent and the project used as a base for the response.
- the criteria used to judge a project's outcome.
- any unexpected side-effects as a result of the project.
- factors that were deemed critical to the project's outcome.
- the utilised methods, tools and techniques.
- what drawbacks the used methods, tools and techniques had.

The most used criteria for judging project success according to the study is listen in the table 2.2 below.

Table 2.2. Criteria used for judging project success according to White and Fortune (2002).

Criteria	Sum of re-coded ranking	Sums ranked
Meets client's requirements	970	1
Completed within schedule	850	2
Completed within budget	766	3
Meets organisational objectives	188	4
Yields business and other benefits	86	5
Causes minimal business disruption	71	6
Meets quality/safety standards	48	7
Other criteria	20	8

As can be seen, the three most popular answers are meeting the client's requirements, completing the project within schedule and completing the project within budget.

In a later study, the same authors, Fortune and White (2006), compared a total of 63 publications and listed the most commonly mentioned project success factors. The data is mainly acquired from empirical studies including both surveys and cases, among theoretical studies. The list of success factors is seen in table 2.3 below.

Table 2.3. *The most commonly identified project success factors across 63 publications (Fortune and White 2006).*

No.	Success factor	Citations
1	Support from senior management	39
2	Clear realistic objectives	31
3	Strong/detailed plan kept up to date	29
4	Good communication/feedback	27
5	User/client involvement	24
6	Skilled/suitably qualified/sufficient staff/team	20
7	Effective change management	19
8	Competent project manager	19
9	Strong business case/sound basis for project	16
10	Sufficient/well allocated resources	16
11	Good leadership	15
12	Proven/familiar technology	14
13	Realistic schedule	14
14	Risk addressed/assessed/managed	13
15	Project sponsor/champion	12
16	Effective monitoring/control	12
17	Adequate budget	11
18	Organisational/adaptation/culture/structure	10
19	Good performance by suppliers/contractors/consultants	10
20	Planned dose down/review/acceptance of possible failure	9
21	Training provision	7
22	Political stability	6
23	Correct choice/past experience of project management methodology/tools	6
24	Environmental influences	6
25	Past experience (learning from)	5
26	Project size (large)/level of complexity (high)/number of people involved(too many)/duration (over 3 years)	4
27	Different viewpoints (appreciating)	3

At least one of the three most cited success factors, *support from senior management*, *clear realistic objectives* and *strong/detailed plan kept up to date* were mentioned in 81 % of the publications, but only 17 % included all three. The table shows that there is only a limited agreement between authors on what factors affect project success. (Fortune and White 2006)

To give another perspective, Baccarini (1999) presents a logical framework model (LFM) for defining project success, in which the author uses a top-down approach to construct a hierarchy of project objectives so that lower objectives are the means to satisfy the higher ones on any given level through cause-and-effect links. This can be seen as a "why-how" relationship, as going through the hierarchy top-down will answer why lower level goals need to be achieved and going from the bottom to the top answers how the higher level objectives are achieved. The four levels of the hierarchy, from top to bottom, goes as follows: *project goal < > project purpose < > project outputs <> project inputs*.

Project goal is defined as the overall strategic orientation to which the project will contribute. The project goals should be consistent with the strategic plans of the organisation. It is a criterion that provides a rationale on which the project relies on, and describes its long-term objectives. Several projects may have the same goal.

Project purpose is described as the intended short-term effects the project has on the users utilising its outputs. It also provides the means of achieving the project goals and determines the required outputs of the project. How well the project's product satisfies the user's needs is a way of measuring how well the project's purpose has been achieved.

Project outputs are the immediate, specific, and tangible deliverables or results of the project. The outputs are used to explain what the project will produce.

Project inputs are the required resource inputs and activities for project execution. The activities explain the modes of operation within the project. Examples of activities are work breakdown structure, schedule, budget and responsibility chart.

Examples of the LFM four-level objective framework is provided in table 2.4 below.

Table 2.4. *Examples of LFM according to (Baccarini 1999).*

Project	Goal	Purpose	Outputs	Inputs
Power station project	Economic development	Electricity	Power plant	Resources and work
Nutrition project in developing country	Increased farmer income	Increased rice production	New farming practices	Resources and work
Fire hydrant project	Reduces fire losses	Prevent and fight fires	Fire hydrants	Resource and work
Light utility vehicle project	Facilitate tactical command of combat	LUVs replace current fleet and meet capability	LUVs	Resources and work

The goal objective and the purpose objective are formulated outside of the project team and can be viewed as strategic objectives. Meanwhile, the outputs and the inputs are objectives that can be viewed as operational, and are the focus and responsibility of the project team. However it is noted that the project team should review the linkages between the outputs, purpose, and goal so it can be aware of them throughout the project. Next, the following distinction is made: project success is built upon two separate categories of success, which are *product success* and *project management success*. (Baccarini 1999)

Product Success deals with the project's product, which to be successful should satisfy the following components:

1. The product should meet the owner's strategic organisation objectives (project goal).
2. The product should satisfy the user's needs (project purpose).
3. The project should satisfy the stakeholder's needs where they relate to the product.

Project management success is defined to have three key components:

1. Meeting the time, cost, and quality objectives (project outputs and inputs) set for the project.
2. The quality of the project management process.
3. Satisfaction of the needs of the project stakeholders' where they relate to the project management process.

The main difference between these two is that one is concerned about the product and the other is concerned about the process. Another difference is that project management success is a subordinate to product success. In the long run, it is more important that the product has met the set objectives than that the project was run sub-optimally. (Baccarini 1999) One can see a parallel to what Wit (1988) said earlier in this chapter, which is in support of the four-level hierarchy, as one can notice that *product success* contains both the project goal, and project purpose, and that *project management success* contains project outputs and inputs from the four-level hierarchy presented earlier. Figure 2.1 below shows how the LFM interacts with the different types of successes.
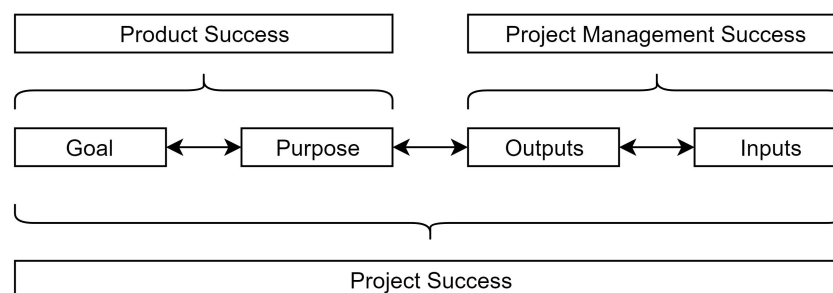

Figure 2.1. *The interaction between the LFM and project success (Baccarini 1999).*

One can see similarities between these definitions by Baccarini (1999) and those by Wit (1988). In fact, even though the terminology is different, the author of this thesis considers the definition of *project success* made by Wit (1988) and the definition of *product success* by Baccarini (1999) more or less, the same. Baccarini (1999) even brings up that project management literature commonly, and confusingly, intertwines these terminologies.

Similarly to distinctions between project success and project management success made earlier by Wit (1988), Cooke-Davies (2002) draws another one between success criteria and success factors. Success criteria are the measures by which the success or failure of a project will be judged, whereas success factors are inputs to the management system that lead directly or indirectly to the success of a specific project or business.

Wateridge (1995) states, in the context of IT-projects, that there does not seem to be clear consensus among authors and researchers on what factors influence project success. However, the author of this thesis considers this to be the case outside of IT-projects as well, and thus is applied here. The problem lies with trying to identify what particular success factors are influencing a specific system.

2.2 Experiential Learning Oriented Risk Management

The objectives and research questions of the thesis influence heavily which method is selected as the backbone for the construction. To find answers and to meet the objectives, the method needs to present a way to create a tool for project management as well as portfolio management. The method also needs to present a way to identify which factors play a role in the success of projects in target environment.

Juuti and Kopra (2016) presents a method for managing project risks in NPD environments called an experiential learning oriented method for risk management (ELO RM). As the name implies the method emphasises experiential learning by using lessons-learned material in a unique manner, to create an understanding of what factors affect the success of projects in the organisation. Success factors are based on those identified from previous projects, as well as factors found from literature. The method offers clear steps to facilitate learning from projects to improve organisational performance. The results of the method are used to create a tool that supports both project management, as well as portfolio management in a multi-project environment. The method results in a project evaluation tool, which is built on valid and relevant project success factors specific to the organisation and context. The project tool includes a selection of project success criteria, which uses terminology relevant and familiar to the organisation so that the tool becomes more integrated into the operative practices of it.

Juuti and Kopra (2016) makes a point that ELO RM is a part of a larger context, as it makes a contribution to project management, project execution and project management activities. As time goes by new experiences from project execution and project management are used as inputs to continuously develop and adapt risk management, which in

turn facilitates organisational learning. Figure 2.2 below shows how ELO RM interacts with an organisation.
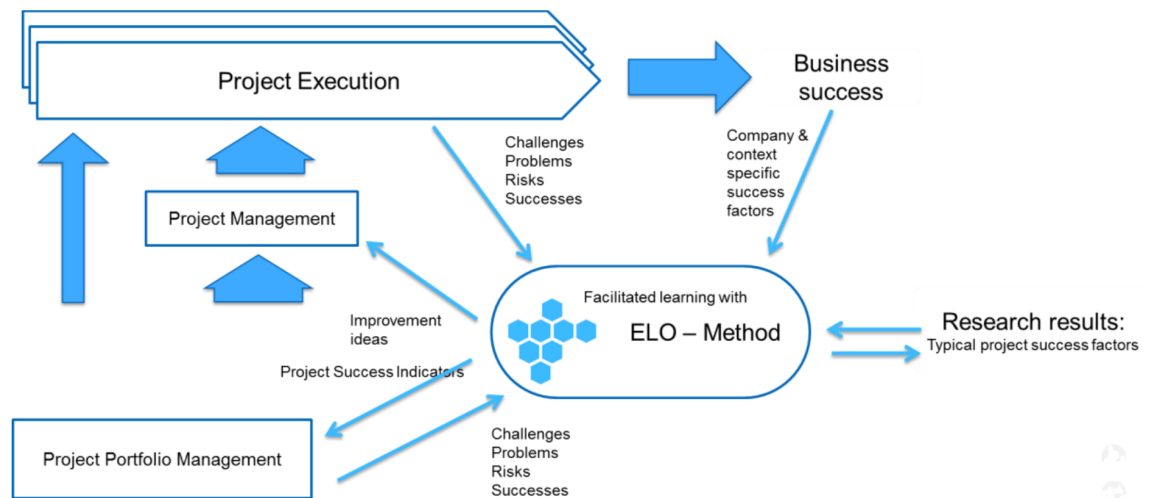
Figure 2.2. *How ELO RM interacts with a business environment (Juuti and Kopra 2016).*

Juuti and Kopra (2016) make use of a case study to present the ELO RM method. The case company is a Finnish manufacturing SME, operating mostly on a global market. The company has evolved from a project- to a product company with its own dedicated R&D team. The company has a fairly large range of products, including automation, electrical, mechanical and software engineering products.

The case ELO RM project started with the authors interviewing personnel working in R&D to get an understanding of what is the status, and what are the challenges in R&D projects. This was followed by two workshops to review and capture lessons learned from a total of four NPD projects. In addition to this, in the second workshop, participants identified factors affecting the success of the projects within the organisation. The second workshop included an intervention to ensure that the company takes extra-organisational input into account when identifying success factors. The intervention made use of FocusChampion cards, which are described in section 2.4. The first NPD project that was reviewed is described as being large and complex. Finally, all the captured lessons learned material across the workshops were reviewed and summarised. (Juuti and Kopra 2016)

The workshop data worked as a basis for the creation of a systematic cause-effect chart, which shows the interrelation and dynamics of the main factors contributing to the success of NPD projects in the case company. In addition to data from the workshops, the chart includes operational practices and different business intents. (Juuti and Kopra 2016) The internals of the cause and effect chart is discussed in detail in section 4.1. Juuti and Kopra (2016) continues that once finished the chart was presented to company representatives in a third workshop, where the chart and its underlying logic was explained. The chart was commented on and modified by company representatives so that it would correlate to their understanding of the situation. Finally, the company representatives, together with the authors, agreed upon which factors can be considered as evaluation

criteria. A similar chart, made for the case company of this thesis can be viewed in figure 4.1.

Once the project evaluation criteria had been selected the authors specified scales for each success criterion by writing descriptions for each level, and organised a fourth work-shop with representatives from the case company to approve, fine-tune and adapt the descriptions made by the authors. (Juuti and Kopra 2016) Davis et al. (2001) describes anchored scales as "... ordinal measures utilizing numeric indicators, each of which is associated with a set of words or phrases that help the respondent to 'anchor' his or her evaluation." Anchored scales force a structure of whatever is being assessed, and help to open up issues that may be treated as highly qualitative and complex so that they are more easily assessed. Anchored scales also ensure that even though different people may be assessing a certain criterion, they arrive at the same answers so that they can be compared across projects. (Davis et al. 2001) In the ELO RM model the 3-level an-chored scales show the status of each selected project evaluation criteria as either poor, adequate or good. For each criterion, the descriptive text was written so that the wording match company-specific terminology. The scales define the target levels for each NPD project success criteria, which in turn indicates to the project managers in what way the projects are evaluated, and what needs to be focused on to ensure project success. After workshop 4, the newly created tool was deployed in a recently started NPD project where the tool could be pilot tested. (Juuti and Kopra 2016) Example of how anchored scales look like in this context are available in table 4.1 and in appendix C.

Figure 2.3 below shows the ELO RM process for the described case.
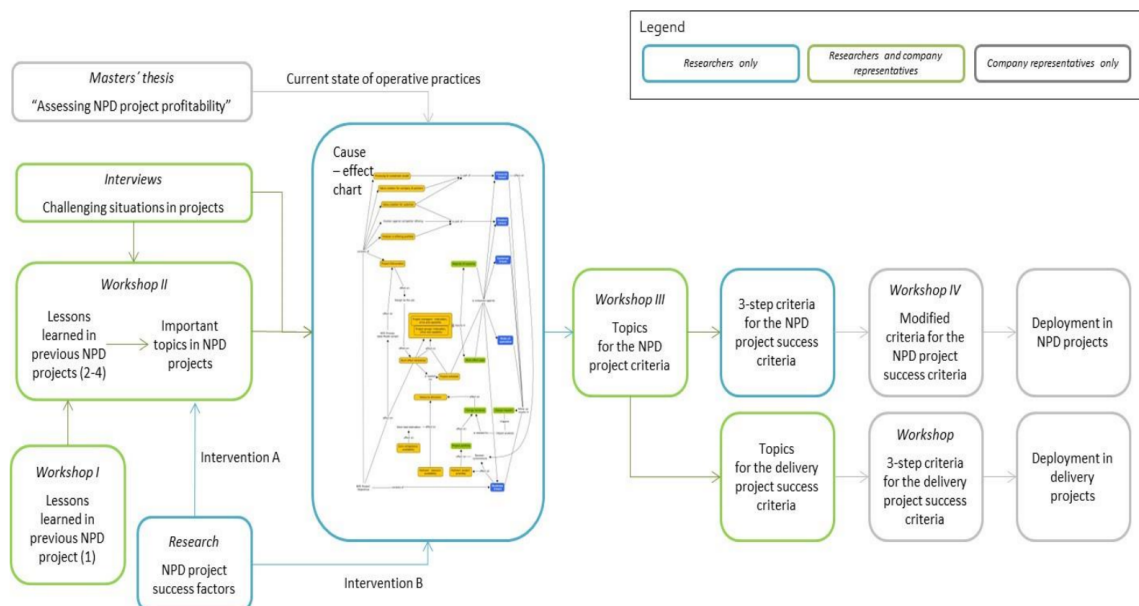
Figure 2.3. *The process of creating NPD project evaluation criteria for the case company (Juuti and Kopra 2016).*

This thesis will, by and large, follow the described method for implementing an ELO RM project. The structure of this particular project, as well as the structure of the workshops, will be explained at the end of this section, in section 2.5.

2.3 Small group facilitation

As much of the captured information comes from the initial lessons learned workshops, it is important that the characteristics of such workshops are explored. The initial workshops are also the largest in both content and in participation, which means they require extra attention in both planning and managing. So that the initial workshops can be better understood, there is one central concept that needs to be explored, and that is small group facilitation. Small group facilitation, in this context, refers to workshops with 5-20 attendees, led by a facilitator. To fully understand small group facilitation, one needs to start by defining and framing the role of a facilitator, as this is a core element.

