Lappeenranta University of Technology
School of Industrial Engineering and Management

Learning from projects: a qualitative metasummary

10.12.2014
Tuomo Virolainen
Examiner: Professor Tuomo Uotila
Supervisor: Research specialist Hannele Lampela

Abstract

Author:	Tuomo Virolainen
Title:	Learning from projects: a qualitative metasummary
Faculty:	School of Industrial Engineering and Management
Degree Program:	Master's Degree in Knowledge Management and Information Networks
Year:	2014
Master's Thesis:	84 pages, 9 figures, 5 tables and 3 appendixes
Examiners:	Professor Tuomo Uotila Research specialist Hannele Lampela
Keywords:	project management, knowledge management, lessons learned qualitative metasummary

The objective of this thesis was to form an understanding about the common gaps in learning from projects, as well as possible approaches to bridging them. In the research focus were the questions on how project teams create knowledge, which factors affect the capture and re-use of this knowledge and how organizations can best capture and utilize this project-based knowledge. The method used was qualitative metasummary, a literature-based research method that has previously been mainly applied in the domains of nursing and health care research. The focus was laid on firms conducting knowledge-intensive business in some form of matrix organization.

The research produced a theoretical model of knowledge creation in projects as well as a typology of factors affecting transfer of project-based knowledge. These include experience, culture and leadership, planning and controlling, relationships, project review and documentation. From these factors, suggestions could be derived as to how organizations should conduct projects in order not to lose what has been learned.

Tiivistelmä

Tekijä:	Tuomo Virolainen
Opinnäytteen nimi:	Projekteista oppiminen: laadullinen metayhteenveto
Tiedekunta:	Tuotantotalouden tiedekunta
Koulutusohjelma:	Tietojohtamisen ja informaatioverkostojen maisteriohjelma
Vuosi:	2014
Diplomityö:	84 sivua, 9 kuvaa, 5 taulukkoa ja 3 liitettä
Tarkastajat:	Professori Tuomo Uotila Erikoistutkija Hannele Lampela
Hakusanat:	projektijohtaminen, projektinhallinta, tietojohtaminen laadullinen metayhteenveto

Tutkielman tavoitteena oli selvittää, miten projektiorganisaatiot luovat tietoa, mitkä asiat vaikuttavat muodostuvan tiedon talteen saamiseen ja miten tätä tietoa voidaan parhaiten saada organisaation hyödynnettäväksi myös projektin päätyttyä. Menetelmänä tutkimuksessa käytettiin kirjallisuuskatsauksiin lukeutuvaa laadullista metayhteenvetoa, jota aikaisemmin on sovellettu lähinnä hoito- ja terveystieteissä. Tarkastelu rajattiin matriisiorganisaatiota käyttäviin tietointensiivistä liiketoimintaa harjoittaviin yrityksiin.

Tutkimuksen tuloksena muodostettiin teoreettinen projektitiedon luomisen malli sekä kartoitus projektioppimiseen vaikuttavista tekijöistä. Näitä ovat kokemus, organisaatiokulttuuri ja johtaminen, suunnittelu ja projektinhallinta, suhteet, projektin arviointi ja dokumentaatio. Näistä tekijöistä johdettiin suosituksia projektien suunnitteluun ja hallintaan oppimisen mahdollistamiseksi.

Preface

The process of writing this thesis has been, due to different factors, an unexpectedly convoluted one. Challenging as it has at times been, support from various people has made it manageable. I would like to thank my supervisor Dr. Hannele Lampela for help and comments along the way, Elina Salminen for proofreading an early manuscript version and my former and current employers for their flexibility and patience. Lastly and foremost, I am grateful to the Lappeenranta University of Technology for the immensely rewarding yet challenging study program, which has lit a lot of light bulbs in my head along its course while simultaneously being, at least most of the time, kind of fun.

Helsinki, 10.12.2014

Tuomo Virolainen

> *Man fängt eine Arbeit nicht an, um sie aufzugeben, sondern um sie zu vollenden; - ein begonnenes Werk und sei es scheinbar noch so belanglos, halb getan und liegen gelassen, verwest und vergiftet den Willen, so wie eine unbegrabene Leiche die Luft eines ganzes Hauses verpestet.*
>
> *You do not begin a task in order to abandon it, but to complete it. A task, however unimportant it appears, once begun and left half finished, corrodes the will with its poison, just as an unburied corpse pollutes the air of the whole house.*
>
> Gustav Meyrink, *Der weiße Dominikaner* (transl. Mike Mitchell)

Contents

Appendices

List of Figures

List of Tables

1 Introduction

In the present state of corporate consensus, it begins to seem a truism to note that intensifying competition, globalization, focus on innovativeness and an increasingly hectic pace of change in the competitive environment have rendered knowledge and knowledge-related capabilities, systems and processes the main assets for firms operating in today's market (Grant, 1996a; Teece, 1998; Nahapiet and Ghoshal, 1998). In pursuit of flexibility and adaptation in the face of these challenges, the tactic of establishing cross-functional projects as extensions of line organizations has recently been gaining increasing importance (Sense and Antoni, 2003). These developments have put pressure on management scholars to study the regularities of knowledge flows in projects as well as to use the burgeoning theoretical understanding to create strategies for capturing and integrating knowledge from projects into the wider organization (Lindner and Wald, 2011). Learning from projects, however, has been identified as a common bottleneck in the knowledge processes of organizations (Lyytinen and Robey, 1999; Schindler and Eppler, 2003). The inability of firms to harvest and integrate project knowledge has been reported in studies universally enough to be christened with labels such as "project amnesia" or "knowledge drain" (Schindler and Eppler, 2003; Aramo-Immonen and Vanharanta, 2009; Jugdev and Wishart, 2014). This phenomenon can lead organizations conducting projects to "re-invent the wheel" as the lessons learned in previous projects are not transferred to new project endeavors (Prusak, 1997; Prencipe and Tell, 2001). Although this problem is well recognized, it has proved a tough nut to crack in practice. It is the purpose of this study to investigate the mechanics of this question, to assess methods for capturing project-based knowledge and to identify their success factors.

1.1 Background

Projects, or temporary organizations as they are often termed, are an increasingly common approach to organizing work in both business firms and the public sector.

This projectization blurs the clear-cut picture of the hierarchical functional organization as organizations launch cross-functional projects, adopt matrix organization models or, at the extreme, base their whole operations around projects, becoming project-based organizations or PBOs (Hobday, 2000). Increased emphasis on projects calls for a solid theoretical understanding of the idiosyncrasies of project work and, foremost, how this knowledge can be combined with empirical experience and transformed into suitable models, processes, tools and practices for project management (Project Management Institute, 2008). Since the knowledge-based view of the firm (KBV) paradigm holds that the main resources and success factors of any organization are knowledge and knowledge-related competences, it follows that the management of knowledge and learning are of crucial importance in temporary as well as permanent organizations (Grant, 1996a; Williams, 2008). This also implies that since most organizations are mixing both functional and project-based work, the management of project-based knowledge and its integration to the organizational knowledge base are increasingly pressing challenges for firm-level knowledge management as well.

Projects are inherently complex, highly goal-oriented, one-off endeavors where problem-solving activities are at the core (Jugdev, 2012; Cacciatori et al., 2011). Since projects are commonly launched to increase organizational flexibility and to perform tasks requiring innovation, and because cross-functional teams bring together people from different parts of the organization, they could be *a priori* thought to be hotbeds of organizational learning (Edmondson, 2002; Bresnen et al., 2004; Hobday, 2000). While extensive research clearly points that knowledge creation is a typical by-product of project work, the research on whether and to which extent organizations learn from their projects is inconclusive and divided (Swan et al., 2010). Although learning within projects does occur, organizations all too often fail to translate this created knowledge into organizational practices, routines and capabilities (Newell et al., 2003). A major part of the factors contributing to the difficulties of knowledge transfer lie in the very nature of project work, such as discontinuities

in processes, human resources, time and other such dimensions - indeed, some of the very same factors to which many core strengths of project work are attributed (Bresnen et al., 2002; Sense and Antoni, 2003).

Failure to re-use project-based knowledge and to integrate it into to the wider organizational knowledge base is a pressing managerial concern that is further exacerbated by the ongoing trend towards increased projectization in organizations (Bresnen et al., 2002; Williams, 2008). As competition is constantly increasing and the value of knowledge-related capabilities as the keys to competitive advantage becomes further recognized, firms are under pressure to develop procedures for capturing lessons learnt in projects and embedding them into organizational practices, instead of repeating past mistakes and inventing things all over again. As Edmondson (2002, p. 128) formulated, *"an organization can be said to learn when its actions have been modified as a result of reflection on new knowledge or insight"*. Adopting this perspective, organizations can be said to actually learn from projects, instead of merely documenting lessons, when this acquired knowledge has an actual influence on how the firm functions. Although there is commonly no lack of various information outputs from projects, the value of knowledge that is not utilized is questionable (Grant, 1996b). As the famous quote from the philosopher George Santayana's The Life of Reason has it, *"those who cannot remember the past are condemned to repeat it"* (Santayana, 2005). Perhaps nowhere is this phenomenon more palpable than in project management, where both mistakes as well as inventions are often repeated without perspective from their precedents.

1.2 Purpose and position of the study

The objective of this study is to form an understanding about the common gaps in project learning, as well as possible approaches to bridging them. This objective is attained by aggregating and systematically analyzing extant peer-reviewed academic studies on project learning using the qualitative metasummary method. The

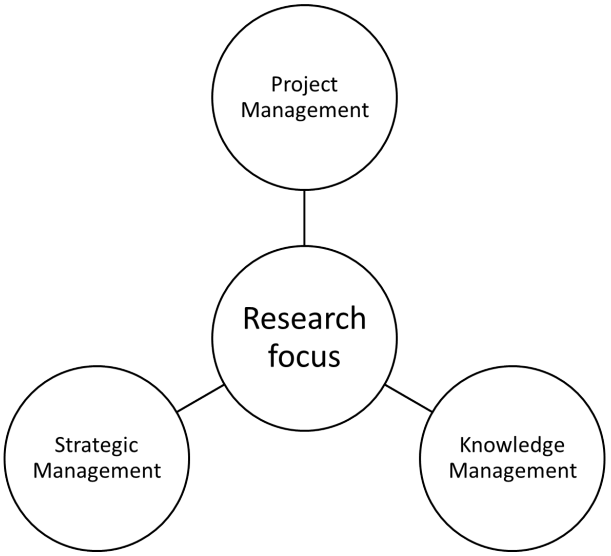

Figure 1: Position of the study

focus is on organizations utilizing project teams inside some variety of the matrix organization model.

As the focus of the study is on knowledge management in the project context, the research is positioned at the intersection of fields of research such as knowledge management, project management and strategic management. Since the studied data is collected from published research literature on the subject, this study classifies as secondary research.

1.3 Research questions

This study aims to address the following research questions:

Q1 *How do project teams create knowledge?*

Q2 *Which factors affect the capture and re-use of project-based knowledge in organizations?*

Q3 *How can organizations best capture and utilize project-based knowledge?* (main question)

In order to answer the main research question, a theoretical understanding on knowledge creation in project teams is needed. This is achieved by analyzing and synthesizing literature from the fields of knowledge management and project management. Based on this discussion, an integrative framework of knowledge creation in projects is proposed as a conclusion to chapter 3. After this discussion, the second and third question are answered based on an analysis of data collected via a literature survey in chapter 6.

1.4 Exclusions and limitations

The focus of this study is on organizations using project teams as extensions to the functional organization. Since it is assumed that the studied project teams are composed of personnel from separate organizational functions, working in parallel with the ongoing operation of the line organization, firms doing mainly project-based work, or project-based organizations (PBO's), are excluded from this study. A more in-depth discussion of the demarcations based on organizational structure is presented in chapter 2.3.

Another exclusion based on organizational context is the nature of work conducted in the organization. In this study, learning and knowledge processes in projects where knowledge-intensive work is conducted are analyzed. Thus, projects in fields such as construction, shipbuilding and such are excluded, as are pure software engineering projects, in which highly specialized project models and methods are typically utilized. Although these areas are excluded from the research focus and data sample, conceptual models and other research findings from the excluded areas are utilized in the theoretical discussion and framework-building phases along with other research with tangents on the focal points of this research.

1.5 Methodology

Since the topic of this study is complex, somewhat unexplored and hard to quantify, and as the purpose is to form an understanding by analyzing and synthesizing conceptual models and theories, a qualitative research approach is adopted (Hirsjärvi et al., 2009). The analysis is conducted using *qualitative metasummary*. Qualitative metasummary is essentially a form of systematic review that can be used to aggregate, synthesize, refine and evaluate extant research data to form a holistic picture of a research topic (Virtanen and Salanterä, 2007; Sandelowski and Barroso, 2003). Qualitative metasummary is a rather novel method that originates from nursing and health care research and has not been previously applied in research on knowledge or project management, although some better known and more widely applied literature survey methods are closely related to it (Salminen, 2011). A characteristic feature of the qualitative metasummary method is the calculation of quantitative statistics, *intensity effect sizes* and *frequency effect sizes*, from processed secondary data, which are then used to assess the relative significance of the used sources and extracted findings in the overall analysis (Sandelowski et al., 2007). A detailed presentation and description of the data collection and methods of analysis are provided in chapter 4.

Qualitative metasummary was chosen as the research method based on multiple viewpoints. For one thing, learning from projects is a field where a clear discrepancy between organizational objectives and actual practice seems to exist: the importance of project learning is recognized but rarely satisfactorily achieved (Williams, 2008). Although methods for circumventing the *project amnesia* -phenomenon exist and are applied, their effectiveness is often questioned (Swan et al., 2010). Although there is no lack of academic studies relating to the management of knowledge in projects, the large number of different research perspectives, terminological ambiguity and a difficulty of forming an overall picture of the variables at play in these processes signal a need to summary and evaluate the current state of research. Due to these

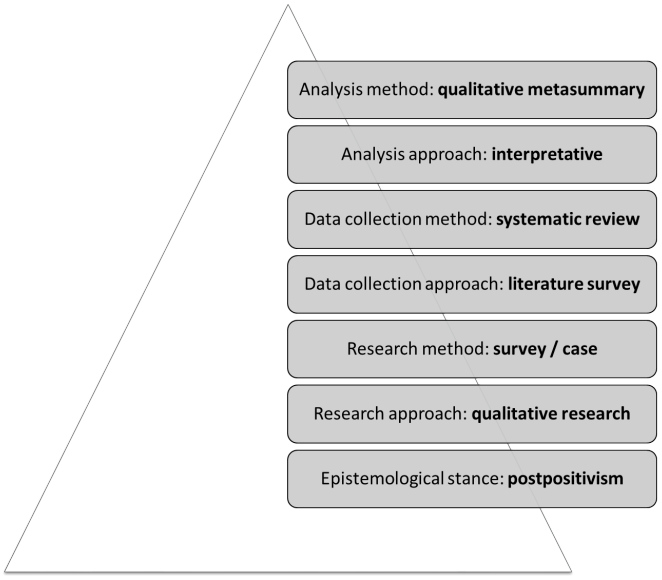

Figure 2: Research approach and methods

considerations, it is worthwhile to gain a "birds-eye view" on what reasons for these phenomena the current body of literature has unearthed and which factors seem to contribute to knowledge drain or successful knowledge capture from projects. Qualitative metasummary contains an structured process to collect and analyze a set of relevant literature and to extract the needed information out of it. What is more, qualitative metasummary contains a process to weigh different research findings and to compare their prevalence in research. Second, since qualitative metasummary has thus far remained a rather obscure method that has mostly been used to summarize research from nursing and health care studies, its application in a totally different field is a methodological experiment that can provide insight on the suitability of this approach for summarizing research in management studies.

According to Hirsjärvi et al. (2009), research strategies can be classified into three distinct categories: experiential studies, survey studies and case studies. In this taxonomy, the qualitative metasummary method falls in the middle ground between survey and case methods. Since the objective of the study is to understand and explain the studied phenomena, an interpretative analysis approach is adopted. Figure 2 summarizes the methodological and philosophical standpoints of this research.

1.6 Structure of the study

The basic structure of this thesis can be broken down into four main parts: introduction (chapter 1), theoretical part (chapters 2-4), empirical section (chapter 5) and discussion & conclusions (chapter 6).

The first chapter functions as an introduction to the themes, concepts and objectives of this study. Research questions as well as an overview of the methodological basis, exclusions and the structure of this study are also presented.

Chapter 2 marks the beginning of the theoretical part of the study. In this chapter, general concepts as well as central models and theories on project management are presented. Chapter 3 will shift the focus from general project management to knowledge and its management in project contexts. In this part, taxonomies of project knowledge and theories of project learning are presented, knowledge creation and transfer mechanisms in projects are discussed and crucial factors affecting these processes are identified. To conclude the theoretical discussion, an integrative framework describing the knowledge creation process in projects is presented. A preliminary summary of factors affecting project learning is also included.