2.3.1 The role of the facilitator

Bens (2012) defines the facilitator as a leadership role without decision-making power. The author (ibid) continues to define a facilitator as "one who contributes structure and process to interactions groups are able to function effectively and make high-quality decisions. A helper and enabler whose goal is to support others as they pursue their objective". Going by this definition one could say the facilitator acts as a sort of a catalyst to the function of the group. One that shortens the time it takes, and sometimes even enables the group to get closer to their objective without changing the outcome. The author of this thesis draws a parallel with catalysts in chemical reactions, which reduce the required energy for reactions and sometimes even enable reactions to happen. Many times the catalyser also accelerates the reaction by presenting a shortcut for the path of the reaction. Bens (2012) continues that rather than being a player a facilitator acts as more of a referee, and merely watch the action instead of participating. Facilitators make sure participants have the necessary tools to develop their own answers. Facilitators also provide rules to guide interaction between participants and provide an orderly sequence of activities. In addition to this, they pace the proceedings of the workshop so that discussion stays focused and that various discussions find closure while staying neutral about the topics. Kopra (2012) adds that facilitators make sure everyone's voices are heard, asks probing questions and offer ideas for the group to consider. They also offer feedback on the meeting and may give suggestions for improvements.

To specify things Herbert (2010) has identified three procedural goals for facilitation, which are:

1. Ensuring the creation of a space with clear and valid parameters for action, which include discussion or decision-making.

2. Upholding the space to give the maximum amount of opportunity for the participants to act and acknowledge their experiences in the space.

3. Letting go of any predetermined or fixed outcomes the group may feel the need to achieve.

Bens (2012) lists five core practices that facilitators make use of during the facilitation:

1. Facilitators stay neutral on the content. This is a hallmark trait of the role of the facilitator. They are neutral outsiders who have no stake in the outcome of the discussion. When facilitators ask questions or make helpful suggestions, they never do it to impose their views or impact decisions made.

2. They listen actively. Listening actively means to understand the topic and hand, rather than to judge. Bens (2012) also makes a point that this includes attentive body language and eye contact to acknowledge the points and to invite quiet participants to take part in the discussions.

3. They ask questions. Questioning is a fundamental tool for the facilitator. By questioning assumptions can be tested, hidden information may be extracted, assumptions may be challenged and consensus may be confirmed. Effective questioning also encourages participants to look past symptoms and find the root causes.

4. They paraphrase continuously. To let people know that they are heard and their inputs are acknowledged, facilitators make use of paraphrasing. It also lets others hear points for a second time and it opens up an opportunity to clarify ideas.

5. They summarise discussions. At the end of, or even in the middle of the discussion, facilitators summarise what has been said and what ideas have been put forth to refresh, to bring everyone up to speed, to check for accuracy and to bring closure. Summarising may also be used if the discussion has stalled and needs to be restarted since it reminds participants of what ideas have already been said and may spark new ideas.

Traditionally the person who manages the meeting process, the chairperson, is held by a group leader. As that person is the power-holder of the group, they could influence the content and the flow of the discussion. For a group leader, this role may be difficult to perform in an objective manner, as they are so intertwined in the group process and holds the power of the group. The role of the group leader may, in some cases, even be in direct conflict with the role of the facilitator. (Kopra 2012)

Conflicts may also arise when the facilitator has other interests, for example, if the facilitator is also conducting research simultaneously. This conflict arises because the role of a true facilitator and a researcher vary some (Herbert 2010). Herbert (2010) has written an article about what facilitators who occupy several roles have to be mindful about, this is especially important if the facilitator is less experienced. The author (ibid) lists the main aspects of the facilitator and researcher role, compared the both, and uses four metaphors *politician*, *magician*, *trader/traitor*, and *ventriloquist* to highlight the different pressures a person occupying several roles will be likely to encounter:

The Politician is a metaphor that highlights the embedded power relations and interests of every situation, which a politician needs to be aware of and work with. Politicians, facilitators and researchers are all subjected to multiple sources of influence. Sources of influence may come from sponsors, participants and expectations of outcome. Facilitators and researchers are also expected to make public statements about their intentions, and are expected to be seen to be achieving them, while simultaneously balancing working with, or against, other forces.

The Magician controls the space around themselves to perform magic tricks successfully. The audience is captivated within a bubble, in which elements of successful performance are coordinated in a flawless flow. Similarly to this facilitators and researchers have spaces to control and elements to coordinate within their respective "performances". Facilitators may have to create and maintain physical spaces with props used in certain ways to support desired processes. Although it is the participants who are involved in the process, the facilitator has to control the circumference of the environment. A researcher tries to observe as unobtrusively as possible to generate data required for the research questions, but taking field notes and facilitating simultaneously is demanding and video or digital recordings may affect participant activity if not done properly.

The Trader/Traitor is a metaphor that highlights the exchanges that happen with participants when the facilitator is also a researcher. Participants give their time, energy and ideas to the researcher and the process, so they must be satisfied by the facilitated process. It is also possible that they may expect more than it is possible to give. If the facilitator does not uphold to the exchanges or the tacit or explicit confidentiality agreements made, they may quickly find themselves marked as a traitor instead of a trader. This may arise when participants do not feel accurately reported on.

The Ventriloquist comes from the fact that both facilitators and researchers must manage the voices of many participants. Facilitators are concerned with voices finding their place, while researchers are conscious about which voices, and to what degree they are represented in the reporting.

The main goals of the facilitator is to create and maintain a space for participants and to let go of any expectations to achieve certain predetermined and fixed outcomes. The created space has clear rules for discussion and decision making and will allow the participants to act and acknowledge their experiences within it. In contrast, the researcher is not necessarily interested in the creation and maintenance of the space, but in the aspects of it, and/or its actors and/or the dynamics, relationships and the outcomes. In other words, a researcher merely interested in observing and analysing the space and its actors, not interfering or taking any conscious action within it. Although these goals should not by themselves disturb the space, it is argued that the mere act of observing the space alters it. (Herbert 2010)

Another aspect of facilitation that is worth noting is the relationship the facilitator has to the case group of participants. That is to say, if the facilitator is external or internal in

relation to the group. Bens (2012) lists the benefits and drawbacks of both internal and external facilitators.

External Facilitators have a much easier time being neutral, and are more trusted to be so by members of the group. Externals are also less encumbered by power hierarchies and politics of the group, can take greater risks and can walk away from possible repercussions of sensitive interventions. They are also often more experienced in leading specialised discussions and have an easier time seeming credible for the group. (Bens 2012) They can also use seemingly naive questions to stimulate discussion (Hogan 2002). As externals are outsiders to the group they do not fully understand the personalities involved, and often lack data about the group and organisation, such as the history. Externals may also have a hard time staying committed to the project, and may be unavailable for follow-on work or may not be able to see the initiatives of the group unfold. An external facilitator may be the first choice when the topic at hand is too sensitive for an internal to tackle, when neutrality is of utmost importance, or when the internals are not experienced enough to conduct. (Bens 2012)

Internal Facilitators possess a good understanding of the group's internal history, dynamics, culture and resources available within the organisation. They have a stake in the success of and the health of the organisation, and are able to follow-up on the outcomes of their work and ensure continuity. Internals are also on hand and easy to access, which makes organising meetings easier, and thus allows a more flexible schedule. They may lack the experience with specific facilitation processes and tools, but they can have a hard time seeming credible even if they are experienced. A negative effect with knowing the history is the history with co-workers, which leads to expectations and lessens the neutrality of the facilitator. As internal facilitators are working in the same environment as the participants they may find some discussions too risky to tackle and may avoid interventions. (Bens 2012)

Bens (2012) emphasises that although there are several aspects that affect how well external and internal facilitators succeed with their tasks, they all work according to the core principles and goals defined earlier in this chapter.

2.3.2 A method for small group facilitation

Kopra (2012) presents a facilitation method for capturing lessons learned by facilitating experienced-based learning. The method is designed for groups of 5-20 persons, to improve group routines by capturing lessons learned. The method is structured so that the group members' experience and knowledge can be articulated, captured and prepared to be used in their own group, or so that it can be transferred. The method includes the meeting structure, the used facilitation tools and the template for capturing lessons learned. The method can be divided into three distinct phases, which are the activities that are conducted before, during and after the workshop.

Prior to the workshop, the facilitator meets the group leader, and perhaps other key persons of the group in a pre-meeting. The purpose of this session is to motivate the group attendees, define the goal(s), and agree on the practical arrangements related to the workshop, such as the venue. The facilitator explains the concept of the facilitation, as well as the planned activities the group leader should perform prior, during and after the workshop. One of the pre-workshop tasks for the group leader is to prepare a presentation about the group history. The attendees of the pre-meeting provide the facilitator with information about the group, its members and activities. These are required so that the facilitator is aware of the potential challenges, and be prepared to deal with them beforehand. Challenges can relate to interpersonal conflicts among group members, urgent group activities that are expected to distract the group members during the workshop, or prior negative experiences group members have had in similar workshops. (Kopra 2012)

The actual workshop starts with a welcome phase, where the facilitator or the group leader explains the goal(s) of the workshop. The purpose of this phase is to highlight the importance of the workshop and to emphasise that the outcomes of the workshop are the responsibility of each individual attending it. If the participants have not met each other face-to-face before, a short round of introductions is recommended. The facilitator gives a short description of the used method as well as the structure of the workshop. If the participants are not familiar with facilitation, the facilitator also gives a brief introduction to facilitation and the role of a facilitator. In addition to this, the rules of the workshop are presented to the attendants. (Kopra 2012):

- Listen to others - everyone's opinions matter.
- Respect others' opinions - there are no right or wrong answers.
- Focus on the workshop - do not use any electronic devices unless it contributes to the outputs of the workshop.
- Consider the time restrictions.
- Stay on topic.

The workshop continues with the presentation of the group's history, which is usually done by the group leader. The presentation is informal, usually in a timeline or other chronological order, and focuses on the main activities of the group, within the scope of the workshop. The participants are encouraged to interrupt and comment on the presentation whenever they feel the need to, as this highlight the activities that were most important from the group members' point of view. The group presentation may take a long time if the group has faced particularly challenging work and/or the group has not been able to discuss past events earlier. It is the facilitator's job to ensure that the discussions progress in the right direction, even though they do not want to influence the content. After the group history presentations, the members are encouraged to express what were the biggest challenges in the group work so far. (Kopra 2012)

The next phase of the workshop is the topic selection. Group members are encouraged to propose topics that they would like to analyse in small groups, these topics are usually

linked to the challenges phased during the group work. The number of topics depends on how many participants are attending, and how much time is available as each analysis takes around 30-40 minutes, and sharing a topic takes around 15 minutes. The group leader may have prepared topics, as a precaution in case the participants are not used to come forward with their own ideas. Groups of 2-7 persons are formed, and the group leader may form the groups beforehand if there is a need to control the group composition. This could include a case where key persons are assigned to different small groups, and the rest choose their group freely. The group leader can participate, or circulate the groups as they wish. If there is more than one topic to be analysed, the small groups can be re-formed to mix the participants between the questions. When the small groups have found a working area at the venue, and are settled down, the facilitator explains the idea of the worksheet and instructs them how to use it. (Kopra 2012) This thesis does not make use of the worksheet in its presented form, and thus it will be left out of this chapter.

Once the analysis is completed, each small group shares and presents their results, all while listeners are encouraged to comment, clarify and ask questions. This phase may take a long time since group members might want to contribute to other topics than the one they were analysing in their small group. When all topics have been presented, commented on and discussed, it is time to form an action plan. The facilitator is not usually involved in the outcomes of the meetings, but they can offer to help the group create one. Post-workshop it is the responsibility of the group leader to implement the action plan, so that knowledge learned from the workshop can be transferred to the organisation and the target groups. (Kopra 2012)

The facilitator is responsible for delivering the workshop notes, discussed topics and completed worksheets if used. The material can then be made public to other groups or to the organisation, which enable others to access the learnings and possibly also learn from the group's experiences. However, it must be reminded that simply copying the learnings to other groups is not possible. The new group must make the effort to familiarise themselves with the learnings and the material, and evaluate their usefulness. The improvement ideas must be re-created to match the group's needs, and then needs to be integrated into the group's routines. If group learnings are deemed useful by the operational development team to most of the organisation, they can be integrated into the organisational routines by the team's decision and/or by developing work processes within the organisation. (Kopra 2012)

The described method is presented in figure 2.4 below.
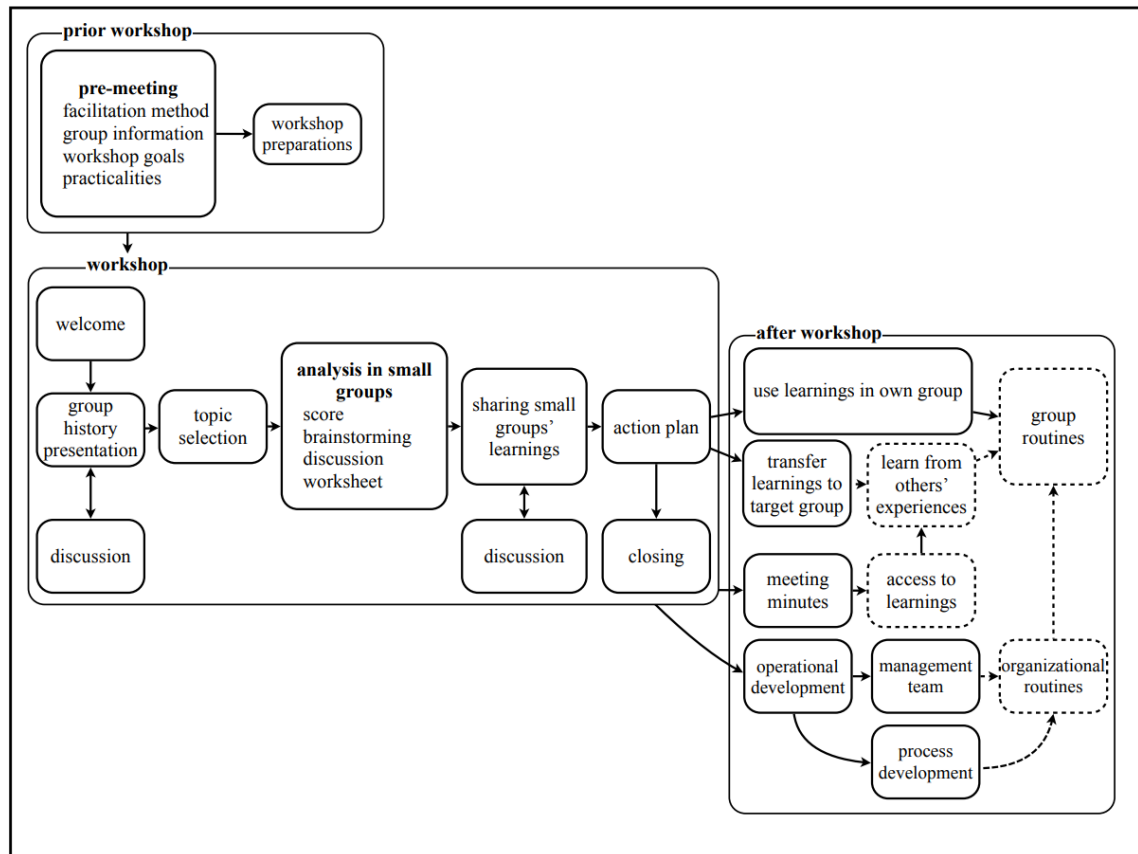
Figure 2.4. *An overview of the method for small group facilitation (Kopra 2012).*

As experiential learning is the central theme of the described method, it is worth expanding upon. Kopra (2012) describes that the process for creating and validating the facilitation method followed the experiential learning cycle by D. A. Kolb (1984). The experiential learning cycle is formed out of four stages, which are: *concrete experiences*, *reflective observations*, *abstract conceptualisation* and *active experimentation*. According to the model, the immediate or concrete experiences are the basis for observations and reflections. These reflections are comprehended and further distilled into abstract concepts, from which new conclusions for action can be drawn. These conclusions can then be actively tested and serve as a guide for new experiences. Ideally, the learner goes through every stage of the cycle, but in practice, this may prove difficult as learning requires abilities which are polar opposites. This means that the learner must continually choose which set of abilities to use in a specific learning situation. (D. Kolb, Boyatzis and Mainemelis 2000)