In chapter 4, the methodological standpoints and data collection process of study are described. The collected data is analyzed in chapter 5. A discussion of the findings is presented in chapter 6 along with their implications for both managerial practice and further research.

2 Project work and management

Although humans have conducted large-scale work requiring careful planning and coordination of personnel since prehistoric times, these endeavors do not qualify as projects in the modern sense of term. The discipline known as project management developed along with strategic management from the 1950's onwards, although the earliest attested example of the term *project manager* is from the year 1913 (Pelin, 2004). In order to understand the foundational concepts and central terms in project management, the fundamental theoretical standpoints of the discipline are briefly discussed in this chapter.

2.1 Definitions

According to the dictionary definitions, the term *project* is derived from Latin. It is a combination of the prefix *pro-* (forwards, forth) and *iacere* (to throw or cast), apparently meaning "something thrown forth". In the light of etymology, it would seem that project can be seen as something to launched towards a goal, especially since the term *projectile* is derived from the same expression. It is interesting to compare this etymology to the definition of the English term *project* presented in Longman English Dictionary.

> 1 : a specific plan or design : SCHEME 2 obs : IDEA 3 : a planned undertaking: as a : a definitely formulated piece of research b : a large usu. government-supported undertaking c : a task or problem engaged in usu. by a group of students to supplement and apply classroom studies 4 : a usu. public housing development consisting of houses or apartments built and arranged according to a single plan

While the definitions for the original Latin term highlight concrete action towards a goal, the modern English general definition stresses *planning* as the characteristic trait of project work. This notion is telling, since specialized definitions of project management are built around these core characteristics.

Unsurprisingly, manifold definitions of the modern concept "project" exist. Perhaps the most influential and widely accepted definition is presented in Project Management Institute's *Guide to the Project Management Body of Knowledge* or *PMBOK*, as it commonly abbreviated. According to this definition, *"a project is a temporary endeavor undertaken to create a unique product, service, or result"* (Project Management Institute, 2008). Along with the goal-orientedness, uniqueness and temporary nature stressed in this definition, projects are characterized by stated goals as well as varying yet often high degrees of complexity and risk (Koskinen et al., 2003). A project has an organization, led by a project manager, and allocated resources (Turner and Müller, 2003). Projects also always have a customer for whom the produced product or service is delivered, be it an organization or individual person, internal or external to the producing company (Kasvi et al., 2003). According to Pelin (2004, p. 35), clear organization, planning, monitoring and controlling are also defining features of projects. Although all projects are transitory, they are not necessarily short in duration.

Although the cumulating definitions of the term contain various characteristics that are indisputably typical for projects, scholars are divided as to *what* projects actually are. A fairly recent view, rooted in organization theory, holds that projects are not the actual body of work conducted but the organization formed to achieve this end (Turner and Müller, 2003; Pelin, 2004). According to the definition presented by Cleland and Kerzner (1985), a project is a *"A combination of human and non-human resources pulled together into a temporary organization to achieve a specified purpose"*. Since projects are by all definitions temporary undertakings, in the context of this view, projects can be called *temporary organizations* (Lundin and Söderholm, 1995).

In the context of this study, the term *project* is used to refer to the actions as a whole performed to achieve the stated goals, while the term temporary organization is used of the project organization conducting these activities. The definitions cited and summarized above are synthesized into the following definition: *"a project is an*

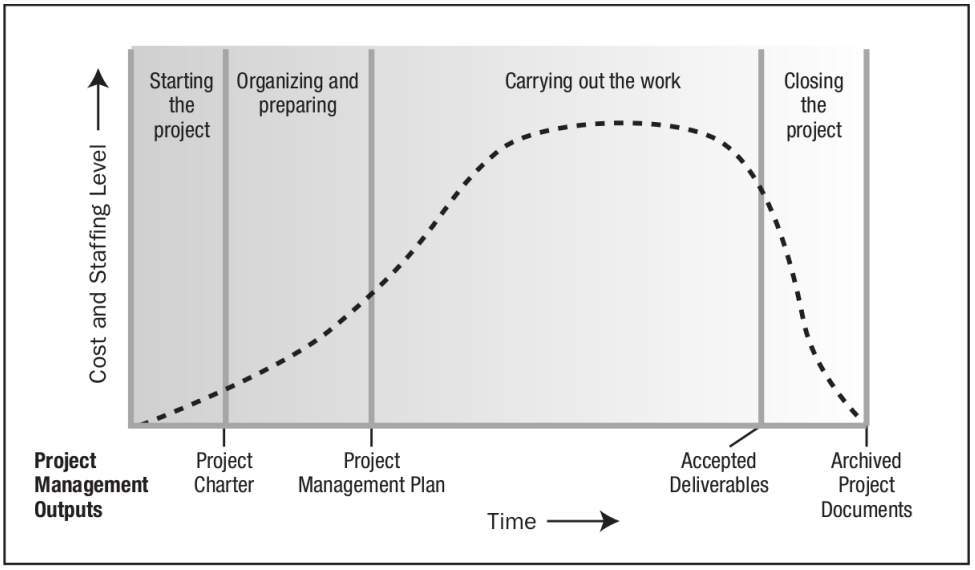

Figure 3: Project lifecycle (Project Management Institute, 2008)

endeavor conducted by a temporary organization led by a project manager to create a unique product, service, or result by following a predefined project plan, using allocated resources".

The art and science whereby projects are conducted and managed is termed, perhaps self-evidently, *project management*. According to a formal definition, project management is *application of knowledge, tools and techniques to organizational and project activities to achieve the aims of an organization through projects* (Project Management Institute, 2003).

One of the most central concepts of project management is the *project lifecycle*. This is a conceptual model which divides projects into successive phases. Most project lifecycle models divide projects into four or five phases with only minor differences. The model presented by PMBOK consists of *starting the project*, *organizing and preparing*, *carrying out the work* and *closing the project* (Project Management Institute, 2008). This is a high-level conceptualization which models the generic project phases at the highest possible level of abstraction in order to be applicable to projects of all scopes and goals.

2.2 Temporary organization theory

The increased projectization of work in recent years has brought forth challenges for management research. Since classical organization theory typically views firms as permanent entities, theoretical understanding of project-based organizing calls for extensions to previous body of research. An influential theory has been presented by Lundin and Söderholm (1995). In this model, a project team is viewed as a *temporary organization*, juxtaposed as a transitory entity to the permanent organization it serves. Building on behavioral and decision-based organization theory, the model is action-based.

Table 1: Corresponding project actions and lifecycle phases

Project phase	Project lifecycle phase
Action-based entrepreneurialism	Starting the project
Decoupling by bracketing	Organizing and preparing
Planned isolation	Carrying out the work
Institutionalized termination	Closing the project

According to Lundin and Söderholm, the defining characteristics for temporary organizations are *time, task, team* and *transition*. Time refers to the temporal orientation of a temporary organization. In contrast to permanent organizations, project organizations are created to have a limited lifespan. Although time is perceived as a valuable resource in permanent organizations as well, the scarcity of time appears more concretely for project organizations since they are "running out of time" as the termination point for the project approaches. In the theory of the temporary organization, time is perceived as a sequence of project phases. Management of project schedule is thus a sequencing task.

The second concept of the temporary organization theory is task. Task refers to the goal-oriented nature of projects. Since most definitions of the term present the project as way to achieve a certain goal, task can be perceived as the *raison d'être*

of the temporary organization and thus the prime cause of its activities. Although permanent organizations have their goals as well, these can be reformulated and reconsidered as firms renew their strategies. In contrast, a project is usually killed rather than be assigned new goals if its original objective becomes obsolete (Pelin, 2004).

Temporary organizations are comprised of people. The project manager and personnel form the team, the third building block of a temporary organization. While this certainly holds for any organization, project teams differ from other organizations in being *formed around tasks*, *created to be temporary* and typically being a *secondary place of assignment* for their personnel. In all but pure Project-Based Organizations project personnel have a primary role in the organization along with their work in the project, unless they are hired especially for the project (Lundin and Söderholm, 1995; Hobday, 2000). This characteristic is palpable in project teams. When viewing project teams as social units, two main relations can be conceptually separated: first, *the relationship between the team and the individual* and second, *the relationship of the team and its surroundings*. Each member of the team brings their personal expectations, skills, knowledge and experiences into the team. Synergies, conflicts or innovative new perspectives may arise. As the work progresses, new collective knowledge, skills, artifacts and project culture result (Ajmal et al., 2010; Kasvi et al., 2003). The outward relations of the project team are connected to legitimization, support and direction, all of which have an effect on the internal workings and relations of the team. As the project ends and the temporary organization dissolves, the relation of the team to its environment begins to concentrate on evaluation.

The last characteristic in Lundin & Söderholm's typology is transition. In their theory, this concept has two dimensions. First, it can refer to the actual transformation brought about via the project. As the project task is attained by conducting the relevant actions, a transition from "as-is" to "to-be"-state is brought about. The other aspect of transition in the model comes from the inner workings of the team;

the perceptions on causal relationships, values and behavior on both group- and individual levels needed in order to bring the concrete change about. In other words, in the course of time, the project team undergoes an inner transition while striving to attain its task. What this means is at heart an organizational change process at the level of a temporary organization. This second aspect of transition in Lundin & Söderholm's model comes conceptually close to *organizational culture*. Below is a well-known definition presented by Schein (2010, p. 18).

> The culture of a group can now be defined as a pattern of shared basic assumptions learned by a group as it solved its problems of external adaptation and internal integration, which has worked well enough to be considered valid and, therefore, to be taught to new members as the correct way to perceive, think, and feel in relation to those problems.

According to this - and most - definitions, organizational culture is formed in relation to problem-solving in relation to performance of tasks. Organizational culture serves as an organizational memory of sorts, as it is formed in successful collective problem-solving. Therein lies also the main problem of organizational culture: its tendency to hinder organizational change as it clings to solutions that were previously valid but the notion of which begins to drag the organization down as its environment changes (Schein, 2010). This phenomenon is sometimes called the *ossification of knowledge* (Berman et al., 2002). Due to the temporally limited lifecycle of projects, this problem does not typically hinder the performance of temporary organizations. It is probable that the potential for innovation so commonly attributed to temporary organizations is connected to this second aspect of transition in Lundin & Söderholm's theory.

Along with the four defining concepts in temporary organizations - time, task, team and transition - the theory also describes the different sequential phases in the lifecycle of a temporary organization. Since the theory is based on action, these phases describe the impetus for action in distinct phases of the project lifecycles from initiation to termination.

The first phase in the model is *action-based entrepreneurialism*. Since projects are by nature more or less unique undertakings, the formation and launch of a project requires entrepreneurial spirit similar to that required for the formation of a permanent organization. The initialization of temporary organizations is usually carried out by a process which Lundin & Söderholm call *mapping by rhetoric*. This entails using suitable rhetoric to give an impetus for the formation of a temporary organization. In the traditional project lifecycle model, this phase corresponds to the phase "starting the project" (Project Management Institute, 2008).

The second phase in the temporary organization theory is *fragmentation for commitment-building*. In this phase, the team is assigned a task, timetable and criteria for termination. First, the project is given a starting point which marks the "birth" of the temporary organization. As the project begins, the temporary organization is decoupled from its parent organization. In Lundin & Söderholm's terminology, this process is called *decoupling by bracketing*. Along with scheduling the second phase contains also *task definition by partitioning*. As the task of the project is defined and partitioned into smaller modules, it is fragmented analogously to time which is brought from an infinite continuum into a defined schedule. Fragmentation for commitment-building corresponds to the "organizing and preparing"-phase of a traditional project lifecycle (Project Management Institute, 2008).

The third phase is called *planned isolation*, which occurs during the execution of the project. A temporary organization works on its objectives in relative isolation. According to Lundin & Söderholm, this is achieved mainly through two strategies: planning and guarding. Planning fosters the isolation of the project organization as the temporary organization works by its own project plan and management. Further detachment from the surroundings of the temporary organization is achieved by guarding, which refers to the actions taken to concentrate on carrying out the project plans.

The last phase of action in the model is *institutionalized termination*. Institutionalized termination occurs at the last phase of the project lifecycle. In PMBOK, this phase is called "closing the project" (Project Management Institute, 2008). By definition, temporary organizations are formed to be dissolved as their task is complete. In Lundin & Söderholm's theory of the temporary organization, institutionalized termination encompasses two aspects: *recoupling by bracketing* and *bridging*. As the temporary organization is terminated, a "right bracket" to its lifecycle is set and the personnel once again adopt their roles in the mother organization, if they have one. A critical and easily neglected aspect of institutionalized termination is bridging, whereby experiences, knowledge and insights from the project work are transferred into the wider organization and to future projects.

2.3 Contextual factors in project management

While research aims to make sense of a complex reality by squeezing it into theoretical models and neat diagrams, it is easy to ignore the fact that innumerable contextual variables affect the way projects perform. This problem is recognized in PMBOK, where some eleven contextual factors are given in a list that is not designed to be complete (Project Management Institute, 2008, p. 14). Since projects are used in practically every field of work imaginable, it is challenging to isolate the factors affecting project performance and to get to the "core" of project management, or the factors which are common to all kinds of projects. In order to highlight the complexity of this topic, three main variables of project management are discussed in this chapter: *organizational structure*, *project management maturity* and *industry and purpose*.

2.3.1 Organizational structure

A key factor affecting the way projects can be conducted and which resources they can be allocated is organizational structure (Project Management Institute, 2008).

The classic organizational form is the functional organization, where the structure is hierarchical and divided into distinct functional units. While this traditional hierarchy is still valid for many kinds of organizational activities, the search for more flexible forms has brought forth other structures, where more focus is laid on project work. On the opposite end of this spectrum is the project-based organization (PBO), where most or all work is centered on projects and no functional departments exist (Wieviora et al., 2009). In the purest form of project-based organization, the role of the organization is limited to coordinating and integrating the various projects (Hobday, 2000). Matrix organization, in turn, is an intermediate structure mixing project-oriented and functional work. As so often happens, the real world does not totally confirm to this rigid conceptual typology. Instead, this spectrum from functional to project-based organizations should be taken as continuous, where firms can be functional, matrix or projectized to a certain degree. Building upon the work by Galbraight (1971, 1973) and Larson and Gobeli (1987, 1989), Hobday (2000) has presented a model (see Figure 3) in which organizations are classified into six categories: *functional*, *functional matrix*, *balanced matrix*, *project matrix*, *project-led organizations* and *project-based organizations*. In a purely functional organization (A), no cross-functional projects are conducted. In the other extreme, project-based organization (F), there are no functional departments at all. In organizations conforming to the other forms, line work and cross-functional projects are mixed in varying ratios. In the diagram, senior management of the organization is placed above other structures. Bars labeled F1, F2 and so on represent functional departments such as marketing, human resources, research & development and the like, while bars and lines with label P depict cross-functional projects.

Organizational structure is an important contextual factor influencing the conduction of projects. The degree of projectization in the organization affects for example the allocation of resources as well as the role and the level of authority of the project manager (Project Management Institute, 2008). The more projectized an organization, the more authority the Project Manager has and the more resources

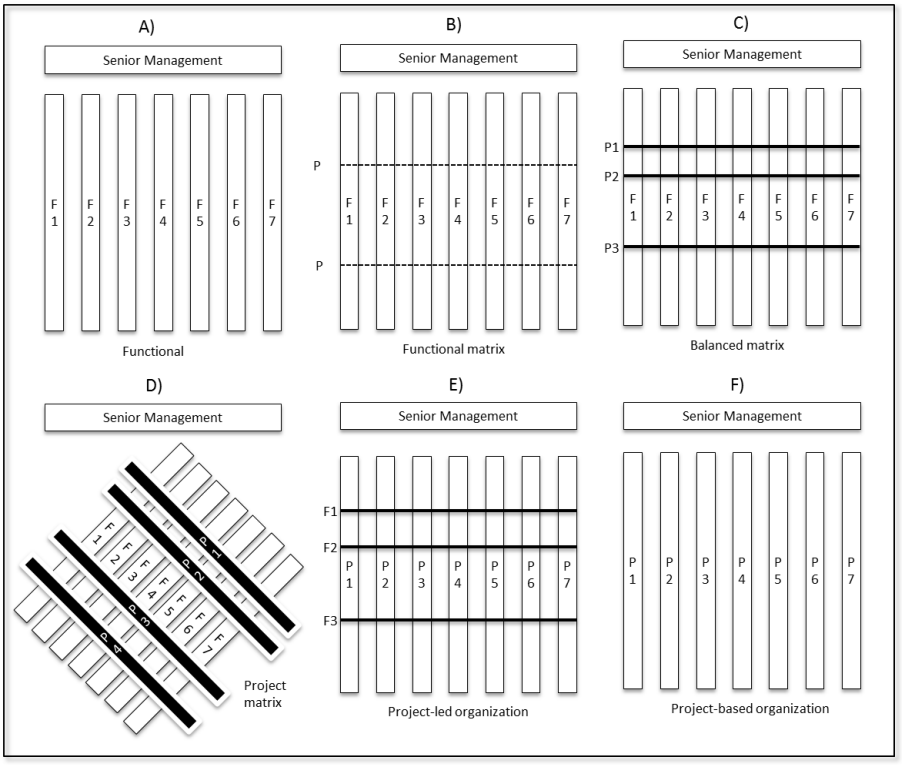

Figure 4: A classification of organizational structures (Hobday, 2000).

are accessible for projects. In a functional organization, the chain of authority is clearly defined and each employee has one direct superior. Table 2 illustrates these differences, using a slightly different way to classify organizational forms than the previously presented model by Hobday.

Research on projects in different types of organizations has indicated that the different variables at play influence project outcomes (Bannan, 2005). Different organizational forms suit different contexts: public sector administrative bodies are traditionally organized following the pure functional organization scheme, while the Project-Based Organization is common in for example construction, consultancy, shipbuilding and various high-tech branches. One major reason behind the ongoing trend towards increased projectization is the view that project-based organizations are agile, flexible and potentially more innovative than organizations based on functional structures (Hobday, 2000; Boh, 2007; Newell and Edelman, 2008). Findings

from empirical studies support these notions, although adopting Project-Based Organization model has its drawbacks as well. According to Hobday, PBO's seem to be able to react more flexibly and handle the uncertainty inherent in complex projects better than matrix or functional organizations (Hobday, 2000). The transient nature of projects also help them resists the anti-innovation bias that can hinder innovation capabilities in permanent organizations. On the other hand, organization-wide coordination of resources and processes is a challenge for PBO's (Hobday, 2000). Studies have also shown that organizational structure affects knowledge sharing and learning in organizations. While organizations that are essentially constellations of projects tend to develop project management capabilities, PBO's do not seem to outperform other types of organizations in learning lessons from projects (Boh, 2007; Hobday, 2000). Although different projects often share similar challenges and could thus benefit from knowledge about previous experiences, new projects tend to start from scratch knowledge-wise (Prusak, 1997; Davies and Brady, 2000). Since pure Project-Based Organizations have no functional structure, their challenge is not how lessons learned from projects can be transferred to the wider organization but to other projects. One way to foster cross-project learning in organizations is to form a Project Management Office (PMO) to coordinate a specific project or a set of projects (Wieviora et al., 2009).

Table 2: The influence of organizational structure on projects (Project Management Institute, 2008)

	Functional	Weak matrix	Balanced matrix	Strong matrix	Projectized
Project manager's authority	Little or none	Limited	Low to moderate	Moderate to high	High to almost total
Resource availability	Little or none	Limited	Low to moderate	Moderate to high	High to almost total
Who controls the project budget	Functional manager	Functional manager	Mixed	Project manager	Project manager
Project manager's role	Part-time	Part-time	Full-time	Full-time	Full-time
Project management administrative staff	Part-time	Part-time	Part-time	Full-time	Full-time

2.3.2 Project management maturity

Organizations differ as to the extent of familiarity and experience in managing projects. The degree of experience and competence of an organization in project management is called Project Management Maturity (PMM). Perhaps dangling perilously close to tautology, Project Management Institute defines PMM as *the degree to which an organization practices organizational project management* (Project Management Institute, 2003). Project management maturity is an organizational capability. As such, it can be seen and systematically developed as a strategic asset (Jugdev and Thomas, 2002). Formalized audit methods have been developed for assessing project management maturity in organizations and guiding its development. These Project Management Maturity Models (PMMMs) can be defined as methodical and sequential frameworks for guiding the development of project management processes (Vergopia, 2008). Maturity models are commonly used in unison with the project management models the organization adheres to (Jugdev and Thomas,

2002). Since the PMBOK is the most commonly applied project management standard, Project Management Institute's Organizational Project Management Maturity Model (OPM3) has also been widely adopted (Project Management Institute, 2008).

Project management maturity models often define a scale of distinct maturity levels. The following taxonomy originates from the influential Capability Maturity Model (CMM) developed by Carnegie Mellon University and the Software Engineering Institute in the early 1990's (Vergopia, 2008; Bach, 1994). The five levels of analysis are typically defined as follows (Vergopia, 2008).

Level 1 No established PM procedures.

Level 2 Some established PM practices exist, but they are not applied universally.

Level 3 PM practices and standards are instituted and mostly followed.

Level 4 The organization applies benchmarking against others and/or standards.

Level 5 Continuous improvement using the benchmarking data.

Studies indicate that the average level of project management maturity in firms is near the value 3 on the five-step Likert scale (Ibbs and Kwak, 2000; Bannan, 2005). In a 2005 PriceWaterhouseCoopers study, a majority of the 200 respondents expressed interest in rising their maturity level, preferably by more than one point (Bannan, 2005). As this eagerness to invest in project management capabilities shows, many firms perceive project management maturity as organizational resources linked to the competitive advantage of the organization (Jugdev and Thomas, 2002).

Attractive as maturity models are, they are not without their critics. Jugdev and Thomas (2002) pointed out that seen from the resource-based view of the firm (RBV) perspective, maturity models are not strategic assets for the organization since they do not fit the VRIN-criteria. While their point is certainly valid, a more interesting question is whether using maturity models actually leads to improved project management maturity in organizations. Project management maturity for sure, if the existence of such a construct can be accepted, qualifies as a strategic

organizational asset. The question is whether it can be accurately measured and further developed using maturity models. Although high PMM levels as measured by maturity models seem to be correlate with increased organizational performance, it has not yet been conclusively demonstrated how much maturity levels can be enhanced by adopting maturity models (Backlund et al., 2013).

For the current study, the most important point to note concerning maturity models is their focus on knowledge. Transferring the project-based knowledge on to new projects is at the core of organizational project management maturity (Project Management Institute, 2003). The list of distinct maturity levels illustrates this by connecting the highest maturity levels to capabilities to internalize and apply knowledge. The logical hypothesis to present is that a high project management maturity level predicts success in project knowledge capture and later utilization.

2.3.3 Industry and purpose

These days, projects are ubiquitous in practically every industry. Although a major part of research on project management is centered on industries such as construction, engineering, IT and high-tech manufacturing, projects are also applied widely in service industries and public sector organizations as well (Ibbs and Kwak, 2000). The industries at the core of project management research typically organize their work around projects. Besides production, projects can also be applied to generate innovative new products or foster organizational change (Lindner and Wald, 2011).

The industry, goals and scope of a project inevitably effect how projects are organized, what types of knowledge is created, and how many people are involved in the project. For some projects, knowledge is a by-product which is easily neglected while the focus lies on the attainment of more concrete goals (Kasvi et al., 2003). In these cases, the capture of project-based knowledge is often carried out as a separate, often afterthought-like process (Williams, 2008). For knowledge-oriented projects, the generation or dissemination of knowledge can be the main goal.

More research is needed to assess to which extent the empirical findings on project management studies can be generalized and which contextual variables should be taken into account in this process. Some of this variation between industries is connected to the different levels of project management maturity in different industries (Cooke-Davies and Arzymanow, 2003). Other major factor is how knowledge-intensive work is carried out in the industry (Lindner and Wald, 2011).

3 Knowledge management in projects

In this chapter, knowledge management in project context is discussed. First, the main theories and assumptions underlying knowledge management approach are summarized. After this, the prevailing models for project learning and knowledge creation are presented. This discussion is concluded by condensing the main theories into a theoretical framework of project knowledge creation. Lastly, a summary of factors affecting learning from projects is collected.

3.1 Underlying theories in the knowledge management approach

At the basis of the knowledge management (KM) approach is the original resource-based view of the firm (RBV) of strategic management, in which the resources of the organization are seen as the key to above-average organizational performance and sustainable competitive advantage (Wernerfelt, 1984; Penrose, 1959). According to this paradigm, these assets can be tangible or intangible. The characteristics of the key resources of an organization are often identified by Barney's (1991) VRIN criteria, according to which they should be *valuable, rare, in-imitable and non-substitutable*. Building upon the resource-based view, a more detailed paradigm emerged which specified knowledge as the most important resource in an organization. This knowledge-based view of the firm (KBV) was sculpted by scholars like Kogut and Zander (1992), Grant (1996a) and Spender (1996). Synthesizing work on organizational learning and learning organizations by Argyris and Schön (1978) and Senge (1990) among others with the knowledge-based view of the firm brought forth the knowledge management discipline, in which organizational knowledge is perceived as an intangible asset to be managed, shared, captured and transformed via various processes, documentation and information technology.

If knowledge is accepted as the most significant resource of a firm, there is no avoiding the murky waters of epistemology; a key question underlying knowledge management is the nature of knowledge. This fundamental consideration determines how knowledge can be utilized and managed. In knowledge management, epistemological emphasis is put not so much into the millennia-old philosophical debate on what can be known and what classifies as knowledge, but more focus is laid on the characteristics, categories and dynamics of knowledge (Grant, 1996a). Knowledge is assumed to be, in a positivist vein, something along the lines of justified true belief, aggregating, dynamic and utilizable commodity (Spender, 1996).

Perhaps the most fundamental conceptual distinction concerning categories of knowledge was drawn by Polanyi (1967), who presented the dichotomy between *explicit* and *tacit* knowledge. According to Polanyi, explicit knowledge can be codified and verbally transmitted, while tacit knowledge is rooted in action and experience and is thus difficult to transfer. In his words, *"we know more than we can tell"* (Polanyi, 1967, p. 4). What we can tell or generally externalize verbally is explicit knowledge while the surplus, such as experiences, practical-level know-how, values and beliefs, remain tacit and oftentimes unconscious.

By far the most influential theory to model the dynamics between these knowledge types was presented by Nonaka and Takeuchi (1995), whose SECI cycle presented a model on how organizations create knowledge by combining and converting the different knowledge types. According to this theory, tacit knowledge is shared and combined in personal contact such as mentoring or on-the-job training (*socialization*), tacit knowledge is converted to explicit by externalizing it in some way or another (*externalization*), explicit knowledge is transmitted by merging it with other explicit knowledge (*combination*) while explicit knowledge can be converted into tacit knowledge by *internalization* (Nonaka, 1994).

An influential addition to the theories previously summarized was the distinction between individual and organizational levels of tacit (or, in his terminology, implicit)

and explicit knowledge drawn by Spender (1996). In his theory, four types of knowledge exist in any organization: conscious, objectified, automatic and collective. The key feature of this model is the distinction between different modes of implicit (tacit) knowledge: individual-level implicit knowledge is basically psychological, consisting of personal experience mixed with educational background and such factors, while social-level implicit knowledge is essentially sociological, consisting of organizational culture, shared values and the like (Spender, 1996).

Knowledge transfer from one person, organization or context to another has been an intriguing problem for scholars. Attempts to adequately model this process in theory have led to many interesting concepts, one of which is the *"internal stickiness"* of information. Introduced by von Hippel (1994) and further developed by Szulanski (1996), the concept of "sticky" information depicts the inertia associated with transferring information to different contexts. Knowledge transfer may entail costs of various kind, and internal replication of best practices in the organization can prove as difficult as their imitation is for competitors (Szulanski, 1996; von Hippel, 1994). Organizational resources fitting the aforementioned VRIN criteria may not be easily recreated even inside the firm.

Empirical evidence seems to suggest that firms differ in their ability to use information to reach their goals. One aspect of this organizational trait is the "innovativeness" of a firm. According to an influential theory by Cohen and Levinthal (1990), this organization-level capacity in knowledge utilization is referred to as the *absorptive capacity* of a firm. Cohen and Levinthal define absorptive capacity as *"a firm's ability to recognize the value of new information, assimilate it, and apply it to commercial ends"* (Cohen and Levinthal, 1990, p. 128). In this model, a firm's absorptive capacity is developed cumulatively upon previous knowledge by investments on knowledge-related tasks such as R&D or technical training of personnel. Central to this theory is presumption that knowledge and knowledge-related capabilities are built upon pre-existing knowledge structure by personal - or organizational - effort. This implies that new knowledge is best assimilated if it is related to what is al-

ready known. Thus, the history of a firm plays a key role in its absorptive capacity. It is also taken that the more effort is put into processing knowledge, the better it can be internalized. Cohen and Levinthal propose that absorptive capacity can be consciously developed by investing in knowledge-related activities and, due to its cumulative nature, this investment reaps greatest rewards when it is done on a constant basis.

To sum up, what does this discussion on the nature of knowledge and its various transformations imply for project management? First, knowledge, or at least a portion of it, tends to be contextual. Second, knowledge has tacit and explicit dimensions. Third, knowledge can exist at individual or collective level. Fourth, knowledge is a dynamic, fluid entity which exists in a constant state of flux. Fifth, organizational knowledge is cumulative in nature and the past knowledge and experiences affect how organizations learn and develop their knowledge-related abilities. Due to these considerations, the capture of project-based knowledge is far from being a trivial or mechanistic task.

Before assessing different possible approaches to capturing project-based knowledge, it is necessary to consider what kind of knowledge types and knowledge processes are typical for projects.

3.2 Project learning

> In the most generic terms, learning may occur in all circumstances whereby agents have an imperfect understanding of the world in which they operate - either due to lack of information about it, or, more fundamentally, to an imprecise knowledge of its structure -; or, when they master only a limited repertoire of actions in order to cope with whatever problem they face [...] or, finally, when they have only a blurred and changing understanding of what their goals and preferences are (Dosi et al., 2003).

It has previously been noted that as a mode of work, projects have characteristics that make them ideal environments for learning and knowledge creation. These include factors such as bringing people from different departments and backgrounds

together to work on shared goals, the problem-solving capabilities demanded by the uniqueness of the task, flexibility in the face of shifting plans as well as pressing budgetary and temporal constraints (Schindler and Eppler, 2003; Kasvi et al., 2003; Fong, 2003). Because of these traits, projects are also commonly used method for attaining innovation in organizations (Huang and Newell, 2003).

However, due to the immense number of contextual factors at play as well as the dynamic and multi-faceted nature of the process, learning within and via projects is a complex area to analyze. Before being able to model this process adequately, more focus into the core concepts of project learning has to be laid. In this chapter, two main themes are discussed. First, what modes of project learning exist and how they function and second, what categories of project-based knowledge exist?

3.2.1 Modes of project learning

The most commonly presented dichotomy of project learning types is that of *intra-project* and *inter-project* learning or learning within and across projects (Kotnour, 2000). This dichotomy is somewhat theoretical, as these two modes tend to overlap to a certain degree depending on the context.

Intra-project learning happens within the project team, often as a by-product of the conducted work and the related problem-solving activities (Kotnour and Hjelm, 2002). This mode of learning in projects typically has the successful delivery of a single project in focus. Intra-project learning is essential for the team in order to develop the quality of their work and avoid repeating mistakes (Kotnour, 2000). According to Kotnour (1999), this type of learning occurs in an *intra-project learning cycle*. In Kotnour's model, this cycle is modelled after the plan-do-study-act (PDSA) cycle known from quality management. As its name suggests, the first phase of the PDSA cycle is *planning*, in which a project team analyzes the problem and plans a solution based on the knowledge available. Next, the team implements this plan. This *do* phase produces results about the effectiveness and outcomes of these actions

while the change brought about by them modifies the perceptions on how the project will proceed. The analysis of these outcomes is done in the *study* phase. Lastly, the *act* phase either brings the process loop to a close or results in a decision to continue it if the change is not seen as sufficient. To sum up, the intra-project learning cycle essentially models the sequence of problem-solving conducted in the course of a project. As the project team is seen as a temporary organization within an organization, this recurrent problem-solving builds organizational knowledge inside the team in a cumulative manner.

Sharing this internally created knowledge with other project teams and synthesizing it with their project-based knowledge is *inter-project learning* (Kotnour and Hjelm, 2002). By inter-project learning, an organization can combine and share lessons from different projects in order to utilize them in future projects. Inter-project learning can also be called *project-to-project learning* (Brady et al., 2002), *cross-project learning* (DeFillippi, 2001) or *learning across projects* (Keegan and Turner, 2001). Organizations often create procedures based on codified manifestations of intra-project learning, most often called *lessons learned*, to support inter-project learning. These supporting structures may include processes, groups and technology tools.