Kopra (2012) draws comparisons between the experiential learning cycle and the method for small group facilitation, as the method can be illustrated in a similar way. Prior to the workshop, the participants have worked with their tasks and day to day work within the group, and that work represents the concrete experiences in the experiential learning cycle. At the beginning of the lessons learned workshop, the group history is presented, and this is done to highlight the concrete experiences. Topic selection guides the reflective observation into certain aspects of the group's work. By analysing the experience the

group enables abstract conceptualisation to happen. An action plan, or a plan for active experimentation, is defined in the workshop. This plan is done to enable transferring the learning to other groups or implementing the improvement ideas to the own group. The actual transfer of knowledge, as well as the evaluation and the use of the improvement ideas, occur after the workshop. The improvement ideas have an impact on the group and/or organisational routines, thus affecting the group work in the future. The comparison between the experiential learning cycle by D. A. Kolb (1984) and the described method by Kopra (2012) can be found in figure 2.5 below, where the experiential learning cycle inside can be seen surrounded by the steps of the method on the outside.
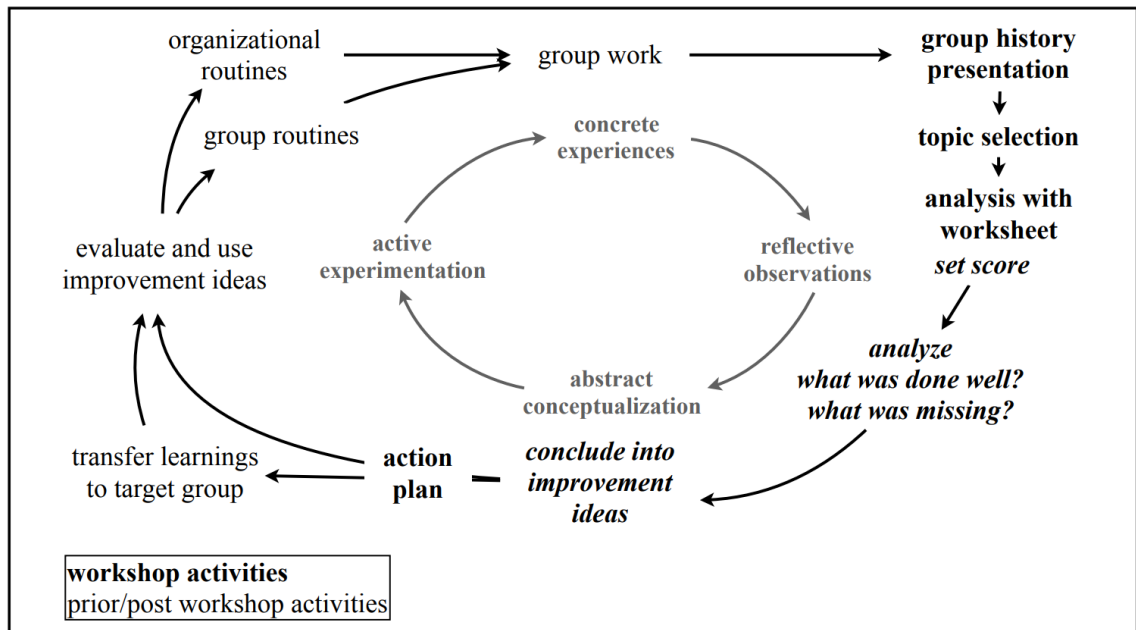
Figure 2.5. Comparing the facilitation method to the experiential learning cycle by D. A. Kolb (1984). (Kopra 2012)

Another link that Kopra (2012) makes is one between the described method and the process of organisational knowledge creation by Nonaka and Takeuchi (1995). The model of Nonaka and Takeuchi (1995) is also known as the SECI (socialisation, externalisation, combination, and internalisation) process, which is built upon four phases seen in table 2.5 below.

Table 2.5. The SECI process (Takeuchi 2006).

Socialisation	Sharing and creation of tacit knowledge through direct experiences
Externalisation	Articulation of tacit knowledge through dialogue and reflection
Combination	Systematising and applying explicit knowledge and information
Internalisation	Learning and acquisition of new tacit knowledge in practice

By presenting the group history previously internalised knowledge is summarised. In small group discussions and in presentations the participants share, or socialise, their experiences and opinions, i.e. their tacit knowledge. Experiences and opinions are articulated when they are written to the worksheet, this externalises the knowledge. Best

practices, as well as improvement ideas, are formulated based on the articulated experiences which are then integrated into the group and/or organisational routines, this is can also be seen as combining. Using these new ideas in practice makes them internalised. (Kopra 2012) A visual comparison between the facilitation method by Kopra (2012) and the process of organisational knowledge by Nonaka and Takeuchi (1995) can be seen in figure 2.6 below.
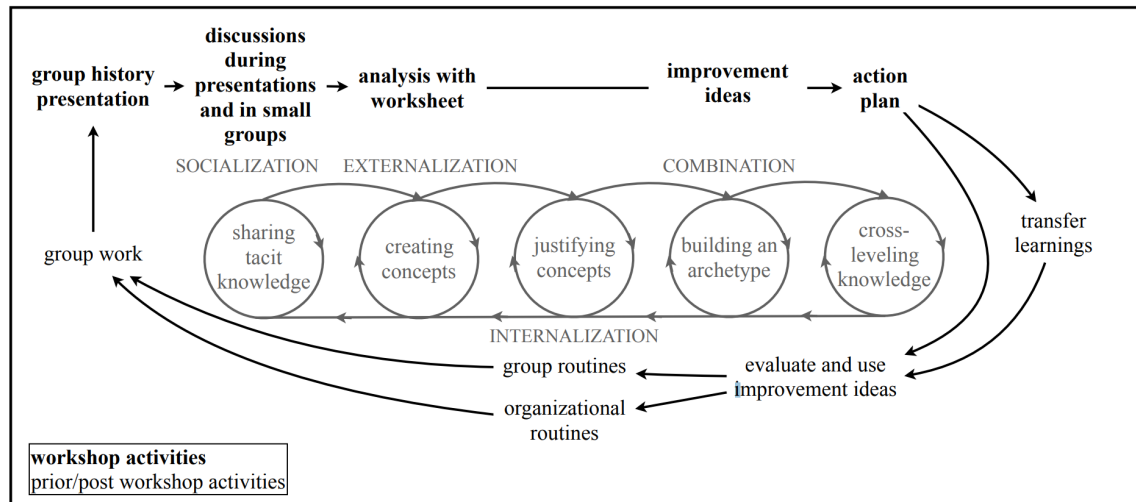
Figure 2.6. *Comparing the facilitation method to the process of organisational knowledge creation by Nonaka and Takeuchi (1995). (Kopra 2012)*

To expand upon the two different forms of knowledge talked about, *tacit knowledge* and *explicit knowledge*, the following paragraphs give a brief overlook on what the the literature defines these as:

Tacit knowledge is knowledge that is highly personal and hard to formalise, which makes it difficult to communicate or share with others. (Takeuchi 2006) Tacit knowledge also covers knowledge which is unarticulated and tied to senses, movements, skills, personal experiences, intuitions and implicit rules of thumb (Kopra 2012). In organisations, this can create problems, as it is difficult to exploit (Kopra 2012). Although it may be difficult to exploit, much of it exists within the organisation in the form of routines. (Lubit 2001) Tacit knowledge is acquired unconsciously when an individual is immersed in an environment. Individuals can have an understanding of the complex structure of systems without being conscious of being so or being able to articulate their understanding of it. (Lubit 2001)

Explicit knowledge on the other hand can be expressed clearly, fully and it leaves nothing implied (Kopra 2012). It is something formal and systematic, and can be expressed in words and numbers and is easily communicated in the form of data, procedures or scientific formulae (Takeuchi 2006).

How the method by Kopra (2012) is implemented in this study are shown in section 2.5 and in section 3.1.

2.4 Champion Tools

The ELO RM method by Juuti and Kopra (2016) utilises knowledge from the Champion Tools-toolbox. The same tools are used in this study as well. Champion Tools is a part of a research project conducted between 2013-2014 at the Department of Mechanical Engineering and Industrial Systems (MEI) at Tampere University of Technology. The results of this research were three tools targeted to Finnish small and medium-sized enterprises (SMEs), and these were: *PowerChampion*, *FocusChampion* and *TeamChampion*. A year later, after having introduced the tools to Tampere region municipal actors supporting SMEs and their development, an update to the tool-set was initiated. The update was funded by the European Regional Development Fund by the Council of Tampere Region and it introduced two new tools: *BusinessChampion* and *GoChampion*. In addition, previously released tools were translated into English. All of the tools included in the toolkit are presented below, along with a small description of their use (Juuti, Kopra et al. 2015):

PowerChampion for analysing co-operation related assets in a project.

FocusChampion for prioritising project tasks.

TeamChampion for selecting the best leaders for different team situations.

BusinessChampion for identifying business benefits for a product/service

GoChampion for evaluating a project status & probability to succeed.

Although there are tools for many types of projects included in the toolkit, it does not include any one tool in particular that could be used in this thesis. Similar methods and structure, along with knowledge derived from research gone into, and standalone parts of the champion-tools is available and used on the other hand.

The first part used, and arguably for this thesis the most important part of the champion-tools, are the *FocusChampion* cards. There are a total of 41 cards and each contain a topic on one side, and a descriptive text on the other. The topics range from funding, to competencies and goals, and can be grouped into nine different areas: *industry*, *value chains*, *investment*, *competencies*, *co-operation*, *project planning*, *project infrastructure*, *project culture*, and *external relations*. Figure 2.7 below shows how the cards look like.

Figure 2.7. *The FocusChampion cards.*

The cards are originally used in the *FocusChampion* tool for prioritising project tasks throughout the project, which will, in turn, increase the chance of the project's success. (Juuti, Kopra et al. 2015) In this thesis, the cards are voted on during workshops so that it can be determined which factors were perceived to have a positive or a negative impact on the outcome of previous projects. In addition to this, the number of votes each card got is added so that the relevancy of each factor can be taken into consideration as well. Some factors may have a negligent role in the success of projects in a certain context, while others are highly influential. All of the English *FocusChampion* cards, as well as their descriptions, are presented in appendix A.

Another part of the Champion-tools used is the structure of the GoChampion tool. GoChampion uses a certain set of criteria to evaluate a project throughout its course (Juuti, Kopra et al. 2015), this is very similar to what this thesis aims to achieve with its resulting tool. The tool utilises 3-level anchored scales to define the level of poor, adequate or good for each criterion. Each criterion, as well as a description of each, can be seen below:

Business Case which measures how well the project is aligned with the long-term strategy of the involved companies.

Window of Opportunity shows if there is a justified window of opportunity for the product/service.

Plans & resources shows if project and resource plans of the company and its partners' are available and approved.

Project manager measures five qualities of the project manager in charge of the project, and how many of them they possess, or lack. The qualities are: available time, motivation, competencies, ability to influence, and credibility in organisation.

Schedule alignment for indicating how well partners' schedules align with the project schedule.

Capacity & investments shows if there a requirement of additional investments or ca-

pacity to perform the expected work effort. It also shows how risky the project is for its partners.

Contracts which gives an indication whether or not the legal agreements for co-operation is in place. It also indicates if the company has worked with the selected partners before.

Division of Power measures how well-defined the division of power is between the partners, and how quickly decisions can be made.

Competencies which indicates how familiarised the project personnel are with the project and whether or not critical competencies are available.

Division of work for how well division is worked is agreed upon and documented. This helps to avoid overlapping tasks or grey areas.

Co-operation history shows how familiar the partners are to the project personnel, and if previous projects were successful or not.

Work practices for how well work practices and processes are defined and agree upon between the company and its partners.

(ICT) tools which shows how well the (ICT) tools are suited for the project, as well if there has been co-operation with partners before.

Maturity of technology measures how new the selected technological solutions are, i.e., whether or not the solutions are used by the company or other companies, or if the solutions are used in current products or services.

The criteria emphasise heavily on collaboration with partners. Figure 2.8 below shows the criteria evaluation view of the GoChampion-tool.

CRITERIA	STATUS			Evaluation 21.3.2016	Comments
	Poor	Adequate	Good		
Business case	The project is not aligned with the long-term strategy of any companies involved and does not have a solid business case.	The project is aligned with the long-term strategy of the involved companies or has a solid business case.	The project is aligned with the long-term strategy of the companies involved and has a solid business case. Co-operation is meaningful for all companies.	Good	Everyone is onboard
Window of opportunity	There is no clear window of opportunity in the company's portfolio for the product/service.	The window of opportunity for the product/service is not clear but it can be justified.	There is a clear window of opportunity in the company's portfolio for the product/service.	Good	
Plans & resources	Company-level project and resource plans are available.	Partners' project and resource plans are available.	We have approved/confirmed project and resource plans for our company that also include partners' plans.	Adequate	One contract still not finalised
Project manager	The project manager lacks 3–4 qualities of available time, motivation, competencies, ability to influence, and credibility in organisation.	The project manager lacks 1–2 qualities of available time, motivation, competencies, ability to influence, and credibility in the organisation.	The project manager has time available, motivation, competencies, ability to influence, and credibility in the organisation.	Good	
Schedule alignment	We have no visibility of our partners' schedules.	Partners' schedules are available but they are not synchronised at a project level or the schedules are conflicting with the project schedule.	Partners' schedules are aligned with project schedules.	Adequate	plans from one suppliers are still missing due to the lack of contract
Capacity & investments	Project execution requires additional investments or causes delays in some other project, OR the project decreases partners' business opportunities, OR we have doubts regarding partners' capacity.	A successful project is possible if work effort or investment estimates do not change.	A project does not require additional investments and does not cause unreasonable risk for the partners. There is a high success probability, even though additional work effort or investments are needed.	Good	
Contracts	We have not worked with the partners before, even at the company level. Legal agreements enabling co-operation do not exist.	The company has worked with the partners before but legal agreements need to be updated for this project.	We have worked with the partners before and the legal agreements are still valid.	Adequate	new customer
Division of power	We have not agreed with partners who make decisions and upon what. It is not possible to make decisions in a reasonable time.	Power division with the partners has been carried out but decision-making is too slow.	All companies involved know who makes decisions and what is decided upon. Decision-making is rapid.	Adequate	One contract still not finalised
Competencies	Competence needs for the projects are known but suitable personnel are not available.	We have all the critical competencies in the project but some of the key personnel are newcomers.	We have all the critical competencies in the project and everyone is familiar with the project and the companies involved.	Good	Re-organizes resources and the new product manager was allocated to another project
Division of work	We have not agreed on work division with the partners.	Work division with partners has been agreed but it is not documented.	We have clearly agreed work division with partners to avoid overlapping tasks and grey areas.	Adequate	one supplier still re-considering
Co-operation history	We have not worked with the partners before, OR previous co-operation with the partners was not successful.	We have worked successfully with the partners before as a company but the project personnel have no personal experience.	Project personnel have successfully worked with the partners on previous projects.	Adequate	new customer
Work practices	We have not worked with the partners before. Work practices and processes for co-operation do not exist.	The company has worked with the partners before but work practices and processes need to be updated for this project.	We have worked with the partners before and agreed work practices and processes are still valid.	Poor	new customer
(ICT) tools	We have not worked with the partners before. (ICT) tools for co-operation do not exist.	The company has worked with the partners before but the (ICT) tools used are not applicable for this project.	We have worked with the partners before and the (ICT) tools are still valid.	Poor	new customer
Maturity of technology	The selected technological solution is being used for the first time in the company. The solution has not been used in other companies.	The selected technological solution is being used for the first time in the company. The solution has already been used in another company.	The selected technological solution has already been verified and used in our other products/services.	Good	old technology, new industry

Figure 2.8. *The GoChampion tool (Juuti, Kopra et al. 2015).*

The main difference between GoChampion and the ELO RM method is that the project evaluation criteria in ELO RM are based on identified success factors from project lessons-learned workshops. This increases the relevancy of the tool to the receiving organisation and the characteristic projects within it, and thus requires a few additional steps to implement. These steps are discussed in the following section.

2.5 Structure of the NPD risk management project

This section will describe how the presented theory is implemented in this thesis. The core of this thesis lies within the ELO RM method described by Juuti and Kopra (2016) and shown in figure 2.3. The method is adapted to suit the requirements of the case company and will be described in this section.