Organizational learning, learning in temporary organizations included, can occur via different operating routines. Zollo and Winter (2002) present three mechanisms whereby which organizational learning can occur, namely *experience accumulation*, *knowledge articulation* and *knowledge codification*. Experience accumulation is learning from experiences, which results in a shared view of cause-effect relationships and correct ways to act and react in situations. When the organization accumulates experience from recurring situations, this learning results in the formation of routines. Since the knowledge created by experience accumulation is by definition experiential, the resulting routines also incorporate tacit knowledge (Zollo and Winter, 2002; Nonaka et al., 2000).

The second learning mechanism in the typology presented by Zollo and Winter is knowledge articulation. This learning mode is most effective in problem-solving settings where groups figure out what works and what does not in certain organizational tasks. In these kind of situations, individuals can voice their views, engage in critical debate and confront each other in a constructive setting (Zollo and Winter, 2002). The most fruitful debates can help to change the organizational beliefs, resulting in what Argyris and Schön (1978) refer to as *double-loop learning*. Viewed against the backdrop of the SECI model of Nonaka and Takeuchi (1995), this process corresponds to externalization and combination of knowledge.

Third, organizational learning is possible via knowledge codification. Codification represents the next step from knowledge articulation, where the the expressed knowledge is condensed into documentation, systems or other explicit data (Zollo and Winter, 2002). Although codification is sometimes seen mainly as a method to transfer knowledge, the process of codification is also important for processing and evaluating knowledge, especially if it is done in a group setting.

While codification certainly is a beneficial approach to capturing knowledge in many contexts, research is divided as to which degree it can be used. This is often referred to as the *codification debate* (Prencipe and Tell, 2001). The discussion boils down to the question on how much of relevant organizational knowledge can be codified, with special concern to the capture of tacit knowledge. Ancori et al. (2000) have presented two antagonistic stances to this questions, which they refer to as the *absolutist position on codification* and the *absolutist position on tacit knowledge*. The first position stresses the potential of codification in capturing knowledge by referring to the economics of information: albeit codification is itself costly, the subsequent use, storage, retrieval and transmission of codified knowledge is straightforward. To use the terminology of economics, codification has high initial fixed costs but low marginal costs (Prencipe and Tell, 2001). The stance opposing this view, the absolutist position on tacit knowledge, stresses the role of tacit knowledge. According to this perspective, all the successful utilization of all codified knowledge is to some

degree dependent on tacit knowledge (Ancori et al., 2000). If organizations rely too much on codified knowledge, they may risk adopting an imperfect perspective of the knowledge resources available in the organization, losing valuable lessons and imposing unnecessary rigidity into their processes by relying too much on documentation. Before discussing the possible shortcomings of codification and the different approaches to overcoming them, it is necessary to first focus on the anatomy of project-based knowledge.

3.2.2 Typologies of project-based knowledge

In most cases, several distinct types of knowledge will be created in a project. These can be broken down into distinct conceptual categories in different ways. The most common distinction is the dichotomy between *product* and *process knowledge*. The former can be defined as *knowledge about what had actually been achieved in relation to the stated goals and objectives*, while process knowledge refers to *knowledge about the processes that the team had deployed to achieve these goals and why they seemed to have worked well or badly* (Newell et al., 2006). Kasvi et al. (2003) broaden this taxonomy by dividing project-based knowledge into three categories: *technical*, *procedural* and *organizational knowledge*. In their definition, technical knowledge is knowledge about the product, its components and operation. In other words, technical knowledge is synonymous to what Newell et al. term product knowledge. Procedural knowledge is connected to action: it concerns the production and use of the end-product as well as how to act in a project. Organizational knowledge in turn concerns communication and collaboration. Of these categories, technological knowledge would be explicit in nature while procedural and organizational knowledge, being knowledge types rooted in action, have both explicit and tacit dimensions. According to this view, technical knowledge could be codified more or less losslessly, while the codification of procedural and organizational knowledge require more processing and can more easily result in losing lessons.

3.3 A model of knowledge creation in projects

From the theories discussed in the previous sections, a complex picture of project knowledge creation, project learning and dimensions of project-based knowledge begins to emerge. To wrap up the hitherto presented theoretical discussion, a model for knowledge creation in project teams is formed. Figure 5 synthesizes these theories into an integrative framework for project knowledge creation and the aspects of project knowledge outputs.

Based on concepts from Lundin & Söderholm's (1995) theory of the temporary organization, the characteristic components of a project are *time*, *task*, *team* and *transition*. In the diagram, a project is portrayed as a triangle with task, team and transition positioned in each corner. The fourth ingredient, time, is depicted as an arrow and positioned inside the project triangle to highlight the linearity and sequentiality of project phases, which are also derived from Lundin & Söderholm (1995).

A project has various knowledge processes at play. Based on the discussed work by Prencipe and Tell (2001) and Kotnour (2000), the knowledge creation process during the project is depicted as the *intra-project learning cycle*. In this model, intra-project learning is a cyclical process, which loops throughout different project phases. As the project progresses forwards on its temporal axis, the intra-project knowledge creation cycle creates an accumulating body of project-based knowledge. This process has inputs and outputs, which are depicted as arrows. The *knowledge input & inter-project learning* arrow stands for external knowledge inputs, such as contact and knowledge transfer with other projects. The knowledge input arrow is two-headed, since this kind of knowledge transfer is typically bi-directional.

The smaller triangle portrays dimensions of project-based knowledge. The inner circle of the diagram depicts the different areas where knowledge is embedded using concepts from Nonaka's SECI model (Nonaka, 1994; Nonaka and Takeuchi, 1995). The corners of this knowledge triangle represent an other dimension of created

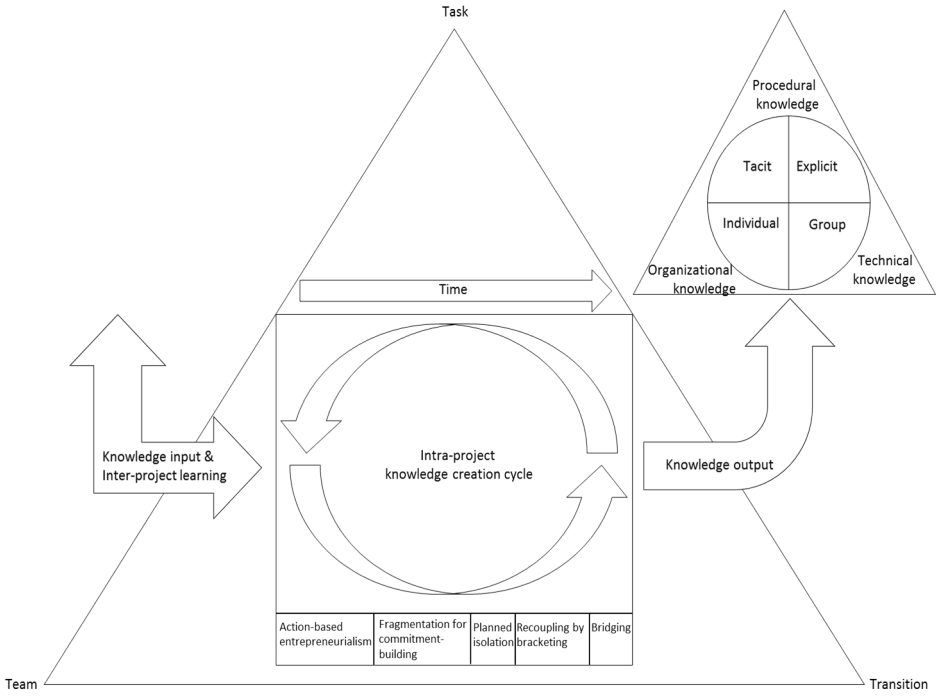

Figure 5: A model for knowledge creation in projects

knowledge, the categories of project knowledge based on content. This classification into *technical*, *procedural* and *organizational knowledge* is derived from Kasvi et al. (2003).

The presented framework is an attempt to integrate the fundamental theories and concepts around intra-project learning and project knowledge outputs. Next, focus is shifted to the interfaces of the project with its environment, which are depicted as arrows.

3.4 Approaches to capturing project-based knowledge

Although the prevailing approach to capturing project-based knowledge is codification, it is not the only one. An influential perspective was presented by Hansen et al. (1999), who argued that firms base their methods for managing knowledge on two distinct strategies: *codification* and *personalization*. The choice between

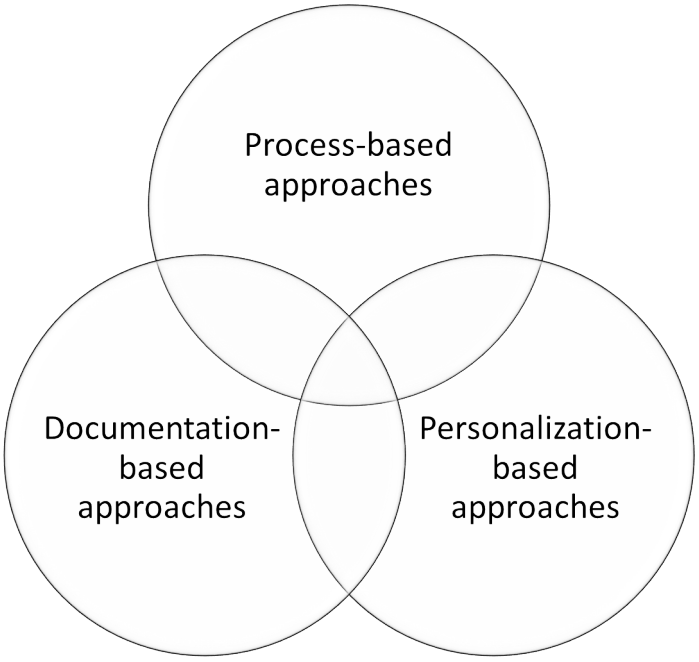

Figure 6: Approaches to capturing project knowledge

these approaches depends on a multitude of variables, such as the field of business, business processes and personnel of the company. While firms adopting the codification strategy focus on documenting lessons learned, companies emphasizing the personalization approach focus on creating dialogue between individuals by organizing conversations and brainstorming sessions (Hansen et al., 1999). This dichotomy is also adopted by Kasvi et al. (2003), who use it as a basis for approaching lessons from projects. In contrast, Schindler and Eppler (2003) present a slightly different taxonomy. In their terminology, project knowledge capture methods can be divided into *documentation-based* and *process-based methods*. As the discrepancy between these two classifications goes to show, the way to cluster different approaches depends on the point of view. While the categories of Kasvi et al. focus on the *object* to which the created knowledge is embedded, Schindler and Eppler stress the *act of capturing* project knowledge instead. For this summary, these two perspectives are synthesized into a scheme of three classes of project knowledge capture methods. To clear the terminological ambiguity around the basis for categorization and to stress viewpoint as the basis of this classification, the taxonomy will fit these meth-

ods, strategies and processes under the umbrella term *approaches*. Thus, the hybrid classification consists of process-based, documentation-based and personalization-based approaches to managing project knowledge. In this context, the different approaches provide methodologies to manage distinct phases of project knowledge capture: documentation-based approaches structure the documentation of gained knowledge, process-based approaches guide the wider process of knowledge capture while personalization-based approaches support the internalization and integration of this knowledge.

3.4.1 Documentation-based approaches

Documentation-based methods are characterized by contentwise organization of the experiences gathered from the project (Schindler and Eppler, 2003). As has been seen, methods based on documenting lessons learned and other important knowledge emanating from project practice form a typical approach to capturing, organizing and storing knowledge from projects. Although the most common phase to document project knowledge is the project completion, the documentation process can also be conducted in cycles or at milestones predefined in the project plan (Newell and Edelman, 2008). The documentation process typically starts from the individual project members, who reflect on their experiences and performance during the project. The results of these meditations are then gathered, organized and stored in a systematical fashion for later use in the organization. Many project knowledge documentation methods have been presented, each with slightly differing applications and terminology (see Schindler and Eppler, 2003).

3.4.2 Process-based approaches

Process-based approaches to project knowledge capture can be defined as methods that focus on the relevant steps and their sequence in course of the project lifecycle (Schindler and Eppler, 2003). This category of approaches contains separate

methodologies for capturing knowledge but also general project management standards where knowledge-related processes are addressed.

Many project management standards and maturity models take knowledge into account as an output among others in different project phases, sometimes as an input as well. In such cases, knowledge capture is embedded into the formalized project management method. The level of guidance to actually conducting these knowledge-related processes, however, is often provided on a very general level, if at all (Williams, 2008). Project Management Institute, for instance, devotes no more than two clauses of guidance for capturing project knowledge in PMBOK, the IEEE standard of project management, proposing the documentation of lessons learned in the course of the project by phrasing: *"Lessons learned are documented throughout the project life cycle, but at a minimum, during project closure"* (Project Management Institute, 2008). Although lessons learned from previous projects are among the inputs of most phases of the PMBOK model, no further guidance is provided. This wording is not atypical in its content or lack of detail, as standards commonly promote conducting project debriefings or documenting lessons learned at the finishing phases of the project, keeping on a general level.

Although structured project management guidelines seldom provide much detail as to how lessons learned should be evaluated and documented, many separate defined processes exist for bridging this methodological gap. These project review processes can be viewed as extensions of traditional project management (Jugdev, 2012). Among the most commonly suggested approaches for documenting and storing knowledge from projects are project debriefings, also called project postmortems or post-project appraisals among many other terms. Project debriefings are formal sessions conducted at the end of a project, where the members of the project team reflect upon and discuss the conducted work from a knowledge perspective or, to use a ubiquitous term, share *lessons learned* (Jugdev, 2012). Lessons learned can be defined as key project experiences which have certain general business relevance (Schindler and Eppler, 2003). The aim of these sessions is to make the project team

assess project outcomes, compare their performance to project plans and to discuss and document what went well, what areas should be improved and what has generally been learned. Apart from the project team members, these reviews can also be done by auditors not personally affiliated with the project (Schindler and Eppler, 2003; Gulliver, 1987). In such cases, the term audit is often used and the perspective is wider, setting the completed project and its outcomes into the framework of the company's strategy. Alongside workshops conducted ex post, some processes involve one or more mid-project review sessions as well.

3.4.3 Personalization-based approaches

Personalization-based approaches to capturing knowledge from projects are designed with special focus on the tacit, personal-level knowledge which is readily translated into artifacts (Hansen et al., 1999; Kasvi et al., 2003). In some organizations, the main part of organizational knowledge is tied closely to the person who originally developed it. In these contexts, the function of knowledge management is to help people communicate this knowledge. This is achieved by personal interaction in connection with problem-solving activities. Mentoring, coaching, workshops and seminars are common examples based of personalization-based methods to transferring knowledge (Pollack, 2012; Kasvi et al., 2003).

3.5 Factors affecting project learning

Research on project learning has identified a multitude of different factors affecting how organizations learn from projects. Empirical surveys have been used to identify which factors correlate with successful transferring of learning from projects as well as pointing out barriers to this. Table 3 summarizes results gathered by Williams (2008) and Kotnour and Hjelm (2002) concerning factors fostering project learning and Schindler and Eppler (2003) on causes of losing project knowledge. Schindler and Eppler categorize their findings in four classes, which represent the root causes of

Table 3: Factors that hinder or foster learning from projects

Fosters learning	Hinders learning
Regularity of lessons-learned activities	High time pressure in project
Separate project management unit	Unwillingness to learn from mistakes
Use of project audits	Lacking knowledge of debriefing methods
Use of a formalized process	Lacking enforcement of the procedures
Encouragement for learning	Lack of perspective on the benefits of codification
Encouragement for innovativeness	Difficulties in co-ordinating project debriefings
Learning as an organizational goal	Missing integration of experience recording into project processes
Incentives for dialogue	

knowledge drain: *time*, *motivation*, *discipline* and *skills*. It can be hypothesized that these causes are interconnected to some extent. A vicious cycle of bad practices is easy to picture: it is probable that time pressures adversely affect motivation, which in turn has a negative effect on discipline and so on. It is also noteworthy that the common area between these two surveys is the discipline factor: the findings of Williams point to the crucial role of regular, formalized process for capturing knowledge from projects, while Schindler and Eppler have noted that difficulties in co-ordinating debriefing sessions as well as lack of integration with project processes adversely affect learning. The leadership actions to boost learning from projects collected by Kotnour and Hjelm seem to be related to the motivation factor.

This list of factors affecting project learning is, of course, not exhaustive. In the following chapters, a more systematical view on the learning-related factors in projects is formed by analyzing the current state of research as reported in literature. By using the qualitative metasummary method, it is feasible to assess the relative importance of the different variables in project learning.

4 Methodology and data collection

In this chapter, the theoretical and methodological fundaments of this research are presented. First, the epistemological presumptions of this study are discussed. A presentation of methodology applied in this study follows. The chapter is concluded by a description of the procedure used for data collection and analysis.