Similarly to the case shown by Juuti and Kopra (2016), the project begins with workshops to capture lessons-learned material from previous projects. The author, along with company representatives, identified two suitable NPD projects for the ELO RM project. The NPD projects are analysed in two separate workshops, 1 and 2, and the outcomes are explained in detail in the next chapter. As previously mentioned in chapter 2.3, the initial workshops account for a large amount of the captured information, and as such must be carefully planned. The structure of the initial workshops based on the method for small group facilitation by Kopra (2012) described in section 2.3.2, but it has been adapted to better suit the ELO RM method and the case company. The main adaptation is the shift from improving group routines to identifying factors that have affected the outcome of the project. This is done by using a different set of questions and tasks for the participants. Another adaptation to the facilitation method comes from an intervention done by including FocusChampion cards, explained in section 2.4, in the workshop. The inclusion is done so that extra-organisational input is also taken into account when identifying success factors, which was also done for the second workshop in the case by Juuti and Kopra (2016). The outcomes of the initial workshops are recorded by the author and are used in the next stage of the project.

Data from workshops 1 and 2 is used as a basis for creating a systematic cause and effect chart as seen in section 2.5. Topics that were discussed in the workshops and more importantly, the factors leading up to the topics, along with the FocusChampion cards are all taken into account in the creation of the cause and effect chart. The cards that received few votes are deemed to be irrelevant in the success of projects and, as such, are left out of the chart. The details of the chart are visible and are discussed in detail in section 4.1.

A third workshop is arranged with the project management group of the case organisation. This is a small workshop, which aims to produce the following outcomes: an approved cause and effect chart, and a handful of project evaluation criteria. The author begins by describing the logic behind the cause and effect chart, and the participants are encouraged to comment, ask questions and to scrutinise the logic of the chart. Suggested changes are agreed upon, and the author implements those in the final version of the chart. Next, the author and the participant agree upon which of the success factors can be used as project evaluation criteria. There is no precise formula on how to select criteria, as this is highly dependent on the case organisation and how the network of factors is formed within the chart. The content of the third workshop is unmodified from the ELO RM method.

Same as in the ELO RM by Juuti and Kopra (2016), the author writes the initial version of the 3-step anchored scales out of the selected project evaluation criteria. Each project evaluation criterion receives a description for poor, adequate and good performance. A fourth workshop with the same participants as the third is organised to evaluate the initial version of the descriptions. Descriptions are adjusted and tied to organisational practices and other tools which may fit selected criteria. After workshop 4 is concluded, the first version of the risk management tool is completed and ready for deployment.

An outline of how the ELO RM project implemented in this thesis, and in this case company, is presented in figure 2.9 below.
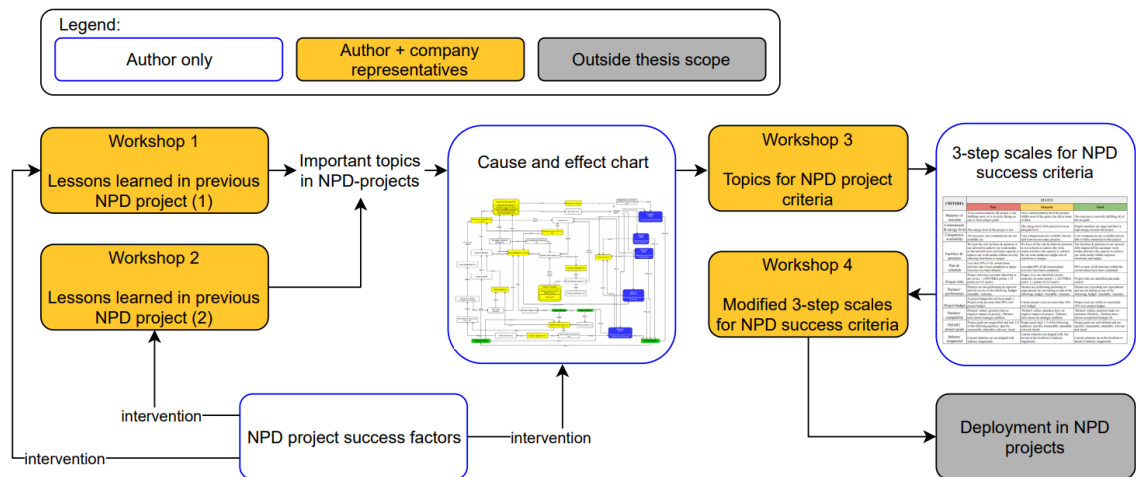
Figure 2.9. *Outline of adapted ELO RM project.*

3 GATHERING DATA

This chapter begins with an overview of the implemented workshop structure. This is followed by the details and outcomes of the workshops 1 and 2, which serve as the raw data for the creation of the results. The chapter ends with the summary of both workshops. The goal of the workshop is to create an environment, where the participants are able to speak about set topics from their own point of view. Genuine questions are used to encourage discussion and open up thinking. The participants seek to find shared beliefs and values, concerns and uncertainties. (Kopra 2012) The main goal of the initial workshops is to capture lessons-learned knowledge, and to create an understanding over the important topics in NPD projects.

3.1 Structure of workshops 1 & 2

The initial workshops begin with a brief welcome and a motivation for why it has been organised. This is followed by the goals and agenda for the day.

- Welcome & and Motivation 5"
- Goals & Agenda 5"
- Introduction 10"
- Highlights 20"
- Successes + lunch 60"
- Challenges 30" + 45"
- Success factors 30"
- Closing words

As the last step before moving over to the project is to introduce the entire ELO RM project and the outline of the thesis. The length of the introduction-phase is expected to be 20 minutes. This phase is constructed to highlight the importance of the workshop as is described in the method by Kopra (2012). The history of the NPD project in focus is presented next, and this is done by the project leader. The presenter is asked to highlight the various successes and challenges faced throughout the project, and listeners are encouraged to interrupt, question and comment while the history is being presented. The presentation is expected to take about 20 to 30 minutes.

After the project history presentation, participants are given individual tasks on the topic of capturing successes. The participants were given 5 minutes, and are asked to brainstorm answers to the following questions:

1. What was successful in this project?
2. What made it possible? (make a list of enabling factors)

This phase acts the topic selection described by Kopra (2012) in their method. After the time is up, each participant is asked to present their answers, which are then noted to a place visible to all attendants i.e. a whiteboard or flip-board. If similar successes arise they can be combined. This is followed by a round of voting, where participants select vote on those successes they would like to further discuss. Once the results of the voting are clear, the participants are divided into as many groups as there are topics. Senior members of the project are asked to sit in different groups, and groups split into different parts of the workshop venue. Each group is given one of the topics to discuss, and are provided with 20 minutes to discuss the enabling factors that lead to the group's particular success. Every enabling factor the team finds is each written down on a separate note. When the time is up the teams rotate tables, and are given a new topic to discuss. The notes are left at their respective tables so that the arriving group can access them. After every topic is discussed, the participants return to their original seating and the enabling factors are presented and commented on. Each note is moved to a visible place under their respective topic on a wall, whiteboard or similar surface. Finally, participants are asked if there are any enabling factors that are missing.

Once project successes are processed, the focus shifts to the project challenges. The participants are once again given an individual task to brainstorm, in 5 minutes, what main challenges were faced throughout the project. The question is stated as follows:

1. What were the main challenges in this project?
2. Why did this challenge exist? (5 x why)

Challenges are presented and noted in the same way as with successes. Depending on how much time went to identifying successes, the topic selection may be done similarly, or the group may discuss and come to a consensus on which topics to discuss in small groups. The participants are once again divided into as many small groups as there are topics at hand. The small groups are given 20 minutes to discuss why their particular challenge existed, and what would have been the enabling factors to that particular challenge. Each enabling factor is noted separately, and once the time has passed, and if time allows, teams rotate and continue the discussions with a new topic. After small group discussions are concluded, the enabling factors are presented and placed, similarly to the success enablers, on a visible surface and participants are asked if there are any enabling factors missing.

Before concluding the workshop the participants are given one final task. The facilitator has prepared a large surface with 41 FocusChampion cards, which have been kept hidden from the participants until now i.e. the backside of a caster-equipped whiteboard.

Each card shows a success factor that has been identified from literature (Juuti, Kopra et al. 2015). The participants are asked to pair up, and each pair is given small adhesive markers in two colours. The pairs are then given the assignment to vote i.e. place markers, on those success factors they perceived had an impact on the outcome of the project. One colour is assigned to signify cards that contributed to the success of the project, and the other is assigned to cards that contributed to challenges. Pairs are allowed to vote on as many cards as they want but are only allowed to place one success or one challenge marker on each card.

That concludes the workshop. The day is summarised and each participant is asked what they thought of the day and if they had learnt anything new. Finally the facilitator thanks the participants for their time and participation.

The workshops are held at a venue about 5 minutes away from the case company main office by car. The venue is owned by the group of which the case organisation is a part of, and specifically designed for conferences and workshops, and acts as a hotel and restaurant for business guests. The workshop space provides ample room for up to 20 participants and contains a large number of modular furniture, a projector, whiteboards and flip charts.

3.2 Workshop 1

The first of two workshops held to gather background information was held on the 3rd of May 2018. As this was the first workshop, it was facilitated Associate Professor (tenure track) Tero Juuti who is one of the authors for several of the main theories utilised in this thesis. The author of this thesis assisted with facilitation and focused on keeping meeting minutes.

The objective of the first workshop is to gain lessons learned about a major NPD-project for the case organisation. The project is one of the largest projects to date, a new product platform, and the had just been launched around the time of the workshop. Attending the workshop are 11 members of the project team, ranging from engineering, to project management, production and after sales. Invited project members dealing with portfolio management, business sector management and marketing were unable to attend.

The workshop started off with a small welcome and the motivation for this thesis and these workshops were given to the attendants. This was followed by a brief overlook of the agenda for the day and what steps make up the workshop. In addition to this, the outline of the thesis was presented, which marked the end of the introduction of the workshop and thesis. This was followed by a 30 min long discussion about project highlights and history presented by the Chief Engineer, who is responsible for the technical outcomes, and the engineering team of the project.

Once the attendants had talked through the project the workshop continued onto captur-

ing the successes of the projects, and what are the underlying factors behind them. The attendants were given the following questions as an individual assignment:

1. What was successful in this project?
2. What made it possible? (make a list of enabling factors)

Participants had 5 minutes to brainstorm answers to these two questions, and each participant was asked to present their results. The results were noted on a whiteboard, and after every topic had been presented each participant was asked to place two votes each. If similar topics arose they were merged, so that there wouldn't be duplicates on the whiteboard. The three most voted successes were chosen for small group discussion. The topics were *open atmosphere*, *unique product* and *lifetime tests*. All of the suggested successes, along with how many votes each was given, is presented in table 3.1 below.

Table 3.1. *Outcome of the successes question in the first workshop.*

Success	Votes
3 Production test batches	-
R&D help for production	-
Good product	-
Open Atmosphere	8
Unique product - different concept (courage)	6
Nice design	-
Well structured project - Enough time to give induction	-
Innovative PCB cooling-design	-
Easy PCB assembly	-
Good Co-operation with industrial designer + mould company network	5
Lifetime tests	6

The participants were divided into three groups and the project members that were most senior and/or invested in the project were separated to get a good mix of experience in each group. Once the small groups had settled in separate corners of the room, each of them was tasked to discuss the topic assigned for that team. They were also tasked to write down factors green adhesive stickers that they perceived had contributed to the assigned topic. Each team were given 20 minutes to discuss the topic. After 20 minutes the teams rotated so that the group would discuss the next success. Once the second discussion had been completed, the group took a lunch break and upon returning the groups rotated one last time for a third 20-minute discussion. The facilitators of this work-

shop followed the discussions, intervening only when needed to keep discussions on topic, and staying neutral to the discussion at hand. After discussions were concluded, each contributing factor to every topic was presented, and participants elaborated on, commented and added factors that had not been mentioned in the small group discussions. The topics, along with a brief description of each and the perceived factors leading up to the successes are presented below:

Open Atmosphere is considered one of the most important topics of success in this project. Factors contributing to this success are: pulse meetings twice a week, R&D and production are close and had open discussions, sounding boards, "dynamic duo", thinking out of the box, flat sense of hierarchy, family-owned company: long-term thinking, technical solutions not locked, and organisation open to new ideas.

Unique Product refers to the technical outcomes of the project. The project took a left-field approach to its solutions and the result is something unique to the market. Factors leading up to this success are: good bank, new teams with no old borders, openness and testing of "crazy" ideas, allowed to make mistakes, effective on-site testing with end users, skilled and motivated problem solvers, good product knowledge, re-using technology, good team spirit, sufficient economic freedom, successful group ideation, and willingness to go new ways.

Lifetime Tests is important to the confidence of the final product. A tight co-operation between the test laboratory and the engineering team throughout the project is perceived to have increased the success of the product. This project, in particular, had the single greatest investment of lifetime testing to date. Factors leading up to this were: fewer surprises when starting to sell, willingness to spend money on practical lifetime testing, characteristic problems identified in earlier products, increased confidence in product, proving the quality for the subsidiaries, bad experiences from previous products, verifying new technology, and willingness to invest time (which postponed launch)

Figure 3.1 below shows how all the brainstormed topics, and factors contributing to topics were presented in the workshop.
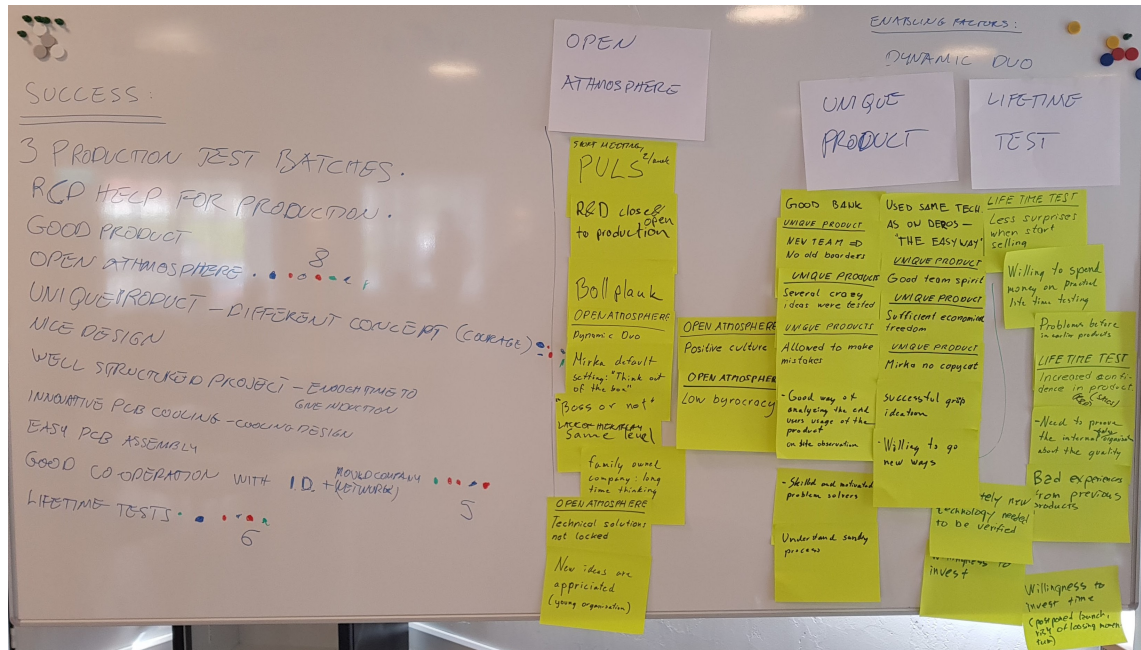
Figure 3.1. Outcome of the successes question in workshop 1.

Next, the teams performed similar tasks, but with challenges in mind. The participants were presented with the following questions:

Individual work:
1. What were the main challenges in this project?
2. Why this challenge existed? (5 x why)
Present the main challenge

Once each participant had had enough time to think about the questions each was asked to present which things they perceived had been challenging in the project. After every participant had listed the challenges they faced the facilitator selected which challenges would be brought up to group discussion. The participants were then presented with the following question:

Team Work: (choose your challenge, max 3 persons per team)
1. Analyse why this challenge existed.
2. What would have been the enablers? (Discuss, agree and write each enabling factor on an orange post-it)

Although the slides suggested max 3 persons per team. It was decided, due to the scarcity of topics to discuss, that only two teams should be formed. These groups consisted of 5 persons each. The groups were not rotated in this exercise, as the group sizes were big enough to keep the discussion going actively throughout the set time. The facilitator and the author rotated between the tables, listening in on the conversation and intervening when necessary. The selected challenges, along with the contributing factors, are listed below:

The Process - Many of the aspects of the product development process hadn't been

developed in the early stages of this particular project and were in many cases tested on it. The participants perceived this as a challenge to the success of the project. The factors leading up to this challenge were: marketing requirements document (project goals), product requirements document, too few prototypes for end-user tests, structured purchasing system during ramp up, new product introduction phase, and commitment to the project process.

Too long project - The project in question was started around 5-6 years before launch. It's worth noting that the project taking too long isn't a challenge per se, but merely a result of several underlying challenges. This fact was brought up in the group discussion and the facilitators intervened to bring the discussion to the factors. Factors contributing to the length of the project were: analysis of previous similar projects to get an accurate work amount, follow-up on schedule to detect delays earlier, modular thinking using platforms, working too long trying to use standard parts, knowing when it is good enough (overworking), insufficient know-how of technology (and computer programs), searching for several solutions at the same time by different persons, not enough resources, not enough resources to test new solutions, and overbooked resources.

As one can see some of the items on this list are a bit diffuse and may perhaps even be contradictory to factors relating to successes. There was an intervention during the discussions of this topic, and the participants were asked which factors would have prevented the project from being worked on too long.

After the discussions each factor was presented and placed visibly on a surface, how the challenges were presented in the workshop is visible in figure 3.2 below. Participants were also asked if there are any challenges missing. As the groups only discussed one topic, this was necessary.
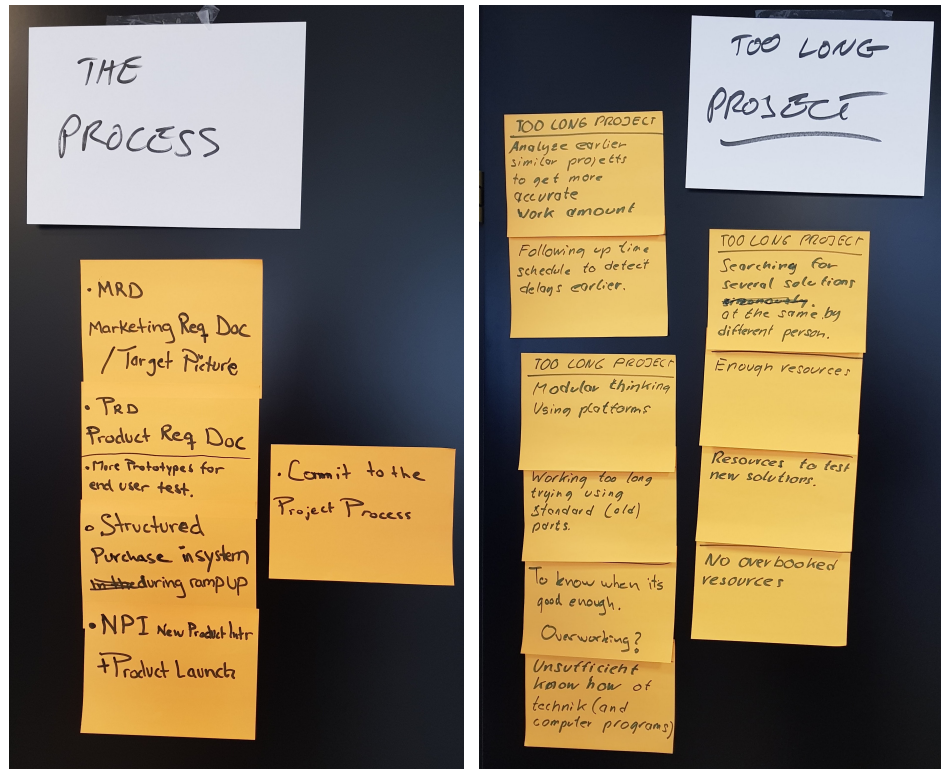
(a) The Process.

(b) Too long project.

Figure 3.2. *Results from discussing selected challenges in workshop 1.*

Once the challenges had been discussed the workshop is subjected to an intervention in the form of the FocusChampion cards. The cards were placed behind a whiteboard by the author before the workshop began, and was now revealed to the participants. The participants of the workshop were asked to pair up, and using small adhesive markers of either blue or red, vote on which factors played a role in the outcome of this particular project. Pairs placed blue markers on factors that had a positive impact on the outcome and red markers on factors that affected the outcome negatively. If the pair saw no correlation with a particular factor and the outcome of the project, no marker was placed. Pairs were allowed to place only one marker on each card but had no limit on the number of cards to place on.

The participants perceived that the *individuals' commitment, motivation & drive for results*, and the *core competencies* affected the project the most positively with both receiving 5 votes each. In addition to this the *market position*, *existing relationships* and *trust, commitment & energy level in the project* were also perceived to have impacted the project positively at 4 votes each. There are also several cards that got three positive votes or less, these are taken to consideration in the creation of the cause-effect chart. The cards that received the most positive votes are presented in table 3.2 below:

Table 3.2. *Top positive cards from the first workshop.*

Success	Pos. votes	Neg. votes
Core competencies	5	-
Individuals' commitment, motivation & drive for results	5	-
Market position	4	-
Existing relationships	4	-
Trust, commitment & energy level in the project	4	-

The factor which got the most negative votes was *plan & schedule* at 4 votes, which is something that was also discussed in the challenges-section of the small group discussions. *SMART project goals*, *partner's references* and *facilities & premises* all got 3 negative votes each, with the two latter receiving 1 positive vote also. The most negative cards from the first workshop are visible in table 3.3 below.

Table 3.3. *Top negative cards from the first workshop.*

Success	Positive votes	Negatives votes
Plan & schedule	-	4
SMART project goals	-	3
Partner's references	1	3
Facilities & premises	1	3

The complete results of the voting are seen in figure 3.3 below. As a final task, the participants were asked what they thought of the day and if they had learnt anything new. The participants were thanked for their time, and the workshop was concluded.
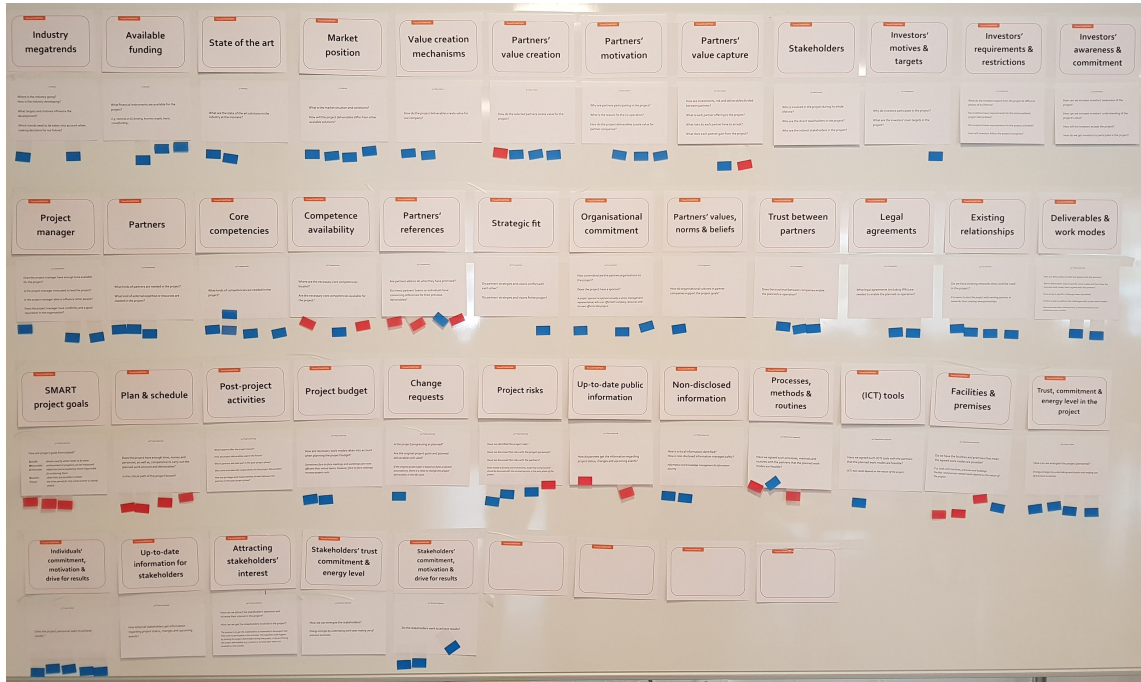
Figure 3.3. FocusChampion voting results from workshop 1.

3.3 Workshop 2

The second of the initial workshops was held on the 7th of June 2018 at the same venue as the first. The goals of the workshop are the same as the first but aimed at a different project instead. Whereas the outcomes of the project in workshop 1 created a new platform with a large number of new components, the project in the second workshop was an adaptation of a previously existing platform. Although extending a platform does ease up some aspects, it does create some challenges as well. Mainly in trying to adapt new technical requirements to standardised components. Eight persons attended this workshop ranging from engineering, to project management, purchasing and after sales. Once again project group members concerning themselves with portfolio management, business sector management and marketing were not able to attend. Members from production management were also unable to attend. Three persons attending the second workshop had also participated in the first.

The agenda for both workshops stayed the same, but for this workshop, the author of this thesis had made a few adjustments to the slides shown on the projector. These included clarification of some sentences and questions to give a clearer picture of what is wanted out of the task at hand. Unlike the first workshop facilitated by Tero Juuti, this one was facilitated by the author of this thesis.

Once the welcoming words, the agenda for the day, and the background for the workshop was presented, the participants were presented with the first task of the day. Participants were given the individual task to answer the following questions:

1. What was successful in this project?

2. What made it possible? (make a list of enabling factors)

As a portion of the participants had been in the first workshop and were familiar with the questions from before. This caused some discussion, as to what way one should answer these questions to get a good continuation on the small group discussions. Participants were given 5 minutes to brainstorm answers, and after completing the task each participants answers were presented and noted on a whiteboard. If similar successes came up, they were merged as seen fit by the facilitator. The participants were then given three votes to cast on which successes they felt had contributed most to the project and those were marked on the whiteboard next to the topic. All of the presented successes are presented table 3.4 below.

Table 3.4. Outcome of the successes question in the second workshop.

Success	Votes
Field testing	2
Mould company	5
Team spirit	3
Money not a problem	-
Good design	1
Quality control	1
Extensive testing	4
Effective communication with partners	2
Project management	2
Risk management	1
Open atmosphere	1
Courage to re-design	2

Compared to table 3.1 it can see that the votes received were much more spread out in the second workshop. Participants were then split into three groups with senior members split to increase the diversity of experience in the groups. The facilitator stepped in to fill in a vacant spot so that each team had a total of three participants. The teams were tasked to identifying which factors lead to the topic being considered a success and to write down each factor onto an adhesive marker. Teams discussed 20 minutes on each topic before rotating. Once every group had discussed each topic, and each factor had been presented and placed on the whiteboard, the workshop took a lunch break. The three successes, along with the factors contributing to the success, are presented next:

Mould company - The development of a new product requires intimate co-operation with

some partners. As bringing forth a plastic mould is a time consuming and complex process, the mould company is one of the most important partners for this particular project. The mould company in this context refers to a partner, that works as a consult in designing for injection moulding, has a vast network of mould makers and experts, and that also handles the production of the finished parts. Below are the factors that were seen contributing to the *mould company* being considered a success: first production batch produced by mould maker, good material know-how, good mould maker, good involvement in mould manufacturing, extensive engineering pilots (mould-trials), realistic quotations, know-how of mould construction process, global network, many years of experience, same culture, same mentality, low threshold for visiting (close by), dedicated partner, communication.

Extensive testing is quite similar to what was seen in the first workshop, that one being *lifetime tests* identified as a project success. Throughout the project, there has been active testing of incoming parts, assembled parts and finished tools. This was seen as a factor that contributed to the success of the project. Extensive testing was seen as a success factor due to the following things: well documented test methods and results, test request system / booking, good testing equipment and facilities, the will to be the best and the knowledge of how to get there, dedicated resources, extensive (and expensive) field testing, defined requirements, lifetime tests, engineering pilots, test plan - a more structured way of testing, and enough prototypes.

Team Spirit was the third of the main successes. This shows a positive attitude within the project team to work with each other. The following things were perceived to contribute *team spirit* being a success in this project: wide know-how, small teams, positive "can do" attitude, management has trust in the R&D organisation, willingness to achieve common goals, open mindset, open atmosphere, open communication, positive feedback, willingness to accept new ideas, learning atmosphere, good leadership, and daily technical dialogues and discussions.

The results of the group discussions on the topic of successes, and how they were presented in the workshop can be seen in figure 3.4 below.

After the success factors were identified, the workshop moved onto the challenges of the project in scope. In the same fashion to the first workshop, the participants were tasked with individually brainstorming, in 5 minutes, answers to the following questions presented on the projector:

1. What were the main challenges in this project?
2. Why this challenge existed? (5 x why)

Instead of selecting a topic, the topics were voted on in the way as with success earlier in the day. Each participant was given three votes to cast, and the challenges with the most votes were selected to the second round of small group discussions. As there were so many topics that received the same amount of votes it was difficult to select which ones should move forward to small group discussions. After having discussed the topics

Figure 3.4. Outcome of the successes question in the second workshop.

which were the most popular, the participants and the facilitator came to a consensus and two topics were selected, these were: *unclear requirements* and a new topic which was created during the discussions called *collaboration with partners*. The presented challenges and the votes are visible figure 3.5 below.

Figure 3.5. Challenges identified in workshop 2.

The participants were split into two groups and were given 20 minutes to write down factors contributing to the challenge issued to the group. After completing the first task the groups rotated to discuss the second topic. A brief overview of the selected challenges, along with the factors contributing to them, are presented next:

Collaboration with partners - A project has many partners throughout its life-cycle. Group discussions revealed that the challenges to the success of the project have come specifically from partners abroad, as the factors included several characteristic challenges, such as indirect communication with technical people, and language & cultural barriers. The factors leading up to this challenge were: long communication chain with supplier, not enough supplier visit, unannounced changes of sub-suppliers, language and cultural barriers, long lead times, long distance communication, lack of equipment/resources to do incoming inspections, indirect communication with technical people, no respect for specifications, unannounced changes in items.

Unclear requirements was the second challenge of this project. Similarities to one of the selected challenges of workshop 1 can be seen, that one being *the process*. The contributing factors to this challenge are: not enough competitor analyses at the beginning of the project, dated design guideline, requirements for spare parts and accessories + packaging, unfrozen requirements, not following the processes, and not investigating critical requirements.

The challenges and the factors contributing to those can be seen in figure 3.6 below:
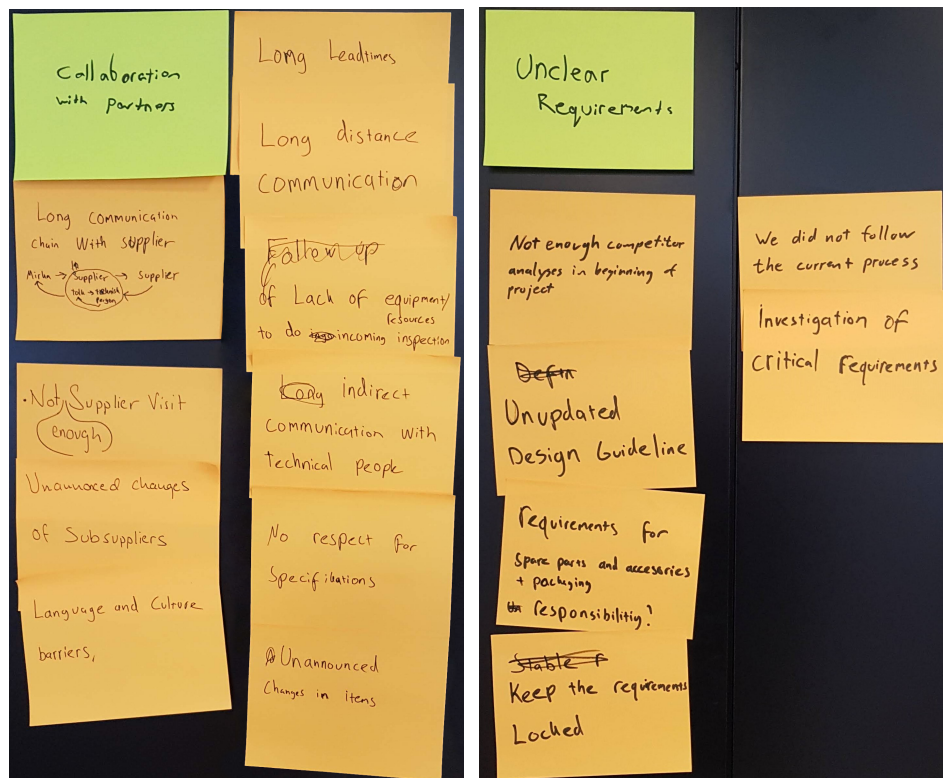
(a) *Collaboration with partners.*   **(b)** *Unclear requirements.*

Figure 3.6. *Results from discussing selected challenges in workshop 2.*

As a final task, in the same way as in workshop 1, the 41 FocusChampion cards were revealed to the participants. Participants were tasked to find a pair and were given red and blue adhesive stickers. Pairs were told to place blue markers on cards that had a positive impact, and red markers on cards that had a negative impact on the project.