4.1 Epistemological stance

The epistemological starting point for this research lies in *postpositivism*. Refining and criticizing the positivist agenda built on the premise that empirical observation using a scientific method can result in objective knowledge about reality, postpositivism acknowledges that observations are always affected by the background and prior knowledge of the observer. Against this rationale, the basis of the postpositivist stance is theoricism, which identifies knowledge with theory instead of observation (McEvoy, 2007). According to postpositivism, knowledge is inherently intertwined with human conjecture, which makes it impossible to completely eliminate the effect of bias. As reality is seen as socially constructed, the researcher is a part of this process of construction herself. Instead of absolute truth, the goal of research should be placed on *warranted assertibility* which approximates truth as closely as is possible (Crossan, 2003). Having complex and contextual social phenomena such as organizational learning as a research focus further exacerbates the problem of finding universal knowledge. It thus needs to be noted that as any observation and analysis are influenced by conjecture, and because the data used in this study will be effectively double-filtered through analysis, the aim of this research is not so much to find a scientific truth about the studied phenomena as to distill, summarize and analyze the current body of literature on the subject.

4.2 Selecting the method

The methodological approach of this study is a systematic review combined with qualitative metasummary. In the following subchapters, a short overview of review methods is first presented, followed by a more detailed description of the methods used in this study.

4.2.1 Review methods

Literature reviews are commonly defined as research methods based on existing research, where results of previous studies are collected, analyzed and synthesized (Salminen, 2011). Because of this, reviews can be seen as research about research, or meta-analysis (Jalonen, 2011). Reviews have traditionally been especially common in medical and health care research and professional practice but they have been recently gaining prominence in social sciences and business studies as well. With the ever-increasing volumes of scientific publishing, efforts to filter and synthesize the most crucial and reliable findings are needed to make sense of this overflow of information (Mulrow, 1994). Besides scholarly applications, systematic reviews can also support the decision-making of practicing professionals, functioning as a gateway of knowledge between academia and the professional field of the discipline in question. In other words, *"the systematic literature review is a method of locating, appraising and synthesising evidence"* (Petticrew, 2001). This being said, it is important to note that literature reviews should not be just descriptive summaries of extant literature, nor are they literary criticism, but valid scientific research (Salminen, 2011; Mulrow, 1994). This entails that systematic reviews should follow and document structured process, seek to answer preformulated research questions as well as to attain the scientific goals of validity and reliability. How, to be precise, can literature reviews contribute to the academic research on a given topic? According to Baumeister and Leary (1997), literature reviews can have five different goals: *theory development*, *theory evaluation*, *surveying the state of knowledge on a particular*

topic, *problem identification* and *providing an historical account of the development of theory and research* on a particular topic. The theoretically inclined reviewer can use the survey of literature to point out inadequacies in prevailing theories and to propose a new conceptual approach or modifications to the existing theories. The most practically oriented approach is the one aiming to summarize and integrate the current knowledge on a particular topic. Reviews can also aim to identify problems and research gaps in the current body of empirical literature, providing guidance for further research. The least common goal for literature reviews is the historical one; to trace the development of a theory or an idea by studying scholarly publications. (Baumeister and Leary, 1997).

Literature reviews do not form a monolithic body of research, but fall into various subcategories. According to Salminen (2011), literature review as such is not so much a method but a category of methods, consisting of three main classes: *descriptive reviews*, *systematic reviews* and *meta-analyses*. Of these, descriptive reviews and meta-analyses can be broken down further into sub-classes. Descriptive reviews follow an approach based on collecting and summarizing large quantities of literature without following tight methodological guidelines. The focus of descriptive reviews is on readability. Descriptive reviews can be further categorized into narrative and integrating reviews. Narrative reviews attempt to structure an area of research, or an evolutionary trajectory of an idea, into a coherent and concise narrative. Integrating narrative, in turn, is characterized by a more critical approach to the reviewed publications. (Salminen, 2011).

Meta-analysis is another class of literature reviews which can be further divided into sub-categories, the main distinction being between qualitative and quantitative meta-analyses. Of these, the qualitative orientation consists of metasynthesis and metasummary (Salminen, 2011). Metasynthesis aims to synthesize a multitude of qualitative studies around a field of study by following a defined process based on finding similar concepts under varying terminology (Paterson et al., 2009; Salminen, 2011). The other qualitative meta-analysis method is metasummary, in which ele-

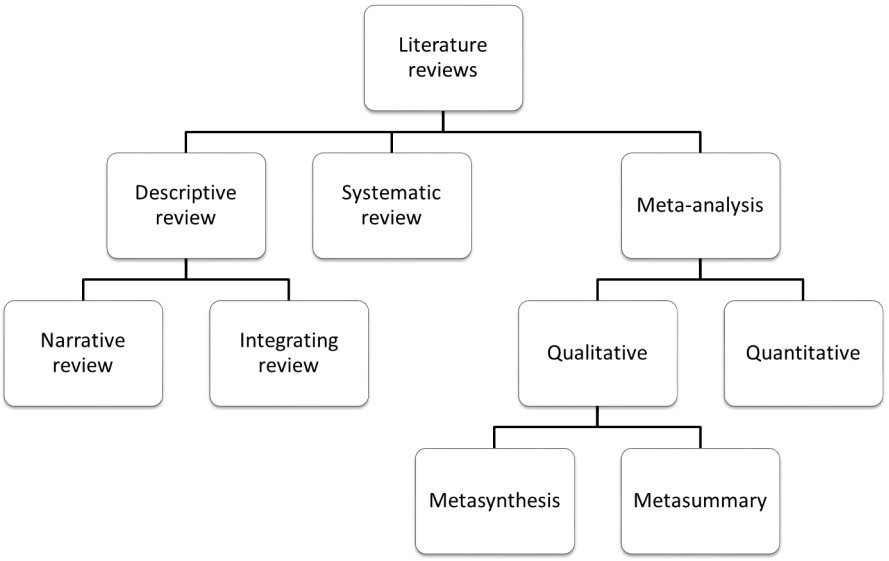

Figure 7: Categories of literature reviews (Salminen, 2011).

ments of quantitative research are also utilized. In short, metasummary consists of the extraction, grouping and formatting of findings and the calculation of frequency and intensity effect sizes from this data, providing a way to integrate findings from both qualitative and quantitative surveys (Sandelowski et al., 2007). Quantitative meta-analysis, on the other hand, is a method whereby findings from quantitative studies are combined and developed further using statistical methods (Salminen, 2011).

The third main category of reviews in Salminen's typology, systematic review, is an approach that follows a defined process, which is also described in detail in the study. Although sometimes perceived more as a part of valid research process than a method of its own, its importance as a research approach has become better recognized in recent years (Salminen, 2011; Fink, 2005). In contrast to the aforementioned approaches, systematic review is characterized by a tight focus on predetermined research questions. Although sometimes assumed otherwise, systematic reviews are

thus not used to summarize a field of research as a whole in a nutshell. Instead, their objective is to seek answers to a specific research question by scrutinizing a tightly defined set of publications, selected by an explicit and unbiased process, and to synthesize and sum up their findings from this specific perspective (Petticrew, 2001; Fink, 2005). Although systematic reviews should be based on literature selected from as wide a pool as possible, the amount of included studies as such does not tell much about the quality of the review, as coherency in the selection of the studies is the more important factor (Salminen, 2011). By analyzing a consistently selected set of high-quality studies, systematic reviews can produce generalizable results (Mulrow, 1994). In this manner, systematic reviews can be compared to puzzles, where a larger picture is formed by combining individual pieces (Mulrow, 1994). This naturally presupposes avoiding bias in study selection as well as consistency of analysis. The consistency of selection and analysis also ensures that the inspected studies do not contain theoretical or methodological premises that would render them incomparable (Metsämuuronen, 2001; Salminen, 2011). Since systematic reviews contain explicit and detailed descriptions of inclusion criteria, data extraction methods, standards for evaluating study quality and techniques for analysis and synthesis of their findings, they can be reproduced (Fink, 2005). In this way, the scientific community is able to critically evaluate their results and conclusions.

4.2.2 Systematic review and qualitative metasummary

The data used for analysis in this study is aggregated using the method for systematic reviews presented by Fink (2005). This framework consists of seven steps: 1) *selecting research questions*, 2) *selecting bibliographic or article databases, Web sites, and other sources*, 3) *choosing the search terms*, 4) *applying practical screening criteria*, 5) *applying methodological screening criteria*, 6) *doing the review* and 7) *synthesizing the results* (Fink, 2005). As is apparent from the titles, the first step helps narrow down the research topic, the four subsequent steps are dedicated to forming the pool of literature to be analyzed while the last two deal with the

analysis itself. Although other process models exist, they tend to differ mostly in the level of detail (Johansson et al., 2007; Suter, 2013; Pullin and Stewart, 2006). Figure 5 presents an example by juxtaposing the Fink model with a five-step approach presented by Khan et al. (2003). Although a slightly different terminology is used, these two models are essentially the same, the main difference being that Fink's model includes two steps (2 and 3, 4 and 5) for steps two (Identifying relevant work) and three (Assessing the quality of studies) of the model introduced by Khan et al..

The analysis part of this process is conducted as a qualitative metasummary. Not to be confused with quantitative meta-analysis, qualitative metasummary is a novel and thus far rarely used analysis technique introduced by nursing researcher Margarete Sandelowski in the early 2000's (Virtanen and Salanterä, 2007; Sandelowski and Barroso, 2003). Although this method is by definition essentially qualitative, it borrows traits of quantitative research by deriving quantitative variables out of qualitative data in the form of frequency and intensity effect sizes (Salminen, 2011). According to Sandelowski et al. (2007), qualitative metasummary can be used for synthesizing descriptive findings from both qualitative and quantitative survey studies. The procedure of analyzing research data by qualitative metasummary is as follows.

The analysis is guided by the research questions. First, all findings relating to the studied phenomenon are identified from the literature in the data pool. Since the focus is on findings of a particular research, and not on general references to studied themes, this process is not mechanistic. Instead, the researcher must separate these original contributions from raw data such as direct quotations of interviewees, references to findings from other studies, descriptions of analytic processes such as coding schemes and discussions of the significance of the findings (Sandelowski et al., 2007). For this end, three parts of the articles are scrutinized: methodology, summary and discussion (Virtanen and Salanterä, 2007). After identification, all sentences in these

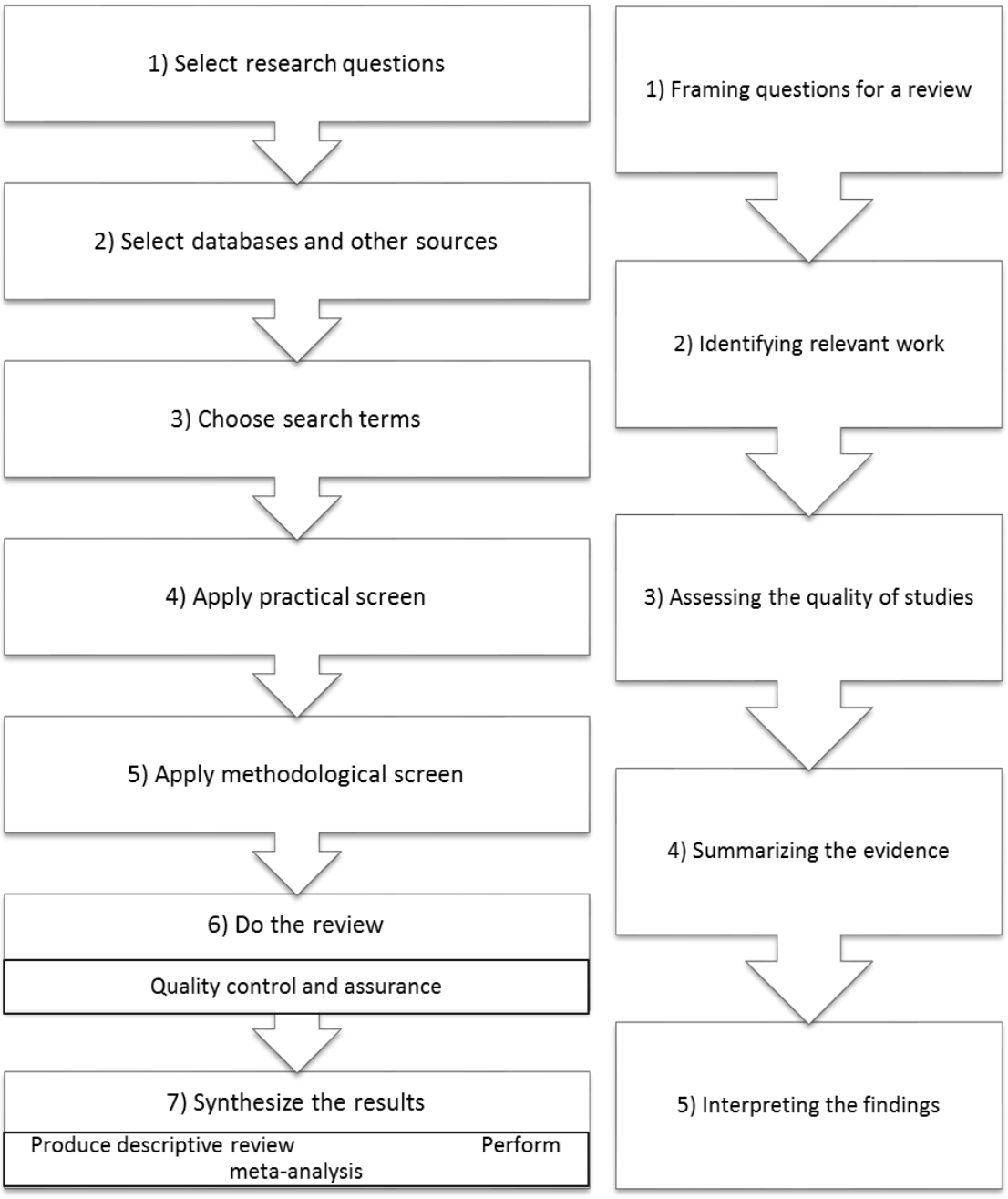

Figure 8: Two processes for performing systematic reviews, adapted from Fink (2005) on the left and Khan et al. (2003) on the right.

parts containing research findings are collected into a table such as a spreadsheet file for further processing.

Second, topically similar findings are grouped together into thematic wholes. After concluding this phase, the similarities and interrelationships between the extracted findings can be discerned (Sandelowski et al., 2007).

The third phase of conducting a qualitative metasummary consists of condensing the findings into a higher level of abstraction. This process aims at getting beyond the original phrasing and into the more general semantic content without losing the complexity and perspectives of the original findings (Virtanen and Salanterä, 2007). The ideal for abstraction is conciseness and comprehensiveness (Sandelowski et al., 2007). These abstracted findings are then thematically grouped.

After these purely qualitative preparations, the metasummary is concluded by calculating two numeral statistics for each abstracted finding: frequency effect size and intensity effect size. Of these, frequency effect size signals the frequency of a finding in the data pool. It is calculated by dividing the amount of studies reporting a certain abstracted finding by the total amount of studied articles (Virtanen and Salanterä, 2007; Onwuegbuzie, 2003). For example, should four studies in a pool of 20 contain a certain finding, the frequency effect size for the finding in question would be 20 percent (Sandelowski et al., 2007). The higher the frequency effect size, the more prevalent the finding in the data set. When the frequency effect size is high, there is significant support for it. On the other hand, findings with low frequency effect sizes can be taken to contribute new knowledge (Virtanen and Salanterä, 2007).

Intensity effect size, in turn, is used for evaluating the role of different source articles. It is computed by dividing the amount of abstracted findings in a certain source text by the total amount of findings (Onwuegbuzie, 2003). Again, to provide an hypothetical example, if the total number of abstracted findings would be 19 and a particular study would contain 5 findings, the intensity effect size of the article would be 26 %, i.e. it contains 26 percent of the extracted findings. This figure can

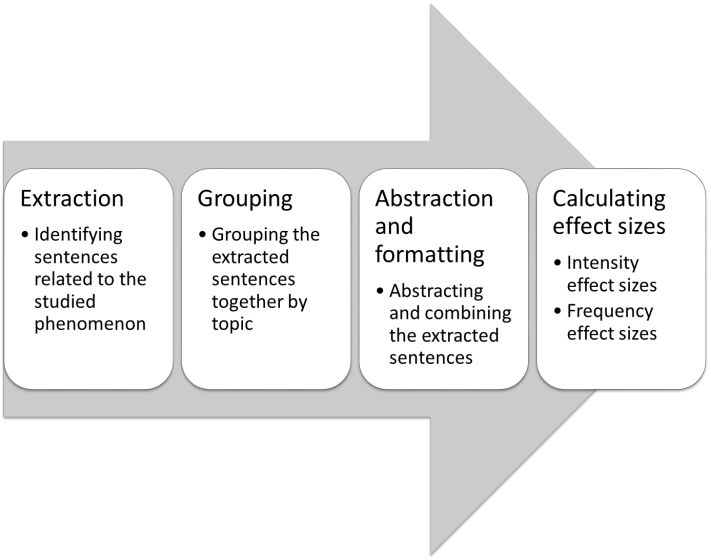

Figure 9: Phases of qualitative metasummary, adapted from Sandelowski and Barroso (2003) and Sandelowski et al. (2007).

have many different uses when analyzing the results. For example, it can be used to indicate whether any findings originated from weaker studies than the others, which studies contributed most findings with the largest frequency effect sizes and which articles contained findings that were not reported elsewhere in the sample (Sandelowski et al., 2007).