Pairs were permitted to vote on as many cards as they perceived necessary but were told to vote only once per card. The cards that got the most positive votes are presented table 3.5 below.

Table 3.5. *Top positive cards from the second workshop.*

Success	Pos. votes	Neg. votes
Value creation mechanisms	4	-
Trust between partners	4	-
Existing relationships	4	-
Project risks	4	-
Facilities & premises	4	-
Trust, commitment & energy level in the project	4	-
Individuals' commitment, motivation & drive for results	4	-
Stakeholder's commitment, motivation & drive for results	4	-

Similarly to workshop 1, there were several cards with three votes or less. These were filtered out of the table above but were taken into consideration in the creation of the cause-effect chart. The cards with the most negative scores are presented in table 3.6 below:

Table 3.6. *Top negative cards from the second workshop.*

Success	Positive votes	Negatives votes
Partners' references	-	4
Project budget	-	4
Partners' values, norms & beliefs	-	3
Processes, methods & routines	-	3
SMART project goals	-	3

In addition to this, several cards received a number of both positive and negative votes and can be considered controversial topics. They were *deliverables & work modes*, and *plan & schedule*, the number of votes each of these factors got can be seen in table 3.7 below:

Table 3.7. Most controversial cards from the second workshop.

Success	Positive votes	Negatives votes
Deliverables & work modes	2	4
Plan & schedule	3	2

The participants were asked what they had learned today, and they were thanked for their time. This concludes the second and the last of the initial workshops of this thesis. The complete voting results of the FocusChampion cards can be seen in figure 3.7 below.

Figure 3.7. Second workshop FocusChampion voting results.

3.4 Summary of Workshop 1 & 2

This concludes the first section of the ELO-RM project. Workshop 1 and 2 supply all of the input that goes into creating the cause- and effect chart. Both workshops were executed in a similar manner, with the major difference being the main facilitator. The first workshop was led by Tero Juuti, who is the supervisor of this thesis and is one of the authors behind many of the theories implemented in it. The second workshop was led by the author. In both workshops, the participants were active in their participation, and no interpersonal conflicts arose. All raw data from the FocusChampion voting results can be found in appendix B.

4 RESULTS

This chapter focuses on the construction and the presentation of the main results of this thesis. The chapter begins with the creation of the cause and effect chart, which is used as the basis for the third workshop. As a result of the third workshop the project evaluation criteria is selected, and descriptions are written as a base for the fourth workshop. The results of the fourth workshop is a project and portfolio evaluation tool, which is approved by the case company.

4.1 Cause and effect chart

The data gathered in the workshops is analysed and used as a basis for a systematic cause-effect chart seen in figure 4.1 below. The goal of the chart is to illustrate the dependencies of the main factors that correlate with project outcome success. Lesser factors are filtered out during the creation, thus leaving those that are seen affecting the outcome the most. Similarly only the most important dependencies are shown in the cause-effect chart. In addition to showing the dependencies of the main factors, the chart illustrates the interrelations between causes and their impacts, which in turn reveals the dynamics and also potential problems within the system (Juuti and Lehtonen 2010).
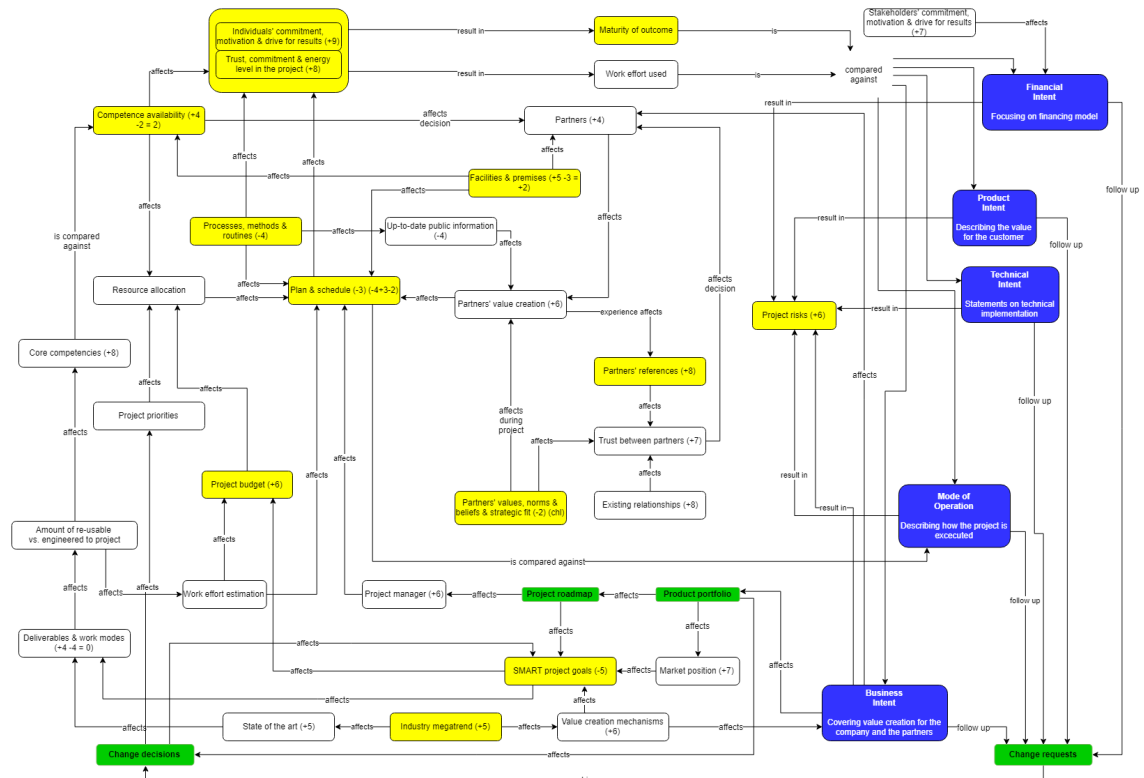
Figure 4.1. *Modified cause and effect chart for the case company.*

As mentioned in section 2.5 there is no strict way of constructing the cause and effect chart. Much of the information comes from experience and knowledge of how the organisation works, which is why there is a third workshop to validate it.

A third workshop was held to present the first version of the cause-effect chart to the NPD management group. The underlying logic on which the relations were built on was explained, and some were adjusted according to the feedback received from the workshop. Following the overview of the chart, the group were tasked to identify which success factors can be used as NPD project evaluation criteria. The selected factors are marked as yellow in figure 4.1. The marked factors are used further in a risk management tool, which is presented later. Boxes marked as green are operative practices, and they are owned and managed separately from risk management practices. Blue boxes are project intentions. Project intentions can be divided into five distinct categories as follows (Juuti and Lehtonen 2010):

1. Business Intent, defined the value creation for the company and its partners.

2. Financial Intent, describes the financing model for the project.

3. Product Intent, focuses on how the product brings value to the customer.

4. Technical Intent, describes the technical implementation of the project.

5. Mode of Operation, defines how projects are executed.

These five categories are the cornerstones of project intentions and as such are a central part of the cause-effect chart. The intents act as a reference point to compare project

progress to. As presented in the cause-effect chart, they cause pressure for change requests, which eventually leads to change decisions. The progress of the project, both for maturity of outcome and work amount used, is compared to the intents of the project. (Juuti and Lehtonen 2010)

The cause-effect chart works as the foundation for the creation of the risk management tool presented in the next chapter.

4.2 A NPD risk management tool

Using the NPD project evaluation criteria identified by the NPD management group the author created a table, with three levels of anchored to describe the status of that criteria. The three levels of these scales are *poor*, *adequate* and *good*. A *poor* status signifies that the topic in question is not properly taken care of in the project. *Adequate* is achieved if some care is taken in a particular topic, but more needs to be done. A topic gains the *good* status when enough work has been done in that area to ensure project success. A flavour text, giving a description for each criteria condition was written by the author and reworked in an additional small workshop with the NPD management group. The goal was to find vocabulary and criteria that are easily identifiable in the case organisation, preferably criteria with numerical values to lessen the subjectivity of the criteria evaluation.

The chosen criteria, along with the rationale behind the descriptions, as seen in table 4.1 are as follows:

Maturity of Outcome, which measures how the current solutions and maturity of the project are compared to the set goals of it. A poor result indicates that the outcome fails at more than 75% of the set project goals, or is deemed to fail severely in at least one of them. An adequate result shows that the outcome fulfils most of the set project goals, but fail in at least 25% of them. A good result, on the other hand, is an outcome that fulfils all the set project goals.

Commitment & energy level is an indicator of the overall energy level of the project. This is not a very tangible or measurable criterion but can be considered one of the most important ones. A lack of commitment and energy severely affects the eagerness to complete project tasks and may be an indicator of project personnel well-being among other things. The levels of this criterion are simply, low, adequate or high energy level. This criterion is created from the combination of two Focus Cards, *Individuals' commitment, motivation & drive for result* and *Trust, commitment energy level in the project*, which both received high positive scores in the workshops, and as such, are seen to have had a great positive impact in previous projects.

Competence availability refers to the allocation of resources between projects in this context. NPD-projects within the context of the core company rarely require full commitment throughout the whole process. For this reason, product development engineers are

split between several projects in different stages, to compensate for the downtime of any one project. Sometimes this may cause issues if projects with different priorities have activities that need to happen within the same time frame and this leads to the definitions of this particular criterion. A poor status is deemed when there are missing assigned core competencies for a certain project, core competence needs can be filled by either in-house personnel or by using partners. An adequate level indicates that core competencies are available, but are split between several projects and are not able to work on this particular project at full capacity at this moment. When all core competencies are able to fully commit this criterion earns a good rating.

Facilities & premises indicated whether or not the case company or the business ecosystem of the case company has the necessary facilities & premises to achieve the set work modes. To measure this both the project time frame and budget will be used to compare. A poor result in this criterion indicates that either the business ecosystem lacks core facilities & premises or lacks the capacity to perform the set work modes without severely affecting either project time frame, budget or both. An adequate result shows that core facilities & premises are covered within the ecosystem, but lack full capacity and will result in a slight cost of time frame and/or budget. A good result indicates that the ecosystem is able to achieve all set work modes without sacrificing the project time frame or budget. This criterion originates from Focus Cards and had received both positive and negative votes and was thus classed by the author as a controversial factor. Originally the Focus Card for this criterion had the following description: *Do we have the facilities and premises that mean the agreed work modes are possible? E.g. tools and machines, premises and buildings. Facility-and premise-related needs depend on the nature of the project.* This left it open to interpretation whether or not "we" in this context means the core company itself or it's business ecosystem. For the sake of future proofing, it was decided in the fourth workshop that the core company interprets this as the latter.

Plan & schedule is an indicator that compared the projects current process against the planned progression, and more importantly whether or not a plan has been made at all. The case company has a project process that splits the project into three distinct phases and nine separate stages. A poor level indicates that no plan has been made for the time frame for each of these stages. If a plan is made a poor level shows that the project stage transition has not happened in time and is late by, or more than, one month. The criterion is at an adequate level if the project is behind schedule, but behind less than one month. The indicator is at a good level if the project is within schedule and thus in the correct stage compared to the planned schedule.

Project budget is a measurement on how the project spending relates to project budget. Similarly to *plan & schedule* this criterion has prerequisites. In this case, it is an actual project budget to compare against. The lack of a project budget results in a poor rating, as does a project spending overshoot of more than 50%. An adequate level for this criterion signifies that project costs have exceeded project budget by more than 10%, but less than 50% and a good level shows us that project costs are within project budget or maximally

10% over it.

Project risks is a criterion tied to three aspects of project risks. The first is the FMEA-tool used within the organisation to assess project risks, the second is the IPR-landscape of the project, and the third is the compliance landscape of the project. The criterion stands at a poor rating when any aspect has not been assessed, or when any of the following apply: FMEA score is over 500 on any item, core project outcomes are in direct IPR conflicts, or when the solutions are non-compliant. Adequate rating is reached when all of the aspects are assessed, but any of the following apply: FMEA score is over 125 on any item, minor IPR conflicts can be found or if current solutions are not protected, or if solutions are internally compliant, but have not been tested by a third party. A good status is achieved when none of the above applies.

Partners' performance is an indicator that measures how well a partner meets the expectations set upon them within the scope of the project. To help measure, the partners will be set against the following three criteria: budget, timetable and outcome. These criteria are relative to the tasks assigned to any particular partner and failing on two of the aforementioned criteria, or failing severely on any one of these results in a poor rating. An adequate level is decided upon if partners perform according to the expectations of the case unit, with the exception of failing on any one of the three criteria. A good level indicates that partners are exceeding the expectations and are able to achieve their set budget, timetable and outcome. This criterion originates from focus cards and was initially called *partners' references*, and the descriptive text of the card was as follows: *Are partners able to do what they have promised? Do (new) partners' teams or individuals have convincing references for their previous deliverables?* The latter part of the description was dismissed when selecting success factors and it was decided that this will be a measurement of performance instead of previous references, and as such the name was also changed to reflect on this.

Partners' compatibility is a less tangible criterion, but nevertheless an important one. It measures how well project partners fit the case company, both culturally and strategically. A poor rating on this criterion is decided upon when it is noticed that partners' culture and practices have a negative impact on the project. A poor rating is also decided upon if partners have shows strategic conflicts. An adequate level shows that partners culture and practices have no negative impact on the project and there is no strategic conflict between the companies. A good rating is achieved when partners' culture and practices make co-operation within the project effortless, or that the strategic fit between the companies has been proven exceptional.

SMART project goals is an indicator that shows how well defined project goals are for the project. SMART is an abbreviation that stands for **S**pecific, **M**easurable, **A**ttainable, **R**elatable, **T**imed. A poor status is given when project goals lack more than 3 of the SMART qualities. An adequate level is given when project goals lack 1 or more of the aforementioned qualities. A good status is achieved with well-defined project goals that have all of the five qualities mentioned.

Industry megatrend is the last criterion within the NPD risk management tool and it is a measurement on how well the current solutions and outcome fairs against current industry megatrend for the specific project scope. A poor level indicates that current solutions are against the development of the industry, adequate levels signify that solutions are in line with current megatrend and a good level shows that current solutions can be seen to be at the forefront of the megatrend, meaning that the solution can be considered innovative and industry-shaping, which is the market position the case company is looking to be and to stay at.

These descriptions and criteria for each of the levels of the anchored scales give an indication of the leanings and priorities of the case company as these are defined with the help representatives of said company. These descriptions are more or less unique due to the environment of its conception. Having descriptions that are tied to case company processes and tools, give this tool more reliability and relevancy within its destined context. The criteria and the definitions for each of the levels are compiled in table 4.1 below:

Table 4.1. NPD risk management tool for case company.