4.2.3 Research procedure

The methods introduced above will be combined for performing the data collection and analysis parts of this study. The two following chapters are centered on these processes. Chapter 5 contains the data collection phase via systematic review and is structured according to its constituent steps. Chapter 6 reports the analysis phase. The research is concluded in chapter 7, where a summary of the results is presented along with answers to the research questions, managerial implications and general discussion.

4.3 Data collection

In this subchapter, a data pool is formed for further analysis by following the previously outlined process for systematic review. The structure of this chapter is based on the model by Fink (2005) with minor adaptations.

4.3.1 Selecting research questions

As the research question *"How do project teams create knowledge?"* was answered in the previous chapter, two questions remain to be addressed. As noted in the introduction, these questions were formulated as follows:

Q2 *How can organizations best capture and utilize project-based knowledge?*

Q3 *Which factors affect the capture and re-use of project-based knowledge in organizations?*

In contrast to the previous discussion on knowledge creation in project teams, these questions address organizational-level learning from projects. In the context of the graphical depiction of the theoretical framework presented earlier (figure 5), the analysis shifts the focus into the arrows whereby the project interfaces with its parent organization.

4.3.2 Selecting sources

Information retrieval was conducted using several published-owned web portals. Reasons for this were threefold. First, the search query was submitted to multiple databases in order to maximize the potential search recall. Second, a number of test searches indicated that publisher portals provide sophisticated (and very similarly designed) search interfaces for creating complex search queries, especially when contrasted with simplistic metasearch engines such as Nelli. Third, publisher portals contain rich metadata and content descriptions in a structured format. In

Search query	Search field
*project**	title
*lesson** OR *review** OR *learn**	title
organizational learning	subject terms
NOT *construction*	subject terms
Limits for search	
Publication type.	peer-reviewed journals
Publication year:	2000-2014
Language:	English

Table 4: The search query used for retrieving articles.

this way, different query facets can be matched to distinct metadata elements such as keywords in a manner not possible using services such as Google Scholar.

Based on these considerations, four portals of the leadings publishers of scientific journals were selected: Business Source Complete (Ebsco), Scopus (Elsevier), Science Direct (Elsevier) and ABI/INFORM (ProQuest).

4.3.3 Choosing the search terms

The search query was formulated as shown in table 4. Since precision and recall tend to be opposing goals in text-based information retrieval, the precision aspect was stressed in query formulation, while the use of multiple databases was aimed at increasing recall (Buckland and Gey, 1994). Conducting this search in all the four databases yielded a total of 247 hits. After every search, the resulting references along with their abstracts were exported into the RefWorks software for further processing.

Once the references had been imported, they were de-duplicated. In this phase, a total of 86 duplicate references were discarded.

Inclusion criteria	Exclusion criteria
Contains empirical research	Conceptual paper
Qualitative / mixed-method approach	Quantitative approach
Focus on project learning	Wider KM-approach
Focus on inter-project learning	Focus on intra-project learning
Focus on organizational learning	Focus on personal-/team-level learning
Published after the year 2000	Published before 2000
Contains case study findings	No case study data
Context: knowledge-intensive business	Context: public administration
	Context: construction
	Context: software projects

Table 5: Inclusion and exclusion criteria for literature

4.3.4 Applying screening criteria

In the first phase of screening, the relevance of the articles was first assessed by going through all article *titles*. While the titles were scanned, further 87 references were removed. Next, the *abstracts* of the remaining 74 articles were inspected, which resulted in discarding 46 more titles.

In the last phase of the process, the remaining 28 papers were studied in their entirety. This final round of screening left a pool of 13 articles for analysis. The selected articles are listed in appendix A.

The papers discarded in the last phase fell into three categories: 1) purely theoretical articles without empiric tests, 2) studies dealing with project learning on individual or team levels, but not on organizational level and 3) methodologically unsuitable papers such as quantitative surveys.

5 Analysis

In this section, the retrieved data is analyzed. The first four subchapters of this section follow the metasummary procedure while the implications of these results are studied in subschapter 5.5.

5.1 Extraction of findings

Before research findings can be extracted, the concept "finding" needs to be defined. According to Sandelowski and Barroso (2003), research *findings* relevant to the metasummary method can be defined as "the databased and integrated discoveries, conclusions, judgments, or pronouncements researchers offered regarding the events, experiences, or cases under investigation". In other words, research findings are comprised of the *interpretations* the researchers derive from the analysis of their data (Sandelowski and Barroso, 2002). This definition excludes for example all references to prior studies, descriptions of the data collection and processing procedures, methodological concerns and analytic procedures as well as discussions on the significance of the produced findings from the analyzed data (Sandelowski et al., 2007). Despite these reservations, these contextual factors are essential for the analysis and assessment of the processed data. Apart from sections titled *findings*, research findings can be located in *methodology* or *discussion* sections (Sandelowski and Barroso, 2003; Virtanen and Salanterä, 2007). The extraction of findings from scholarly literature is not as trivial a task as it may seem at first glance. For example, it is essential to distinguish descriptions of analytic procedures of research data from research findings - a task in which even many scholars writing research papers seem to fail (Sandelowski and Barroso, 2002).

Using these demarcations as guidelines, the retrieved thirteen articles were scrutinized. In the course of this process, every sentence suiting to the aforementioned

definition of a research finding was separated into a spreadsheet file. This process resulted in a total of 237 extracted sentences.

5.2 Grouping the findings

After all the sentences relating to the research questions were identified and extracted from the selected literature, their content was analyzed. This process proceeded as follows. First, a fresh sheet in the file was created and split into two halves corresponding to the remaining research questions (*Q2: Which factors affect the capture and re-use of project-based knowledge in organizations?*, *Q3: How can organizations best capture and utilize project-based knowledge?*). Second, an initial content analysis was performed on the captures sentences to identify common themes in the data. These themes were formulated into working titles and classified under the research questions. The purpose of this phase was to provide structure into the extracted set of data and to prepare the material for closer analysis. The main function of the grouping phase is to recognize connections in the data. Since the extracted sentences are clustered in their original phrasing, the original semantic complexity of the research reports is preserved (Sandelowski et al., 2007).

5.3 Abstraction and formatting

When a certain structure had been imposed into the mass of data extracted from the analyzed research papers by grouping the findings, the sentences with similar semantic content were combined. In this process, they were rephrased in an attempt to lift them to a higher level of abstraction without losing the complexity of their content (Sandelowski et al., 2007). An important criterium in this process was to reformulate the findings in a way that they would remain understandable outside of their original context (Sandelowski and Barroso, 2003).

This process is best illustrated by an example. The following two sentences were among the extracted data:

> "Conversely, if the project manager clearly defines the project from the start as a 'zero-mistake' project and proactively utilizes learning from-previous-projects reflection sessions, this will positively influence the attitude of project team members towards learning activity." (Sense and Antoni, 2003)
>
> "Further evidence of this firm's approach to learning between projects is the initiative of one project manager in calling for a start-up meeting in the early phases of a project. In the initial phase, the project and team managers invite someone from another recently completed project to sit down with them and give them the benefit of his experience." (Prencipe and Tell, 2001).

Since the second quotation was presented as an example of a successful approach to motivate employees, these two quotations could be combined into the following abstracted finding: *"If the project manager uses knowledge gained from previous project experiences, the staff is more willing to document learning."*.

By going through all the sentences referencing to research findings that were extracted from the studied reports, the 237 sentences were condensed into 67 abstracted findings. A complete list of findings is included as aependix 2.

5.4 Calculating effect sizes

In the last phase of processing data for analysis, the two quantitative statistics characteristic to the qualitative metasummary method were calculated. To recap, *frequency effect size*, calculated for every finding, indicates the frequency of a finding in the selected research papers. Since the total pool of literature included for analysis was 13 articles, this figure was calculated by dividing the number of articles reporting a finding by 13 (Sandelowski and Barroso, 2003). Again, to provide a concrete example of this procedure, the finding no. 16 (*"Staff does not believe in the usefulness of review sessions. They are seen as a bureaucratic requirement."*) was found in 3

papers. Its frequency effect size was thus 3 / 13 * 100 = 23 %, or that 23 percent of the studied reports contained this finding.

Since the studied pool of research consisted of only thirteen studies, the scale of frequency effect sizes proved to be quite limited. The highest frequency effect size was 62 %. This was the frequency of only one finding (no. 6, *"Limited resources and tight schedules hinder learning from projects"*). Frequency effects 43 % (no. 32) and 38 % (no. 28), depicting the absolute amounts of 6 and 5 mentions respectively, were equally rare. Only a few findings amounted to the next two frequency effect sizes. There were two findings that were mentioned in four sources (31 %) and six with three mentions (23 %), while almost a third of the findings had only two mentions (15 %) and over a half were found in only once in the set (8 %).

Next, intensity effect sizes were determined for the selected sources. This figure represents the amount of findings contributed by each studied paper. Intensity effect size was calculated by dividing the amount of findings each article contributed to the study by the total number of extracted findings, which in this study was 67. This figure serves as an indicator of how prevalent each paper is the data. To illustrate, twelve distinct findings were extracted from the article by Duffield and Whitty (2014). When this number is placed in the equation, the result is 12 / 67 * 100 = 18 %. Thus, 18 percent of the findings were found in this paper.

When the comparing the intensity effect sizes, it is found that the amount of findings contributed by a single source ranges from 3 to 18 (4 % - 27 %), the average being around 9 (14 %). The paper with the highest intensity effect size was *"Sharing knowledge across projects: limits to ICT-led project review practices"* by Newell et al. (2006). A comprehensive list of the intensity effect sizes of the sources is found in appendix C.

5.5 Synthesizing the results

Based on a content analysis of the abstracted findings, seven main themes could be discerned. The following subsections are structured around these topics. In the following discussion, references to abstracted findings listed in appendix B are done by giving their number and frequency effect size in parentheses after the reference.

5.5.1 When and how does learning occur?

Concerning the question on how organizations learn from projects, the accumulation of experience from previous undertakings was the most frequent finding (1, 23 %). Accumulated personal-level experience can be disseminated in the organization by assigning senior employees to new projects. It has also been noted that problem-solving along the course of the project is an important source of learning - even failures and mistakes can provide new knowledge if they are acknowledged (2, 15 %). However, there is indication that people are not always willing to reflect upon their own actions (44, 8 %) or to admit mistakes (38, 15 %). When firms gain experience of conducting projects, they develop project management routines which may help planning future projects but, on the other hand, diminish the extent of learning in project work (3, 15 %). Two studies also found that when projects are routinized in nature, learning may not be important to their success (23, 15 %). These findings raise interesting questions about the role of project management maturity discussed previously.

5.5.2 Organizational context

Ten findings were related to the effect the organizational context to learning lessons from projects. The most common finding in the studied data was that learning from projects is often hampered by the lack of time or resources to reflect upon what has been learned (6, 62 %). If possible, management should alter schedules in order to

alleviate the sense of hurry and thus provide space for learning and reflection (25, 8 %). It was also noted that the project owner should be committed to capturing knowledge from projects in order for it to succeed (3, 23 %). Organizational culture plays also an important role in learning from projects. When the culture values learning and helping colleagues, learning is likely to happen (8, 23 %). This can be called *people culture* (Duffield and Whitty, 2014). Culture also plays an effect on how and if tools for capturing project knowledge are utilized (13, 8 %).

The data provided interesting points about the role of organizational structure on learning from projects. Due to its stability and longer temporal orientation, functional organizations may value learning more than highly projectized firms (10, 15 %), but the double role of employees in both functional organization and project team seems to hinder learning from project work (9, 23 %). According to these studies, this is due to the fact that employees with a permanent role in the parent organization tend to prioritize this as their "real" work (Swan et al., 2010).

5.5.3 Leadership and the attitudes of staff

It seems to be fairly common that project team members are sceptical towards the usefulness of end-of-project review sessions (16, 23 %). Projects may be seen as unique undertakings or that the phenomenon of "re-inventing the wheel" is an unavoidable characteristic of project work (20, 15 %). When this kind of views prevail, the use of databases and other tools is going to be limited (19, 15 %). Even when different projects encounter and solve similar problems, the generated solutions can be difficult to generalize and to see the connections (37, 15 %). It was also mentioned that lessons learned -documentation may not be useful for dealing with unforeseen situations (50, 15 %). There also seems to be a tendency to forget ambivalent experiences (65, 8 %) or solved problems (61, 8 %) by the time the reviews are conducted, which corrodes the usefulness of the documentation.

On a personal level, employees may feel that knowledge learned during projects is their "intellectual property", which they are reluctant to share (17, 23 %). People may see knowledge as a source of personal competitive advantage that can help their career advancement or that others may try to take credit from (Jugdev and Wishart, 2014). On the other hand, people are not always willing to accept knowledge from others (21, 15 %). Even if project team members have a high degree of trust in each others' capabilities, learning is hampered due to the lack of debate (24, 8 %). If it is presumed that others have things under control and have better understanding on what has been done, review discussions are less likely to be felt necessary.

Although project personnel might generally be sceptic towards the potential of project reviews and documentation, their faith in them is likely to be strenghtened if they can see knowledge from previous projects being actually utilized (22, 15 %). For learning, it important that staff understands the relationship between different projects as well as how they relate to organizational goals (17, 15 %). It was also found that using a suitable method for conducting project review sessions can boost the level of interest in participants (49, 15 %).

5.5.4 The role of informal relations and personal contact

In many of the analyzed studies, it was stated that the most important channel to share knowledge were informal networks (28, 38 %). When people were in personal contact, asked each other for help and engaged in discussions, knowledge was likely to be transferred (29, 15 %). Experienced senior employees were seen as important sources of expertise (30, 15 %), even after they were officially retired (Jugdev and Wishart, 2014). On the other hand, it was noted that knowledge is lost when experienced people retire (39, 8 %). Besides transferring knowledge between employees, informal networks were found to be an efficient way to share project knowledge between project managers (31, 8 %).

5.5.5 Barriers to learning

Quite a few studies had noted what the knowledge management literature has observed for years: tacit, experiential knowledge is problematic to document and transfer (32, 46 %). Several studies did also show that even when lessons learned from project experiences were documented, this documentation was not extensively used or disseminated (33, 31 %), sometimes due to difficulties of access (41, 8 %), sometimes because of the immense volumes of documentation (52, 8 %). The use of previously prepared lessons learned can also be hampered by lack of contextual information in the documentation (36, 15 %). It was also found that one problem with benefiting from documentation is the fact that it may focus too much on what was done, not how (59, 8 %). Lastly, it has been found that distances of various kind are barriers to learning in and from projects. These include physical distances (34, 15 %), for example where different projects are conducted, time gap between the capture and need for project knowledge (45, 8 %) and cultural distances such as different "organizational cultures" between different projects (46, 8 %).

5.5.6 Documentation and review sessions

Concerning post-project review sessions and lessons learned -documentation, the most common finding was that tacit knowledge is often transferred by using storytelling and metaphors in review sessions (47, 31 %). A noteworthy findings was also that while there are often problems in dissemination and utilization of lessons learned -documents, project review sessions themselves were considered beneficial for learning - even though not everything was translated into documentation (48, 15 %). Documentation, once prepared, is often accessible to the participants of the meeting but not neccessarily to outsiders (54, 8 %). It was noted that more emphasis is laid on post-project reviews than is actually gained from them (51, 8 %). This finding is consistent with the scepticism felt by the staff mentioned earlier (16).

Not all findings concerning documentation were sceptical. It was found that despite the aforementioned reservations, documentation was helpful in transferring knowledge (57, 8 % and 60, 8 %). An interesting finding was that sometimes the willingness to disseminate lessons learned -documentation was hindered by reservations about their content: if the documentation contains classified information (64, 8 %) or criticism towards management (63, 8 %) there may exist reluctance to share it.

5.5.7 The role of technology

The findings from the studied research papers did not place technological tools significant value in capturing learning from projects. The two findings concerning this theme merely stated that intranets, portals and databases can be useful in sharing project knowledge (67, 8 %) but only if they are properly understood (66, 15 %).

6 Discussion and conclusions

The objective of this study was to form an understanding on how project-based knowledge is constructed, disseminated to the wider organization, why this process all too often seems to fail and, based on these considerations, how this knowledge drain could be circumvented. The main research question was defined as "*How can organizations best capture and utilize project-based knowledge?*".

6.1 Conclusions

The first section of the research sought insight to the mechanics of knowledge creation in projects, more specifically *"How do project teams create knowledge?"*. Based on a discussion of research on knowledge management in projects, an integrative framework of knowledge creation in projects was proposed. In this model, the project team is perceived as a temporary organization conducting its work in relative isolation from the parent organization. The lifecycle of this temporary organization is divided into distinct sequences based on the actions performed. Throughout the project, knowledge is created in *intra-project knowledge creation cycle*, which is fed mainly by problem-solving activities of the performed work, contact between project team members from different organizational functions and backgrounds as well as external knowledge inputs. The knowledge created in the project team is embedded in the individual team members, shared by the team and documented in data artifacts. Project-based knowledge is cumulative, reaching its peak at the final stages of the project. This knowledge has various dimensions. In the model presented in this study, project-based knowledge can be classified according to its nature (tacit-explicit-dimension), its embeddedness (individual versus shared knowledge) and the phenomena it refers to (procedural-, technical- and organizational knowledge).

The question on *"Which factors affect the capture and re-use of project-based knowledge in organizations?"* was assessed via a qualitative metasummary of literature on

management of project knowledge. First, a set of relevant literature was retrieved using the methodology for systematic review. As this data was analyzed, a total of 67 abstracted research findings were identified and collected. Based on these findings, a number of factors affecting knowledge capture and re-use can be identified. These include *experience*, *culture and leadership*, *planning and controlling*, *relationships*, *review* and *documentation*.

Experience: Practical lessons can be transmitted from one project to the next via many different routes. Besides codified documentation, experienced employees assigned to new projects make it possible for the other team members to tap into their experience. Since project documentation is often centered around explicit-level product knowledge, the participation of senior employers can help transfer procedural and organizational knowledge from one project to the next. This kind of knowledge transfer by interaction corresponds to the personalization category of knowledge transfer approaches. As firms conduct projects, procedural knowledge is also embedded in project routines, which act as knowledge carriers.

Culture and leadership: Learning from projects is likely to fail if the parent organization and the project team are not equally committed to it. The analyzed articles strongly point that where a people-oriented culture committed to learning and continuous improvement prevails, learning is to be expected. For organizational learning to occur, staff needs to be motivated to capture learnings. This motivation is linked to the employees' understanding of project goals and how they are aligned with the strategy of the organization. According to the temporary organization theory, the project is a transitional phase for the team, during which shared assumptions, values and procedures are formed, largely by problem-solving activities. Thus, the project manager can foster the formation of a culture of learning and critical debate. These findings are consistent with the initial summary of factors affecting project learning, which reported the importance of a culture committed to learning, dialogue and innovativeness as learning enablers and unwillingness to learn from mistakes as a barrier to learning. According to the data, the team members are

likely to be more motivated to learn and document lessons if they can see knowledge from previous projects being actually re-used.

Planning and controlling: The most common barrier to learning from projects was the lack of resources and tight schedules, which were reported in the majority of the studied papers. This is consistent with the preliminary summary of factors affecting project learning conducted as a part of the theoretical discussion in chapter 3.5. In this summary, time pressures were mentioned as a key barrier to knowledge drain in projects while regularity of lessons-learned activities was found to predict learning. In matrix organizations, the pressure on project team members is often increased by their double role in the permanent and project organizations. In these contexts, project work is often perceived as a secondary priority, especially if the project is already in the review phase.

Relationships: It appears that informal relationships complement formalized channels for knowledge transfer. Especially for transferring tacit knowledge that is problematic to transfer through codified artifacts, face-to-face communication and the availability experienced senior employees for consulting are important. The findings also suggest that project knowledge can be spread from one project to another by informal networks of project managers. Informal networks are likely to complement formalized review sessions as a channel to exchange procedural and organizational knowledge related to projects.

Reviews: The results suggest that project review sessions are important venues to create, exchange and codify project-related knowledge if certain conditions are met. Although review sessions have to tendency to be centered around documenting lessons learned, they are also a potentially important venue for learning. In review sessions, perceptions about the project are formed by discussion as opinions are voiced and related documentation is reviewed. In these settings, tacit knowledge is transferred using narratives and metaphors. While review sessions are often designed from the codification perspective, the personalization function is also important as

people often learn more than they document. Using a suitable, formalized method for review sessions can help to boost the motivation of participants. When applying such a method, it is easier for the employees to understand if it is somehow demonstrated, rather than theoretically explained. A tendency for cognitive bias and the selectiveness of participants' memory should be acknowledged when organizing review sessions. Although projects are to some extent sequences of problem-solving activities, the lightbulb moments associated with successful solutions tend to be ephemeral as the context of the problem and failed solutions are often forgotten. A possible solution to this problem would be to conduct project review sessions on predetermined intervals along the project instead of doing them as project postmortems. This is also suggested by the initial summary of factors enabling learning, where the use of formalized process and regular lessons learned -activities are mentioned. It is also important to analyze project experiences instead of merely documenting them. The data pointed out that project personnel tend to have difficulties in generalizing findings and get to root causes, which results in superficial learning.

Documentation: Lessons learned -documentation can serve important functions under suitable conditions, but it should not be seen as the only channel to transmit project knowledge. When documenting lessons, attention should be paid to include enough contextual information in order to make the lessons generalizable. It is also noteworthy that documentation may not solve problems when project experiences are most needed: in unforeseen, critical situations. Documentation should be seen as a complementary channel and a reservoir of technical and procedural project knowledge, which can be tapped to in need. Project documentation is only useful if it is accessible and if the employees can find what they need. This suggest that metadata and information retrieval functionality of document management systems and databases are important. Technology should, however, be seen as enabler of access, not a solution in itself.

Concerning the question on *"How can organizations best capture and utilize project-based knowledge"*, a generalized answer can be presented on the basis of the previous

discussion. Foundations for capturing project knowledge can be laid by establishing suitable conditions, culture and procedures. The ideal ground to cultivate project learning seems to be a people-oriented culture where debate and knowledge are valued, where failures are acknowledged and analyzed and where employees do not benefit from hoarding information. The formation of informal networks should be encouraged. Project teams should be assigned sufficient resources and their work should be supported by management. In such context, a suitable formalized project review methodology should be adopted. It should be recognized that besides project review documentation, project-based knowledge can be embedded in people and processes. Procedural and organizational knowledge can be transferred from one project to the next by assigning experienced personnel to project work. Project review sessions should be systematically conducted on regular intervals. During projects, conscious effort should be placed in utilizing as much lessons from previous projects as possible in order to motivate employees and to integrate previous knowledge into new insights.

6.2 Evaluation of the research

Conducting a qualitative metasummary on project management research proved to be an interesting experiment. Since this method is a novel one and has thus far been applied foremost on the domains of nursing and health care research, it provided fruitful potential for analyzing and summarizing research from a very different field. Qualitative metasummary is an interesting method which a lot of potential outside the scope of its original applications in health care research. It provides a well-defined and structured process for synthesizing research findings.

However, some methodological concerns arose in the course of the study. First, the calculation of sentences containing research findings is a problematic phase. Mechanistic as this sounds, the process is far from trivial. Although the authors of the qualitative metasummary method try to define what a research finding is and

how such a thing should be identified, the process leaves room for interpretation. In actuality, drawing a distinction between sentences containing references to research findings and those discussing noteworthy details in research data is a subject of conjecture. The researcher has to distinguish between the analysis of research data and the interpretations, or findings, constructed as a result.

Second, in the social sciences, research findings are built upon theories and theoretical frameworks produced by earlier research which should be considered when comparing results from different sources. When individual research findings are identified and extracted from research reports, extra caution should be placed to ensure that the original meaning of the sentences is not distorted and they are not generalized outside of their original context.

Third, as project learning is an exceedingly complex phenomenon with a multitude of contextual variables at play, a certain terminological ambiguity seems to exist in research. For example, what do different authors mean by *project learning*? As has been demonstrated, this phenomenon can occur in a multitude of different organizational contexts, in widely varying fields of business, in a wide range of scopes, on distinct yet interlocking levels from individual to team to organization, relate to a great variety of distinct knowledge types, happen within or between projects and so forth. The qualitative metasummary method stresses consistent and well-designed information retrieval and screening phases as keys to managing this complexity of perspectives, but this can at best alleviate, not solve, the problem.

Finally, it is for good reason that methodological guidelines often emphasize the importance of preparing review studies in groups, or at the very least, having a research partner validate the choices made in the information retrieval and article selection phases. In a review-based study, logical and error-free data collection and screening are crucial prerequisites for reaching valid results. The immense volume of the academic literature on project learning and the abovementioned terminological and theoretical ambiguities further exacerbate this problem.

It has to be noted that most, if not all, of the aforementioned reservations apply to review methods in general. Based on the experiences of the current research, qualitative metasummary should not be considered more problematic an approach than other literature-based methods.

To sum up, qualitative metasummary is an interesting approach for identifying and synthesizing research findings and assessing their importance. As the method is still in its infancy and not yet been widely implemented, it is yet to be seen how fruitful an approach it proves to be outside its original field of application in nursing and health care. However, the present study is one step towards answering this question.

More research is needed concerning the effects of different contextual factors in project learning. Since projects are conducted different purposes in pretty much every kind of organization imaginable, the number of contextual variables in play is practically infinite. In current research, these contextual factors are not always sufficiently considered. Rather, project management is traditionally studied as a universal art where similar rules and regularities hold. This is also the case for project management standards and maturity models, although specialized methods also exist. As the area of study matures, more insight into the effects of different contextual configurations will be valuable.

References

M. Ajmal, P. Helo, and T. Kekäle. Critical factors for knowledge management in project business. *Journal of Knowledge Management*, 14(1):156–168, 2010.

B. Ancori, A. Bureth, and P. Cohendet. The economics of knowledge: the debate about codification and tacit knowledge. *Indutrial and corporate change*, 9(2): 255–287, 2000.

H. Aramo-Immonen and H. Vanharanta. Project management: the task of holistic thinking. *Human Factors and Ergonomics in Manufacturing*, 19(6):582–600, 2009.

C. Argyris and D. A. Schön. *Organizational learning: a theory of action perspective*. Reading: Addison-Wesley, 1978.

J. Bach. The immaturity of CMM. *American Programmer*, 7(9):13–18, 1994.

F. Backlund, D. Chronéer, and E. Sundqvist. Project management maturity models – a critical review : A case study within Swedish engineering and construction organizations. 2013.

R. M. Bakker, B. Cambré, L. Korlaar, and J. Raab. Managing the project learning paradox: a set-theoretic approach toward project knowledge transfer. *International Journal of Project Management*, 29(5):494–503, 2011.

K. J. Bannan. Potential for greatness. *Project Management Network*, 19(5):51–54, 2005.

J. B. Barney. Firm resources and sustainable competitive advantage. *Strategic Management Journal*, 17(1):99–120, 1991.

R. F. Baumeister and M. R. Leary. Writing narrative literature reviews. *Review of General Psychology*, 1(3):311–320, 1997.

S. L. Berman, J. Down, and C. W. L. Hill. Tacit knowledge as a source of competitive advantage in the National Basketball Association. *Academy of Management Journal*, 45(1):13–31, 2002.

W. F. Boh. Mechanisms for sharing knowledge in project-based organizations. *Information and Organization*, 17(1):27–58, 2007.

T. Brady, N. Marshall, A. Prencipe, and F. Tell. Making sense of learning landscapes in project-based organizations. *Third European Conference on Organizational Knowledge, Learning and Capabilities, hosted by ALBA, Athens Greece, 5-6 April 2002*, 2002.

M. Bresnen, A. Goussevskaia, and J. Swan. Embedding new management knowledge in project-based organizations. *Organization Studies*, 25(9):1535–1555, 2004.

M. Bresnen et al. *Cross-sector research on knowledge management practices for project learning.* Innovative Research in Management European Academy of Management 2nd Annual Conference Stockholm Sweden, may 2002.

M. Buckland and Fredric Gey. The relationship between recall and precision. *Journal of the American Society for Information Science*, 45(1):12–19, 1994.

E. Cacciatori, D. Tamoschus, and G. Grabher. Knowledge transfer across projects: Codification in creative, high-tech and and engineering industries. *Management Learning*, 43(3):309–331, 2011.

D. I. Cleland and H. Kerzner. *Project Management Dictionary of Terms.* New York: Van Nostrand Reinhold, 1985.

W. M. Cohen and D. A. Levinthal. Absorptive capacity: a new perspective on learning and innovation. *Administrative Science Quarterly*, 35(1):128–152, 1990.

T. J. Cooke-Davies and A. Arzymanow. The maturity of project management in different industries: an investigation into variations between project management models. *International Journal of Project Management*, 21(6):471–478, 2003.

F. Crossan. Research philosophy: towards an understanding. *Nurse Researcher*, 11 (1):45–55, 2003.

A. Davies and T. Brady. Organizational capabilities and learning in complex product systems: towards repeatable solutions. *Research Policy*, pages 931–953, 2000.

R. J. DeFillippi. Introduction: project-based learning, reflective practices and learning outcomes. *Management Learning*, 32(1):5–10, 2001.

G. Dosi, L. Marengo, and G. Fagiolo. Learning in evolutionary environments. *LEM Working Paper Series, October 2003*, 2003.

S. Duffield and S. J. Whitty. Developing a systemic lessons learned knowledge model for organisational learning through projects. *International Journal of Project Management*, 2014.

A. C. Edmondson. The local and variegated nature of learning in organizations: a group-level perspective. *Long Range Planning*, 13(2):128–146, 2002.

A. Fink. *Conducting Research Literature Reviews: From the Internet to the Paper*. Thousand Oaks: Sage Publications, 2005.

P. S. W. Fong. Knowledge creation in multidisciplinary project teams: an empirical study of the processes and their dynamic interrelationships. *International Journal of Project Management*, 21(7):479–486, 2003.

P. A. Fuller, A.R.J. Dainty, and T. Thorpe. Improving project learning: a new approach to lessons learnt. *International Journal of Managing Projects in Business*, 4(1):118–136, 2011.

J. R. Galbraight. Matrix organizational designs - how to combine functional and project forms. *Business horizons*, 14(1):29–40, 1971.

J. R. Galbraight. *Designing Complex Organizations*. Reading, MA: Addison-Wesley, 1973.

R. M. Grant. Prospering in dynamically competitive environments: organizational capacity as knowledge creation. *Organization Science*, 7(4):375–387, 1996a.

R. M. Grant. Toward a knowledge-based theory of the firm. *Strategic Management Journal*, 17(7):109–122, 1996b.

F. R. Gulliver. Post-project appraisals pay. *Harvard business review*, 65(2):128–132, 1987.

M. T. Hansen, N. Nohria, and T. Tierney. What's your strategy for managing knowledge? *Harvard business review*, 44(2):106–116, 1999.

S. Hirsjärvi, P. Remes, and P. Sajavaara. *Tutki ja kirjoita*. Helsinki: Tammi, 2009.

M. Hobday. The project-based organization: an ideal form for managing complex products and systems? *Research Policy*, pages 871–893, 2000.

J. C. Huang and S. Newell. Knowledge integration processes and dynamics within the context of cross-functional projects. *International Journal of Project Management*, 21(3):167–176, 2003.

C. W. Ibbs and Y. H. Kwak. Assessing project management maturity. *Project Management Journal*, 31(1):32–43, 2000.

H. Jalonen. Epävarmuuden ilmeneminen innovaatiotoiminnassa - systemaattinen kirjallisuuskatsaus. *Liiketaloudellinen Aikakauskirja*, 4(11):422–442, 2011.

K. Johansson, A. Axelin, M. Stolt, and R.-L Ääri. *Systemaattinen kirjallisuuskatsaus ja sen tekeminen*. Turku: Turun yliopisto, 2007.

K. Jugdev. Learning from lessons learned: project management research program. *American Journal of Economics and Business Administration*, 4(1):12–22, 2012.

K. Jugdev and J. Thomas. Project management maturity models: the silver bullets of competitive advantage? *Project Management Journal*, 33(4):4–14, 2002.

K. Jugdev and P. Wishart. Mutural caring - resolving habituation through awareness: supporting meaningful learning from projects. *Project Management Journal*, 45(2):66–82, 2014.

J. J. J. Kasvi, M. Vartiainen, and M. Hailikari. Managing knowledge and knowledge competences in projects and project organisations. *International Journal of Project Management*, 21(8):571–582, 2003.

A. Keegan and R. J. Turner. Quantity versus quality in project-based learning. *Management Learning*, 32(1):77–98, 2001.

K. S. Khan, R. Kunz, J. Kleijnen, and G. Antes. Five steps to conducting a systematic review. *Journal of the Royal Society of Medicine*, 96(3):118–121, 2003.