CRITERIA	STATUS		
	Poor	**Adequate**	**Good**
Maturity of outcome	At its current maturity the project is not fulfilling most, or is severely failing on one or more project goals.	At its current maturity level the project fulfills most of the goals, but fail at some of them.	The outcome is currently fulfilling all of the set goals.
Commitment & energy level	The energy level of the project is low.	The energy level of the project is on an adequate level.	Project members are eager and have a high energy towards the project.
Competence availability	All necessary core competencies are not available yet.	Core competencies are available, but are split between too many projects.	Core competencies are available and are able to fully committed to this project.
Facilities & premises	We lack the core facilities & premises in our network to achieve our work modes or the network lacks sufficient capacity to achieve our work modes without severily affecting timeframe or budget.	We have all the core facilities & premises in our network to achieve the work modes and have the capacity to achieve the set work modes at a slight cost of timeframe or budget.	The facilities & premises in our network fully support all the necessary work modes and have the capacity to achieve our work modes within expected timeframe and budget.
Plan & schedule	No schedule for project stages has been made. | Project stage transition is late by more than 1 month.	Project is behind plan and scheduled stage transition has not happened.	Project is within schedule and in the correct stage of development.
Project risks	Project risks have not been identified or are severe. | ≥500 FMEA points on any one item | Patent conflicts or patent landscape not identified. | Compliance not acceptable or untested.	Project risks are identified and are moderate on some points. || ≥125 FMEA points on any one item | Minor patent infringements OR outcome not protected. | Compliance not tested by external agency.	Project risks are identified and under control.
Project budget	A project budget has not been made. | Project costs are more than 50% over project budget.	Current project costs are more than 10% over budget.	Project costs are within or maximally 10% over project budget.
Partners' performance	Partners are not performing as expected and fail on two of the following: budget / timetable / outcome.	Partners are performing according to expectations, but are failing on one of the following: budget / timetable / outcome.	Partners are exceeding our expectations and are not failing on any of the following: budget / timetable / outcome.
Partners' compability	Partners' culture, practices have a negative impact on project. | Partners have shown strategic conflicts.	Partners' culture, practices have no negative impact on project. | Partners have shown no strategic conflicts.	Partners' culture, practices make co-operation effortless. | Partners have shown exceptional strategic fit.
SMART project goals	Project goals are unspecified and lack 3-4 of the following qualities: specific, measurable, attainable, relevant, timed.	Project goals lack 1-2 of the following qualities: specific, measurable, attainable, relevant, timed.	Project goals are well defined and are specific, measurable, attainable, relevant and timed.
Industry megatrend	Current solutions are not aligned with industry megatrends.	Current solutions are aligned with, but are not at the forefront of industry megatrends.	Current solutions are at the forefront or ahead of industry megatrends.

The tool is lightweight and allows for quick updates on a bi-weekly or a monthly basis and project follow-up using three different views. These three types of views are current view,

historical view, and project portfolio view. The tool indicates to project managers what the health of the project is, and what needs to be done to ensure success (Juuti and Kopra 2016).

The project team works mostly on the current and historical view throughout the project, while project managers also work with the project portfolio view to assess the health of the entire portfolio. Table 4.2 below shows the historical view of "project 3".

Table 4.2. Historical view of "project 3" within the NPD risk management tool.

CRITERIA	Project 3														
	Innovation				Product Development							Launch			
	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30
Maturity of outcome	red	red	red	red	red	red	red	yellow	yellow	yellow	green	green	green		
Commitment & energy level	green	green	green	yellow	yellow	green	green	red	yellow	yellow	yellow	yellow	yellow		
Competence availability	green	green	green	yellow	yellow	green	green	red	red	yellow	yellow	yellow	yellow		
Facilities & premises	yellow	yellow	yellow	yellow	yellow	yellow	yellow	yellow	yellow	yellow	yellow	yellow	yellow		
Plan & schedule	red	yellow	yellow	green	red	red	red	red	yellow	yellow	green	red	green		
Project risks	red	yellow	green	yellow	yellow	red	red	yellow	yellow	yellow	yellow	yellow	yellow		
Partners' performance	red	red	red	yellow	green	green	green	green	green	green	green	green	green		
Project budget	red	green	green	green	yellow	yellow	yellow	yellow	yellow	yellow	yellow	red	red		
Partners' compability	yellow	yellow	yellow	yellow	green	green	green	green	green	green	green	green	green		
SMART project goals	red	red	red	yellow	yellow	yellow	yellow	yellow	yellow	green	green	green	green		
Industry megatrend	yellow	yellow	yellow	green	green	green	green	green	green	green	green	green	green		

This hypothetical example represents week 26 of a relatively short NPD project, which is planned to be completed within four weeks. By the colouring, the viewer can see how different criteria have lived over the course of the projects lifetime. The viewer can see that at its current state the maturity of outcome is on a good level, indicating that the current solutions are fulfilling the assigned project goals. One can also see that the budget of the project is overrun by more than 50%, but that it is considered to be ahead of its time regarding megatrend that affect the industry at the moment. With more information about the activities within the project, one could give context to reasons why the criteria are marked as they are.

Another example in table 4.3 below shows a hypothetical project portfolio consisting of eight separate NPD projects. All NPD projects within the case organisations environment are considered to have the same success criteria and can thus be represented as the table shows. These projects are all in different stages of progression, which could be represented in the same table. Although some aspects of the portfolio can be viewed directly from the table as an outsider, context and knowledge of each project are needed to get the complete picture of the portfolio.

Table 4.3. Project portfolio view of NPD risk management tool.

CRITERIA	Project portfolio							
	Project 1	Project 2	Project 3	Project 4	Project 5	Project 6	Project 7	Project 8
Maturity of outcome	Red	Red	Green	Yellow	Yellow	Green	Yellow	Red
Commitment & energy level	Green	Green	Green	Green	Green	Green	Green	Red
Competence availability	Green	Green	Yellow	Yellow	Yellow	Yellow	Green	Red
Facilities & premises	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow
Plan & schedule	Red	Red	Yellow	Yellow	Yellow	Yellow	Yellow	Red
Project risks	Red	Yellow	Green	Yellow	Yellow	Green	Yellow	Red
Partners' performance	Green	Green	Yellow	Yellow	Green	Yellow	Yellow	Yellow
Project budget	Green	Yellow	Red	Yellow	Red	Yellow	Green	Green
Partners' compability	Green	Green	Green	Yellow	Yellow	Green	Green	Yellow
SMART project goals	Red	Yellow	Green	Green	Yellow	Green	Green	Yellow
Industry megatrend	Green	Green	Green	Yellow	Green	Yellow	Green	Yellow

The project teams work mostly on the first level, updating the tool on how the different criteria are at the time. Project management works mostly on the second level and is able to view, at a glance, the health of each project according to the criteria. This, in turn, will allow project management to spot if there are chronic problems within the organisation, which span many NPD projects.

Figures used above work as a reference point on how the tool can look like. Ideally, the tool is integrated into currently used solutions of the organisation.

5 DISCUSSION

This chapter is dedicated to discussing the outcomes of this thesis. It begins with the discussion of the results. The results are also compared to the theoretical framework presented in chapter 2. The chapter continues with discussing the reliability of the method and the results. It is followed by discussing the relevancy, and finally the novelty of the outcomes.

5.1 Discussing the results

The results of this thesis are presented in section 4.2. For this R&D unit, the selected project evaluation criteria are: *maturity of outcome*, *commitment & energy level*, *competence availability*, *facilities & premises*, *plan & schedule*, *project risks*, *partners' performance*, *project budget*, *partners' compatibility*, *SMART project goals* and *industry megatrend*. In addition to this, there are several important success factors that are visible in the cause and effect chart in figure 4.1 and in appendix C. Out of the selected project evaluation criteria, five can be directly linked to success factors found in table 2.3 by Fortune and White (2006). These are:

Competence availability, which correlates to no. 6 *skilled/suitably qualified/sufficient staff/team* and no. 10 *sufficient/well allocated resources*.

Plan & schedule is directly linked to no. 3 *strong/detailed plan kept up to date*.

Project risks can be linked to no. 14 *risk addressed/assessed/managed* and to *meets quality/safety standards* found in table 2.2 by White and Fortune (2002).

Partners' performance which correlates to no. 19 *good performance by suppliers/contractors/consultants*

SMART project goals, which is linked to no. 2 *clear realistic objectives*.

Out of the five directly linked project evaluation criteria, two are linked with success factors that are ranked highly in table 2.3. This direct connection shows that the selected criteria are common across publications. Even though the rest of the selected criteria are not visible in the same table, it does not negate their effectiveness in the target environment.

When compared to the GoChampion risk management template by Juuti, Kopra et al. (2015) discussed in section 2.4 and seen in figure 2.8, there are no criteria that strongly

matches. Only *competence availability* and *plan & schedule* have some resemblance to the criteria found in the tool. This shows that the ELO RM method has produced relevant criteria to this particular environment. Simply using the GoChampion tool as is, would most likely prove ineffective in this case.

5.2 Reliability

The entire thesis is based on the theoretical framework presented in chapter 2. The construction of this thesis is based on the case study presented by Juuti and Kopra (2016) in their explanation of the method, with adaptations to fit the case organisation. For structuring the initial workshops to capture lessons-learned material, the author used the theories made by Kopra (2012) and adapted them to fit the nature of the ELO RM project. To understand the role of the facilitator, the relevant theories were explored as a part of the theoretical framework. Throughout the implementation of the method, the supervisor of the thesis and one of the authors of the ELO RM method guided the author through the process. The method for achieving the workshop results can thus be considered reliable.

The next paragraphs highlight characteristics of the arranged workshops, that may affect the results for the sake of transparency. The paragraphs are grouped into different themes, to further differentiate the nature of the factors:

Workshop participation - Due to the timing and length of the initial workshops, several members of the project teams were unable to attend. Albeit invited, there was no participation from business sector management or marketing, and portfolio management only for a short while in the second workshop. This caused the participation to skew towards the engineering group, which may have altered the results. Although the engineering group is the one working most intimately with the R&D projects, it is unknown whether or not the lack of participation has any major effect on the effectiveness of the created risk management tool. On the other hand, the portfolio- and business sector management team represent the receiving end of the product and their input would have been very valuable in the entirety of this project. Workshop 2 had a lack of participants, which caused the small groups to be lacking in size, with only three, three and two members. This caused that the facilitator had to join in one of the groups so that it wouldn't only be a dialogue. The facilitator tried to stay neutral to the topic at hand, but there are admittedly several factors that may have altered the course of the group's discussions, as told by Herbert (2010) and Bens (2012). Another aspect of workshop participation that is worth noting is the overlap of participants. The case unit is not very large, so several members of the participators attended both of the workshops.

Workshop tasks - In both workshops, there was some confusion about what were the expected outputs of some questions, namely in cases where the question asked for successes or challenges, and factors leading up to these. Sometimes participants answered factors leading to when asking for successes/challenges and vice versa. This could be

the cause of confusing questions, lack of examples or lack of facilitator intervention. When voting for FocusChampion cards the workshop members are paired up, and every pair gathers around the whiteboard to place their markers. This causes distractions from the actual task, as members are crowded around the cards, trying to read and vote. This may also cause group pressure between the pairs.

Comparability of projects - The projects in focus were in different stages during the time of the workshops. The project in workshop 1 had been released a few months prior with a large order stock and backlog in the production lines. This may have caused an increased perception of success. The project in workshop 2 had been released for a while, and sales had already peaked.

External vs Internal facilitator - One major difference between workshops 1 and 2 was the change of facilitator. The facilitator in workshop 1 was Associate Professor (tenure track)Tero Juuti, who is one of the authors for the ELO RM method and parts of the theoretical framework as well as the supervisor for this thesis. Workshop 2 was facilitated by the author, who is a member of the case organisation. Throughout the workshops, there were several occasions where the differences between the facilitators became visible, especially when dealing with difficult situations, i.e. when answering questions about the theoretical framework, or next course of action in the event of unexpected results. The author's lack of authority also showed in workshop 2. While participation was good, the discussions got out of hand at a few points and senior members participating in the workshop helped the author calm the situation and steer it back to the workshop. The difference in facilitator authority can also be illustrated in a humorous manner by comparing figures 3.3 and 3.7 and seeing how the FocusChampion voting markers were placed. In the former figure, the markers are placed in an organised and tidy manner, while this is far from the case in the latter. While there are factors at play that may affect an internal facilitator negatively, the author found it helpful that they had good knowledge about the case unit from previously, and that management and group members were close at hand when constructing the cause and effect chart. The author is of the opinion that constructing a reliable cause and effect chart requires intimate knowledge about the receiving organisation.The differences between an external and an internal facilitator aligned with the theories by Bens (2012).

5.3   Relevance

The ELO RM method relies heavily on input from the target organisation for the creation of the results. All of the input data, which is used to create the systematic cause and effect chart comes from the initial workshops and lessons learned material from previous projects. The data is captured using a workshop structure based on experiential learning methods, i.e. the method supports the capture and sharing of previously gathered, internal knowledge. In addition to capturing lessons learned material, the group members participating in the workshops select which factors identified from literature are relevant

in the context of their operating environment, without external input. The cause and effect chart created by the author is scrutinised, modified and finally accepted by members of the case organisation management group. The project evaluation criteria were selected in co-operation with the aforementioned group and the author, and the descriptive texts for the 3-level anchored scale were modified and accepted by them. The created tool is thus heavily influenced by the members of the target organisation, and are considered relevant to the highest degree.

The background study and the objectives build a foundation that gives the research questions their relevancy. The work aims to produce answers to meet the needs of the case company, by answering the set research questions.

5.4 Novelty

By implementing the ELO RM project, the thesis successfully able to capture and utilise knowledge from the members of the case unit. As mentioned in the section for relevancy, all of the input data comes from the organisation. With minimal outside input, this means the created tool a direct result from previously silent, or tacit knowledge. The author of this thesis and the case organisation have also gained knowledge of how to utilise experiential learning in the creation of project management tools, as well as the structure of workshops to support capturing of lessons-learned material.

The thesis also serves as a case study for the implementation of the ELO RM method in a Finnish large enterprise. It explores all of the required knowledge for the adaptation and management of the method and presents results in a comparable manner.

6 CONCLUSION & FUTURE WORK

In this chapter, the conclusions of this thesis are drawn and the research questions will be answered. In addition to this, the chapter will discuss the deployment of the created product management tool and in what way the work will be supported in the future.

6.1 Answers the research questions

The objective of this thesis was to create an understanding of the environment NPD-projects exist within the case organisation. The answer to the research questions required a theoretical base and empirical research, and thus a constructive research approach was selected. The first research question, *What are the success factors in this particular business environment?*, was answered with the results of the created construction. The construction is based on the ELO RM method by Juuti and Kopra (2016), and used two NPD projects as a source for the lessons-learned material. The most relevant success factors in this particular business environment are, in no particular order: *maturity of outcome*, *commitment & energy level*, *competence availability*, *facilities & premises*, *plan & schedule*, *project risks*, *partners' performance*, *project budget*, *partners' compatibility*, *SMART project goals* and *industry megatrend*. These, including their definitions for achieving a *poor*, *adequate* or *good* status, is presented in table 4.1 found in the results section of the thesis. The causal relationships between these success criteria and several other success factors are presented in figure 4.1. The relationship between factors is an important part of being able to identify the most relevant ones. The novelty of this answer is to be able to present the relationships and the most important factors for success in NPD projects for this particular R&D unit and its business environment. This, along with the tool created, will allow the case company to quickly identify the health of any particular NPD project and the entire NPD project portfolio. The outcomes will also save project management from having to identify risk factors for every new project, as these are deemed to be the most relevant ones in this context and can be used to evaluate projects of similar stature.

The second research questions, *How is it possible to identify these particular success factors?*, is answered using a theoretical foundation including knowledge based on small group facilitation, champion tools and experiential learning oriented risk management methods. The theoretical foundation is used in conjunction with workshops to create empirical data The empirical data shows which success factors affect the particular en-

vironment the most and which factors a project team can influence and measure. The outline of the method is presented in figure 2.9 and is based on the ELO RM method presented by Juuti and Kopra (2016).

6.2 Future work

The project risk management tool will be integrated into routines in NPD projects at the case company and will be deployed in future projects. While in use, and as projects are completed, they will be compared against the first version of the risk management tool created in this thesis. This practice will be used to validate the effectiveness of the tool. If discrepancies are noticed the tool will be modified to more accurately reflect the business environment.

The created tool has sparked interest within the case organisation, and there has been a request from another R&D unit to create a similar tool for their environment. This will create an interesting opportunity to compare how the two R&D units' environments differ from each other.

REFERENCES

Baccarini, D. (1999). The Logical Framework Method for Defining Project Success. *Project Management Journal* 30.4, 25–32.