J. Kim and D. Wilemon. The learning organization as facilitator of complex npd projects. *Creativity and Innovation Management*, 16(2):176–191, 2007.

M. Kleinsmann and R. Valkenburg. Learning from collaborative new product development projects. *Journal of Workplace Learning*, 17(3):146–156, 2005.

B. Kogut and U. Zander. Knowledge of the firm, combinative capabilities, and the replication of technology. *Organization Science*, 3(3):383–397, 1992.

U. Koners and K. Goffin. Learning from new product development projects: and exploratory study. *Creativity and Innovation Management*, 14(4):334–344, 2005.

K. U. Koskinen, P. Pihlanto, and H. Vanharanta. Tacit knowledge acquisition and sharing in a project work context. *International Journal of Project Management*, 21(4):281–290, 2003.

T. Kotnour. A learning framework for project management. *Project Management Journal*, 30(2):32–38, 1999.

T. Kotnour. Organizational learning practices in the project management environment. *International Journal of Quality & Reliability Management*, pages 393–406, 2000.

T. Kotnour and M. Hjelm. *Leadership mechanisms for enabling learning within project teams*. Athens, Greece, The Third European Conference on Organizational Knowledge, Learning and Capabilities, 2002.

E. W. Larson and D. H. Gobeli. Matrix management: contradictions and insights. *California management review*, 29(4):26–138, 1987.

E. W. Larson and D. H. Gobeli. Significance of project management structure on development success. *IEEE Transactions on Engineering Management*, 36(2): 119–125, 1989.

F. Lindner and A. Wald. *Success factors of knowledge management in temporary organizations*. 29, 7, 2011.

R. A. Lundin and A. Söderholm. A theory of the temporary organization. *Scandinavian Journal of Management*, 11(4):437–455, 1995.

K. Lyytinen and D. Robey. Learning failure in information systems development. *Information Systems Journal*, 9(2):85–101, 1999.

J. G. McEvoy. Modernism, postmodernism and the historiography of science. *Historical Studies in the Physical and Biological Sciences*, 37(2):383–408, 2007.

J. Metsämuuronen. *Tutkimuksen tekemisen perusteet ihmistieteissä*. Helsinki: International Methelp, 2001.

C. D. Mulrow. Systematic reviews: Rationale for systematic reviews. *British medical journal*, 309(6954):597–599, 1994.

J. Nahapiet and S. Ghoshal. Social capital, intellectual capital, and the competitive advantage. *Academy of Management Review*, 23(2):242–266, 1998.

S. Newell and L. F. Edelman. Developing a dynamic project learning and cross-project learning capability: synthesizing two perspectives. *Information Systems Journal*, 18(6):567–591, 2008.

S. Newell, M. Bresnen, L. Edelman, H. Scarbrough, and J. Swan. Sharing knowledge across projects: limits to ICT-led project review practices. *Management Learning*, 37(2):167–185, 2006.

S. Newell et al. 'best practice' development and transfer in the NHS: the importance of process as well as product knowledge. *Health Services Management Research*, 16(1):1–12, 2003.

I. Nonaka. A dynamic theory of organizational knowledge creation. *Organization Science*, 5(1):14–37, 1994.

I. Nonaka and H. Takeuchi. *The knowledge-creating company*. New York: Oxford University Press, 1995.

I. Nonaka, R. Toyama, and N. Konno. SECI, ba and leadership: a unified model of dynamic knowledge creation. *Long range planning*, 33(1):5–34, 2000.

A. Onwuegbuzie. Effect sizes in qualitative research: a prolegomenon. *Quality & Quantity*, 37(4):393–409, 2003.

B. L. Paterson et al. Conducting qualitative metasynthesis research: Insights from a metasynthesis project. 2009.

R. Pelin. *Projektihallinnan käsikirja*. Helsinki: Projektijohtaminen Oy Risto Pelin, 2004.

E. T. Penrose. *The theory of the growth of the firm*. Oxford: John Wiley and Sons, 1959.

M. Petticrew. Systematic reviews from astronomy to zoology: myths and misconceptions. *British medical journal*, 322(7278):98–101, 2001.

M. Polanyi. *The tacit dimension*. London: Routledge & Kegan Paul, 1967.

J. Pollack. Transferring knowledge about knowledge management: implementation of a complex organisational change programme. *International Journal of Project Management*, 30(8):877–886, 2012.

A. Prencipe and F. Tell. Inter-project learning: processes and outcomes of knowledge codification in project-based firms. *Research Policy*, 30(9):1373–1394, 2001.

Project Management Institute. *Organizational Project Management Maturity Model (OPM3).* Newtown Square, Pennsylvania :PMI, 2003.

Project Management Institute. *A guide to the project management body of knowledge.* s. l. :PMI, 2008.

L. Prusak. *Knowledge in organizations.* Boston (MA): Butterworth-Heinemann, 1997.

A. S. Pullin and G. B. Stewart. Guidelines for systematic review in conservation and environmental management. *Conservation Biology*, 20(6):1647–1656, 2006.

A. Salminen. *Mikä kirjallisuuskatsaus? Johdatus kirjallisuuskatsauksen tyyppeihin ja hallintotieteellisiin sovelluksiin.* Vaasa: Vaasan yliopisto, 2011.

M. Sandelowski and J. Barroso. Finding the findings in qualitative studies. *Journal of Nursing Scholarship*, 34(3):213–219, 2002.

M. Sandelowski and J. Barroso. Creating metasummaries of qualitative findings. *Nursing research*, 52(4):226–233, 2003.

M. Sandelowski, J. Barroso, and C. I. Voils. Using qualitative metasummary to synthesize qualitative and quantitative descriptive findings. *Research in nursing and health*, 30(1):99–11, 2007.

G. Santayana. *The Life of Reason: The Phases of Human Progress.* New York: Dover, 2005.

E. Schein. *Organizational culture and leadership*. Jossey-Bass, San Francisco, 4th edition, 2010.

M. Schindler and M. J. Eppler. Harvesting project knowledge: a review of project learning methods and success factors. *International Journal of Project Management*, 21(3):219–228, 2003.

P. M. Senge. The leader's new work: building learning organizations. *MIT Sloan Management Review*, 32(1):7–23, 1990.

A. J. Sense and M. Antoni. Exploring the politics of project learning. *International Journal of Project Management*, 21(7):487–494, 2003.

J. C. Spender. Making knowledge the basis of a dynamic theory of the firm. *Strategic Management Journal*, 17:45–62, 1996.

G. W. I. Suter. Review papers are important and worth writing. *Environmental Toxicology and Chemistry*, 32(9):1929–1930, 2013.

J. Swan, H. Scarbrough, and S. Newell. Why don't (or do) organizations learn from projects? *Management Learning*, 41(3):325–344, 2010.

G. Szulanski. Exploring internal stickiness: impediments to the transfer of best practice within a firm. *Strategic Management Journal*, 17:27–43, 1996.

D. J. Teece. Capturing value from knowledge assets: the new economy markets for know-how, and intangible assets. *California Management Review*, 40(3):55–79, 1998.

J. R. Turner and R. Müller. On the nature of the project as temporary organization. *International Journal of Project Management*, 21(1):1–8, 2003.

C. Vergopia. *Project review maturity and project performance: and empirical case study*. 2008.

H. Virtanen and S. Salanterä. Laadullinen metayhteenveto: systemaattinen kirjallisuuskatsaus laadullisista tutkimuksista. In Minna Stolt Kirsi Johansson, Anna Axelin and Riitta-Liisa Ääri, editors, *Systemaattinen kirjallisuuskatsaus ja sen tekeminen*, pages 71–83. Turun yliopisto, Turku, 2007.

E. von Hippel. "Sticky information" and the locus of problem solving: implications for innovation. *Management Science*, 40(4):429–439, 1994.

M. von Zedtwitz. Organizational learning through post-project reviews in R&D. *R&D Management*, 32(3):255–268, 2002.

B. Wernerfelt. A resource-based view of the firm. *Strategic Managemet Journal*, 5 (2):171–180, 1984.

A. Wieviora et al. *The impact of unique characteristics of project-based organizations on knowledge transfer*. 2009.

T. Williams. How do organizations learn from projects - and do they? *IEEE Transactions on Engineering Management*, 55(2):248–266, 2008.

M. Zollo and S. G. Winter. Deliberate learning and the evolution of dynamic capabilities. *Organization Science*, 13(3):339–351, 2002.

Appendices

A Included research papers

Author(s)	Title	Year	Journal
Bakker et al.	Managing the project learning paradox: A set-theoretic approach toward project knowledge transfer	2011	International Journal of Project Management
Duffield & Whitty	Developing a systemic lessons learned knowledge model for organisational learning through projects	2014	International Journal of Project Management
Fuller et al.	Improving project learning: a new approach to lessons learnt	2011	International Journal of Managing Projects in Business
Jugdev & Wishart	Mutual caring - Resolving habituation through awareness: Supporting meaningful learning from projects	2014	Project Management Journal
Kim & Wilemon	The learning organization as facilitator of complex NPD projects	2007	Creativity and Innovation Management
Kleinsmann & Valkenburg	Learning from collaborative new product development projects	2005	Journal of Workplace Learning
Koners & Goffin	Learning from New Product Development projects: and exploratory study	2005	Creativity and Innovation Management
Newell & Edelman	Developing a dynamic project learning and cross-project learning capability: synthesizing two perspectives	2008	Information Systems Journal

Newell et al.	Sharing knowledge across projects: Limits to ICT-led project review practices	2006	Management Learning
Prencipe & Tell	Inter-project learning: processes and outcomes of knowledge codification in project-based firms	2001	Research Policy
Sense & Antoni	Exploring the politics of project learning	2003	International Journal of Project Management
Swan et al.	Why don't (or do) organizations learn from projects?	2010	Management Learning
von Zedtwitz	Organizational learning through post-project reviews in R&D	2002	R&D Management

B Abstracted findings

No.	Finding	N	Frequency
	When and how does learning occur?		
1	Experience accumulation is important for transfering knowledge. Experienced employees spread knowledge in new projects.	3	23 %
2	Project teams can learn a lot from problems encountered in the project. Besides problem solving, much can be learned from failures and mistakes if they are acknowledged.	2	15 %
3	Experience from conducting projects leads to a certain routinization in conducting projects. This is a result of learning, although it can also hinder future learning.	2	15 %
4	In collaborative projects, a long-term relationship with partners fosters learning from each other.	1	8 %
5	When people from different organizational functions collaborate, learning occurs.	1	8 %
	Organizational context		
6	Limited resources and tight schedules hinder learning from projects.	8	62 %
7	The parent organization should be aware and committed to transfering project-based knowledge in order for it to succeed. Knowledge sharing should be encouraged by leadership.	3	23 %
8	Learning from projects is likely to occur when the organizational culture encourages sharing knowledge and helping colleagues and values learning.	3	23 %
9	The double role of employees in the functional and project organization hinders learning project knowledge, as people prioritize functional work over project-related work.	3	23 %
10	A functional organization may value learning more than projectized organization due to the difference in temporal orientation.	2	15 %
11	A high level of absoptive capacity of the parent organization is an essential, although not sufficient, requirement for knowledge transfer to succeed.	1	8 %

12	The relationship of the project manager and project owner is important for the transfer of project-based knowledge. The amount of interaction, shared understanding of goals and experience of collaboration foster knowledge transfer.	1	8 %
13	Organizational context and culture affect how tools for knowledge capture are used.	1	8 %
14	A specialized unit supporting project work can only effectively support learning in cross-functional projects if the functional units are committed to learning.	1	8 %
15	When the structure of the organization is altered, new knowledge processes and be adopted.	1	8 %
	Leadership and the attitudes of staff		
16	Staff does not believe in the usefulness of review sessions. They are seen as a bureaucratic requirement.	3	23 %
17	Personal-level project-based knowledge is often seen as personal "intellectual property", which discourages sharing it with others.	3	23 %
18	Understanding the goals of the organization and the relationship between different projects fosters successful knowledge transfer.	2	15 %
19	The use of databases for documenting lessons learned is limited when their use is too laborious or when employees do not believe in documentation.	2	15%
20	Employees feel that "re-inventing the wheel"-problem is inevitable. Projects are seen as unique undertakings.	2	15 %
21	A reluctance to accept learning from others can hinder learning.	2	15%
22	If the project manager uses knowledge gained from previous project experiences, the staff is more willing to document learning.	2	15 %
23	Learning is not crucial to the success of routine projects.	2	15 %
24	A high degree of trust in others' capabilities minimizes debate and adversely affects knowledge sharing.	1	8 %
25	Management can alter schedules to accomodate time for learning and reflection.	1	8 %
26	A celebratory meal after a review session can reinforce team learning.	1	8 %
27	Theoretical explanations of knowledge capture methods are not sufficient in motivating staff to use them – experience from their use is.	1	8 %

	The role of informal relations and personal contact		
28	Informal networks are often seen as the most important channel to share knowledge, especially dyadic relationships.	5	38 %
29	Personal contact, oral communication and asking for help from experiences colleagues fosters learning.	2	15 %
30	Senior employees sharing their experience is an important channel to spread knowledge.	2	15 %
31	Informal networks of project managers are an efficient way to share project-based knowledge in organizations.	1	8 %
	Barriers to learning		
32	Tacit, experiential knowledge is difficult to document and transfer.	6	46 %
33	Project documentation is often insufficiently disseminated and used.	4	31 %
34	Physical distance is a barrier to learning.	2	15 %
35	Insufficient communication is a barrier to learning.	2	15 %
36	Insufficient documentation, especially lack of contextual data, is a barrier to learning.	2	15 %
37	It can be difficult to generalize and abstract single project occurrences or see the connection between similar situations in different projects.	2	15 %
38	Reluctance to admit mistakes hinders learning from experiences.	2	15 %
39	Staff turnover, especially when experienced people retire, results in knowledge drain.	1	8 %
40	Discontinuities in organizations are harmful to learning.	1	8 %
41	Project documentation is often not easy to access.	1	8 %
42	Knowledge is often not actively sought before a problem arises. When everything goes well, learning is ignored.	1	8 %
43	The potential and benefits of learning from others is not always recognized.	1	8 %
44	People do not always want to reflect upon their own actions.	1	8 %
45	Time gap between knowledge capture and when its needed hinders learning.	1	8 %
46	Cultural distance is a barrier to learning.	1	8 %
	Documentation and review sessions		
47	The tacit nature of knowledge is reflected in the use of metaphors and stories in review sessions.	4	31 %

48	Personnel often learn more than is documented in review sessions. Review sessions provide space for reflection.	2	15 %
49	A suitable method can stimulate interest for reflection in teams.	2	15 %
50	Project documentation is may not be useful in unforeseen situations.	2	15 %
51	More emphasis is laid on PPRs than is actually gained from them.	1	8 %
52	The volume of project documentation can be too vast to find the needed information.	1	8 %
53	Codification is not done systematically.	1	8 %
54	Project documentation is disseminated effectively among participants of PPR sessions, but not to others.	1	8 %
55	Documenting lessons is not directly related to team- or organization-level learning.	1	8 %
56	Codified knowledge is easier to share than personal learning.	1	8 %
57	Documenting lessons is important for team-level learning.	1	8 %
58	Documents are often not used after they are prepared.	1	8 %
59	Documentation is often centered on product, not process knowledge – what, not how, things were done.	1	8 %
60	Documentation is seen as a useful way to transfer lessons to future projects.	1	8 %
61	Problems solved along the project are often forgotten by the time the end-of-project reviews are conducted.	1	8 %
62	ICT-based systems to knowledge sharing are not effective.	1	8 %
63	If management is criticized in review documentation, team members may be reluctant to share it outside the team.	1	8 %
64	Documented classified information cannot be freely distributed.	1	8 %
65	Ambivalent experiences are often forgotten, while easy-to-remember information gets documented.	1	8 %
	The role of technology		
66	Technology must be understood to be useful.	2	15 %
67	Intranets, portals and databases can be used for sharing project knowledge.	1	8 %

C Intensity effect sizes

Article	No. of findings	Intensity effect size
Newell et al. (2006)	18	27 %
Prencipe and Tell (2001)	13	19 %
Swan et al. (2010)	13	19 %
Duffield and Whitty (2014)	12	18 %
Newell and Edelman (2008)	12	18 %
Kim and Wilemon (2007)	11	16 %
Sense and Antoni (2003)	9	13 %
Jugdev and Wishart (2014)	7	10 %
Kleinsmann and Valkenburg (2005)	6	9 %
Koners and Goffin (2005)	6	9 %
von Zedtwitz (2002)	6	9 %
Fuller et al. (2011)	4	6 %
Bakker et al. (2011)	3	4 %