Bens, I. (2012). *Facilitating with Ease! Core Skills for Facilitators, Team Leaders and Members, Managers, Consultants, and Trainers*. Hoboken: John Wiley & Sons, Incorporated, 1–228.

Cooke-Davies, T. (2002). The "real" success factors on projects. *International Journal of Project Management* 20.3, 185–190.

Davis, J., Fusfeld, A., Scriven, E. and Tritle, G. (2001). Determining a project's probability of success. *Research-Technology Management* 44.3, 51–57.

Fortune, J. and White, D. (2006). Framing of project critical success factors by a systems model. *International Journal of Project Management* 24.1, 53–65.

Gericke, K. (2011). Enhancing Project Robustness: A Risk Management Perspective. PhD thesis. Technische Universität Berlin, 12–18.

Herbert, A. (2010). Facilitator, Researcher, Politician, Magician. *Simulation & Gaming* 41.5, 681–693.

Hogan, C. (2002). *Understanding Facilitation: Theory and Principles*. London, England: Kogan Page.

Juuti, T. and Kopra, M.-J. (2016). NPD Risk Management with Experiential Learning Oriented Method. *NordDesign 2016 Proceedings Part 2*, 390–399.

Juuti, T., Kopra, M.-J., Lehtonen, T., Tuokko, R. and Lanz, M. (2015). *Champion tools: The facilitator's handbook*. Tampere: Tampere University of Technology, 1–68.

Juuti, T. and Lehtonen, T. (2010). Design management in product development organisation - the elaboration of comprehensive design management model. *NordDesign 2010 Conference, 25-27 August, 2010, Göteborg, Sweden*, 65–74.

Kasanen, E., Lukka, K. and Siitonen, A. (1993). The constructive approach in management accounting research. *Journal of Management Accounting Research* 5, 243–264.

Kolb, D. A. (1984). *Experiential learning*. Englewood Cliffs, NJ: Prentice-Hall.

Kolb, D., Boyatzis, R. and Mainemelis, C. (2000). Experiential Learning Theory: Previous Research and New Directions, in in Perspectives on Thinking, Learning and Cognitive Styles.

Kopra, M.-J. (2012). Facilitating Experience-based Learning in Groups: A Method for Capturing Lessons Learned. PhD thesis. Tampere University of Technology, 1–240.

Lubit, R. (2001). The keys to sustainable competitive advantage: Tacit knowledge and knowledge management. *Organizational Dynamics* 29.3, 164–178.

Nonaka, I. and Takeuchi, H. (1995). *The Knowledge Creating Company: How Japanese Companies Create The Dynamics Of Innovation*. Vol. 29.

Takeuchi, H. (2006). The New Dynamism of the Knowledge-Creating Company. Japan, Moving toward a More Advanced Knowledge Economy. Volume 2. Advanced Knowledge-Creating Companies. 2006, 1–9.

Wateridge, J. (1995). IT projects: a basis for success. *International Journal of Project Management* 13.3, 169–172.

White, D. and Fortune, J. (2002). Current practice in project management - an empirical study. *International Journal of Project Management* 20.1, 1–11.

Wit, A. de (1988). Measurement of project success. *International Journal of Project Management* 6.3, 164–170.

A FOCUSCHAMPION CARDS

This appendix contains all of the FocusChampion cards used in the thesis. The FocusChampion cards contain project success factors identified from the literature, and is a part of the Champion Tools research project by Juuti, Kopra et al. (2015). The Champion Toolbox contains 41 FocusChampion cards with each card having visible success factor on one side and a descriptive text on the other. How the participants of workshops 1 and 2 voted on the cards is available in chapter 3 and in appendix B.

Due do the amount of cards, they are split into two tables. Table A.1 shows cards 1-20, while table A.2 shows cards 21-41.

Table A.1. *FocusChampion Cards 1-20.*

No.	Area	FocusChampion Card	Decription
1	Industry	Industry megatrends	Where is the industry going? How is the industry developing? What targets and motives influence the development? Which trends need to be taken into account when making decisions for our future?
2	Industry	Available funding	What financial instruments are available for the project?
3	Industry	State of the art	What are the state of the art solutions in the industry at the moment?
4	Industry	Market position	What is the market situation and conditions? How will the project deliverables differ from other available solutions?
5	Value chains	Value creation mechanisms	How do the project deliverables create value for our company?
6	Value chains	Partners' value creation	How do the selected partners create value for the project?
7	Value chains	Partners' motivation	Why are partners participating in the project? What is the reason for the co-operation? How do the project deliverables create value for partner companies?
8	Value chains	Partners' value capture	How are investments, risk and deliverables devided between partners? What is each partner offering to the project? What risks do each partner have to accept? What does each partner gain from the project?
9	Value chains	Stakeholders	Who is involved in the project during its whole lifetime? Who are the direct stakeholders in the project? Who are the indirect stakeholders in the project?
10	Investments	Investors' motives & targets	Why do investors participate in the project? What are the investors´ main targets in the project?
11	Investments	Investors' requirements & restrictions	What do the investors expect from the project at different phases of its lifetime? Do investors have requirements for the (intermediate) project deliverables? Do investors have requirements for the project schedule? How will investors follow the project's progress?
12	Investments	Investors' awareness & commitment	How can we increase investors' awareness of the project? How can we increase investors' understanding of the project's value? How will the investors accept the project? How do we get investors to participate in the project?
13	Competencies	Project manager	Does the project manager have enought time available for the project? Is the project manager motivated to lead the project? Is the project manager able to influence other people? Does the project manager have credibility and a good reputation in the organisation?
14	Competencies	Partners	What kind of partners are needed in the project? What kind of external expertise or resources are needed in the project?
15	Competencies	Core competencies	What kind of competencies are needed in the project?
16	Competencies	Competence availability	Where are the necessary core competencies located? Are the necessary core competencies available for the project?
17	Competencies	Partners' references	Are partners able to do what they have promised? Do (new) partners´ teams or individuals have convincing references for their previous deliverables?
18	Co-operation	Strategic Fit	Do partners´ strategies and visions conflict with each other? Do partners´ strategies and visions fit the project?
19	Co-operation	Organisational commitment	How committed are the partner organisations to the project? Does the project have a sponsor?
20	Co-operation	Partners' values, norms & beliefs	How do organisational cultures in partner companies support the project goals?

Table A.2. *FocusChampion Cards 21-41.*

No.	Area	FocusChampion Card	Decription
21	Co-operation	Trust between partners	Does the trust level between companies enable the planned co-operation?
22	Co-operation	Legal agreements	What legal agreements (including IPRs) are needed to enable the planned co-operation?
23	Co-operation	Existing relationships	Do we have existing networks that could be used in the project?
24	Project planning	Deliverables & work modes	How are deliverables divided and agreed with the partners? Which deliverables require specific work modes and how have the required work modes been agreed with the partners?
25	Project planning	SMART project goals	How are project goals formulated? Specific, Measurable, Achievable, Realistic, Timed.
26	Project planning	Plan & schedule	Does the project have enought time, money and personnel, as well as, competence to carry out the planned work amount and deliverables? Is the critical path of the project known?
27	Project planning	Post-project activities	What happens after the project closure? How are project deliverables used in the future? Which partners also take part in the post project phase?
28	Project planning	Project budget	How are necessary work modes taken into account when planning the project budget?
29	Project planning	Change requests	Is the project progressing as planned? Are the original project goals and planned deliverables still valid?
30	Project planning	Project risks	Have we identified the project risks? Have we discussed the risks with the project personnel? Have we discussed the risks with the partners?
31	Project planning	Up-to-date public information	How do partners get the information regarding project status, changes and upcoming events?
32	Project planning	Non-disclosed information	How is critical information identified? How is non-disclosed information managed safely?
33	Operational viewpoints	Processes, methods & routines	Have we agreed such processes, methods and routines with the partners that the planned work modes are feasible?
34	Operational viewpoints	(ICT) tools	Have we agreed such (ICT) tools with the partners that the planned work modes are feasible?
35	Operational viewpoints	Facilities & premises	Do we have the facilities and premises that mean the agreed work modes are possible?
36	Project culture	Trust, commitment & energy level in the project	How can we energise the project personnel?
37	Project culture	Individuals' commitment, motivation & drive for results	Does the project personnel want to achieve results?
38	External relations	Up-to-date information for stakeholders	How external stakeholders get information regarding project status, changes and upcoming events?
39	External relations	Attracting stakeholders' interest	How can we attract the stakeholders' attention and increase their interest in the project? How can we get the stakeholders' involved in the project?
40	External relations	Stakeholders' trust commitment & energy level	How can we energise the stakeholders?
41	External relations	Stakeholders' commitment, motivation & drive for results	Do the stakeholders want to achieve results?

B WORKSHOP FOCUSCHAMPION CARD VOTING

The next page of this appendix shows table B.1, where the raw data of how participants in workshops 1 and 2 voted on the FocusChampion cards. The table shows how many positive and negative votes each card got in each of the workshops. It also shows the combined positive and negative votes for each card and a count of the number of votes. This data has been used in the creation of the cause and effect chart visible in chapter 4 and in appendix C. The FocusChampion cards contain project success factors identified from the literature, and is a part of the Champion Tools research project by Juuti, Kopra et al. (2015). The Champion Toolbox contains 41 FocusChampion cards with each card having visible success factor on one side and a descriptive text on the other. All of the FocusChampion cards and their descriptions are available in appendix A.

Table B.1. *FocusChampion voting results from workshops 1 and 2.*

No.	Area	FocusChampion Card	WS1 Pos.:	WS1 Neg.:	WS2 Pos.:	WS2 Neg.:	Comb. Pos.:	Comb. Neg.:	Tot.	# Votes:
1	Industry	Industry megatrends	2	0	3	0	5	0	5	5
2	Industry	Available funding	3	0	0	0	3	0	3	3
3	Industry	State of the art	2	0	3	0	5	0	5	5
4	Industry	Market position	4	0	3	0	7	0	7	7
5	Value chains	Value creation mechanisms	2	0	4	0	6	0	6	6
6	Value chains	Partners' value creation	3	-1	3	-1	6	-2	4	8
7	Value chains	Partners' motivation	3	0	1	0	4	0	4	4
8	Value chains	Partners' value capture	1	-1	1	0	2	-1	1	3
9	Value chains	Stakeholders	0	0	0	0	0	0	0	0
10	Investments	Investors' motives & targets	1	0	1	0	2	0	2	2
11	Investments	Investors' requirements & restrictions	0	0	1	0	1	0	1	1
12	Investments	Investors' awareness & commitment	0	0	1	0	1	0	1	1
13	Competencies	Project manager	3	0	3	0	6	0	6	6
14	Competencies	Partners	3	0	2	-1	5	-1	4	6
15	Competencies	Core competencies	5	0	3	0	8	0	8	8
16	Competencies	Competence availability	1	-2	3	0	4	-2	2	6
17	Competencies	Partners' references	1	-3	0	-4	1	-7	-6	8
18	Co-operation	Strategic Fit	1	0	1	0	2	0	2	2
19	Co-operation	Organisational commitment	3	0	0	-1	3	-1	2	4
20	Co-operation	Partners' values, norms & beliefs	1	0	0	-3	1	-3	-2	4
21	Co-operation	Trust between partners	3	0	4	0	7	0	7	7
22	Co-operation	Legal agreements	2	0	0	0	2	0	2	2
23	Co-operation	Existing relationships	4	0	4	0	8	0	8	8
24	Project planning	Deliverables & work modes	2	0	2	-4	4	-4	0	8
25	Project planning	SMART project goals	0	-3	1	-3	1	-6	-5	7
26	Project planning	Plan & schedule	0	-4	3	-2	3	-6	-3	9
27	Project planning	Post-project activities	0	0	3	0	3	0	3	3
28	Project planning	Project budget	2	0	0	-4	2	-4	-2	6
29	Project planning	Change requests	1	0	0	-2	1	-2	-1	3
30	Project planning	Project risks	3	-1	4	0	7	-1	6	8
31	Project planning	Up-to-date public information	0	-2	0	-2	0	-4	-4	4
32	Project planning	Non-disclosed information	2	0	0	0	2	0	2	2
33	Operational viewpoints	Processes, methods & routines	1	-2	0	-3	1	-5	-4	6
34	Operational viewpoints	(ICT) tools	1	0	1	-2	2	-2	0	4
35	Operational viewpoints	Facilities & premises	1	-3	4	0	5	-3	2	8
36	Project culture	Trust, commitment & energy level in the project	4	0	4	0	8	0	8	8
37	Project culture	Individuals' commitment, motivation & drive for results	5	0	4	0	9	0	9	9
38	External relations	Up-to-date information for stakeholders	0	0	2	-1	2	-1	1	3
39	External relations	Attracting stakeholders' interest	0	0	3	0	3	0	3	3
40	External relations	Stakeholders' trust commitment & energy level	0	0	3	0	3	0	3	3
41	External relations	Stakeholders' commitment, motivation & drive for results	3	0	4	0	7	0	7	7

C EXPERIENTIAL LEARNING ORIENTED RISK MANAGEMENT TOOL

This appendix contains all the main results of the thesis. The results are discussed in chapter 4. The results are the output of the construction of the thesis.

Figure C.1 shows the most important topics for NPD projects in the case organisation, according to two reference projects and knowledge from the participants of workshops 1, 2 and 3.

Figure C.1 shows the main result of the thesis, which is a NPD project risk management tool. The criteria are selected and modified from the cause and effect chart in figure C.1 by the case unit management team and the author. The criteria are placed in a 3-level anchored scale, where each criterion is given a descriptive text for a *poor*, *adequate* or *good* status. The criteria, along with the descriptive texts, show the values of the case company and R&D unit, along with their ambitions.

Figure C.1. *Case unit cause and effect chart.*

Table C.1. NPD risk management tool.

CRITERIA	STATUS		
	Poor	**Adequate**	**Good**
Maturity of outcome	At its current maturity the project is not fulfilling most, or is severely failing on one or more project goals.	At its current maturity level the project fulfills most of the goals, but fail at some of them.	The outcome is currently fulfilling all of the set goals.
Commitment & energy level	The energy level of the project is low.	The energy level of the project is on an adequate level.	Project members are eager and have a high energy towards the project.
Competence availability	All necessary core competencies are not available yet.	Core competencies are available, but are split between too many projects.	Core competencies are available and are able to fully committed to this project.
Facilities & premises	We lack the core facilities & premises in our network to achieve our work modes or the network lacks sufficient capacity to achieve our work modes without severily affecting timeframe or budget.	We have all the core facilities & premises in our network to achieve the work modes and have the capacity to achieve the set work modes at a slight cost of timeframe or budget.	The facilities & premises in our network fully support all the necessary work modes and have the capacity to achieve our work modes within expected timeframe and budget.
Plan & schedule	No schedule for project stages has been made.	Project stage transition is late by more than 1 month.	Project is behind plan and scheduled stage transition has not happened.	Project is within schedule and in the correct stage of development.
Project risks	Project risks have not been identified or are severe. |$\geq$500 FMEA points on any one item	Patent conflicts or patent landscape not identified.	Compliance not acceptable or untested.	Project risks are identified and are moderate on some points. ||$\geq$125 FMEA points on any one item	Minor patent infringements OR outcome not protected.	Compliance not tested by external agency.	Project risks are identified and under control.
Project budget	A project budget has not been made.	Project costs are more than 50% over project budget.	Current project costs are more than 10% over budget.	Project costs are within or maximally 10% over project budget.
Partners' performance	Partners are not performing as expected and fail on two of the following: budget / timetable / outcome.	Partners are performing according to expectations, but are failing on one of the following: budget / timetable / outcome.	Partners are exceeding our expectations and are not failing on any of the following: budget / timetable / outcome.
Partners' compability	Partners' culture, practices have a negative impact on project.	Partners have shown strategic conflicts.	Partners' culture, practices have no negative impact on project.	Partners have shown no strategic conflicts.	Partners' culture, practices make co-operation effortless.	Partners have shown exceptional strategic fit.
SMART project goals	Project goals are unspecified and lack 3-4 of the following qualities: specific, measurable, attainable, relevant, timed.	Project goals lack 1-2 of the following qualities: specific, measurable, attainable, relevant, timed.	Project goals are well defined and are specific, measurable, attainable, relevant and timed.
Industry megatrend	Current solutions are not aligned with industry megatrends.	Current solutions are aligned with, but are not at the forefront of industry megatrends.	Current solutions are at the forefront or ahead of industry megatrends.