JYU DISSERTATIONS 166

Helena Merikoski

How to Start a Software Development Project in a Customer-Supplier Context

The Supplier's Viewpoint

UNIVERSITY OF JYVÄSKYLÄ
FACULTY OF INFORMATION TECHNOLOGY

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Esitetään Jyväskylän yliopiston informaatioteknologian tiedekunnan suostumuksella
julkisesti tarkastettavaksi yliopiston Agora-rakennuksen Lea Pulkkisen salissa
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ABSTRACT

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How to start a software development project in a customer-supplier context: the supplier's viewpoint
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Suppliers continue to find it challenging to successfully deliver software development projects to external customers. A project's start-up phase is recognized to be crucial to success of the project. This dissertation aims to find a solution to the research problem: how to start a software development project in a customer - supplier context?

To find an answer to the research problem, this research concentrates on the supplier's perspective and studies the project business of six supplier firms by applying both quantitative and qualitative research methods. As a result, a project start-up model was developed, concentrating on the project start-up phase from the supplier's perspective.

The model combines the project start-up practices and the roles involved. The practices described in the model are designed to help a supplier firm create the conditions for the success of the project by following a structured and systematic approach during the project start-up phase. Additionally, this research identified context-related challenges from supplier's perspective during the project start-up phase. The identified challenges emphasize the importance of differentiating the customer's and supplier's perspectives, especially when studying software development projects in a customer-supplier context.

This research offers deeper understanding about the software development projects within the customer-supplier context and makes the project start-up phase visible from the supplier's perspective. This research provides a tool, in the form of a project start-up model, for suppliers to use when developing their project processes and practices. For future research, it is important to test the developed project start-up model and to ensure its applicability in different contexts and projects. Implementing the project start-up phase by applying the proposed model contributes to the success of a software development project and thus helps ensure achievement of the business objectives set for the project from both the supplier's and the customer's perspectives.

Keywords: project business, project start-up, project management, supplier, software development project

TIIVISTELMÄ (ABSTRACT IN FINNISH)

Merikoski, Helena
Kuinka käynnistää ohjelmistokehitysprojekti asiakas-toimittaja kontekstissa: toimittajan näkökulma
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Ohjelmistokehitysprojektin toteuttaminen projektille asetetut liiketoimintatavoitteet saavuttaen on haasteellinen tehtävä toimittajayritykselle. Projektin käynnistämisvaihe on tunnistettu yhdeksi kriittisimmistä vaiheista projektin onnistumista tarkasteltaessa. Tässä väitöskirjassa pyritään löytämään ratkaisu tutkimusongelmaan: kuinka käynnistää ohjelmistokehitysprojekti asiakas-toimittaja kontekstissa?

Tutkimusongelman ratkaisemiseksi laadittiin kirjallisuuteen perustuva kuvaus asiakas-toimittaja kontekstista. Tästä kontekstista valittiin toimittajan näkökulma ja tutkittiin yhteensä kuuden toimittajayrityksen ohjelmistokehitysprojektien toteuttamiseen keskittynyttä projektiliiketoimintaa. Tutkimuksen aikana sovellettiin sekä määrällisiä että laadullisia tutkimusmenetelmiä.

Tehdyn työn tuloksena syntyi projektin käynnistämismalli. Malliin on koottu projektin käynnistämiseen liittyvät käytännöt ja niiden toteuttamiseen osallistuvat roolit. Mallissa esitettyjen käytäntöjen tavoitteena on auttaa toimittajayritystä luomaan projektille onnistumisen edellytykset noudattamalla projektin käynnistämisvaiheessa jäsenneltyä ja systemaattista toimintatapaa. Lisäksi tutkimuksessa tunnistettiin asiakas-toimittaja kontekstin aiheuttamia projektin käynnistämiseen liittyviä haasteita toimittajan näkökulmasta. Tunnistetut haasteet korostavat asiakkaan ja toimittajan näkökulmien erottamisen tärkeyttä erityisesti asiakas-toimittaja kontekstissa toteutettavia ohjelmistokehitysprojekteja tutkittaessa.

Tutkimus syventää ymmärrystä ohjelmistokehitysprojekteista asiakas-toimittaja kontekstista ja tekee projektin käynnistämisvaiheen näkyväksi toimittajan näkökulmasta. Siten tutkimus tarjoaa projektin käynnistämismallin muodossa työkalun toimittajayrityksille kehittää projektin käynnistämiseen ja projektiliiketoimintaan liittyviä prosesseja ja toimintatapoja. Jatkossa on tärkeää testata kehitettyä projektin käynnistämismallia ja varmistaa sen käyttökelpoisuus erilaisissa yrityksissä ja projekteissa. Projektin käynnistämisvaiheen toteuttaminen esitettyä projektin käynnistämismallia soveltaen edesauttaa asiakas-toimittaja kontekstissa toteutettavan ohjelmistokehitysprojektin onnistumista ja siten myötävaikuttaa projektille asetettujen liiketoimintatavoitteiden saavuttamista niin toimittajan kuin asiakkaankin näkökulmista.

Asiasanat: projektiliiketoiminta, projektin käynnistäminen, projektinhallinta, toimittaja, ohjelmistokehitysprojekti

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LIST OF INCLUDED ARTICLES

I. Ahonen J. J., Savolainen P., Merikoski H., and Nevalainen J. (2015). Reported project management effort, project size, and contract type. *Journal of Systems and Software*, 109, 205–213.

II. Merikoski H., Savolainen P., and Ahonen J.J. (2017). Supplier's software development project start-up practices. *International Journal of Managing Projects in Business*, 10(4), 880-896.

III. Merikoski H., Savolainen P., and Ahonen J.J. (2019). Perspective matters: Challenges during handover in supplier firms and their linkage to influential factors. Submitted to *Project Management Journal*.

IV. Raninen A., Merikoski H., Ahonen J.J., and Beecham S., (2015). Applying software process modeling to improve customer support processes. *Journal of Software: Evolution and Process*, 27(4), 274-293.

FIGURES

TABLES

CONTENTS

1 INTRODUCTION

Suppliers continue to find it challenging to successfully deliver software development projects to external customers. Even though project failures have been the subject of various studies for decades, no ideal roadmap has been created to help prevent project failures.

In this research, the focus is on software development projects that are carried out in a customer-supplier context. In this situation, when a customer identifies a development need in its organization, it acquires software development work from an external supplier. Then, the supplier delivers the project which fulfils, at the same time, both the requirements of the customer and the objectives of supplier's own business. Thus, this research makes a distinction between customer's and supplier's perspectives by adopting the supplier's viewpoint of a software development project, meaning the supplier and the customer are not part of the same organization.

It is common practice today to acquire software development work from an external supplier; in-house software development has become relatively uncommon way to conduct IT operations. This evolution towards outsourcing has opened up almost limitless business opportunities for software suppliers globally. However, the majority of earlier software development outsourcing studies have focused on the customer's perspective; the supplier's perspective has gained less attention among researchers (Gopal et al., 2011; Gonzalez et al., 2006).

It is understood that software development outsourcing should produce benefits not only for the customer, but also for the supplier (Dibbern et al., 2004; Wang et al., 2017). Gaining deeper understanding about the supplier's perspective is important because the supplier bears significant responsibility for fulfilling both the customer's and supplier's objectives (Lee, 2008). This is not easy to achieve, and as a result, outsourced software development projects carry a reputation for frequent failure. Previous studies have posited that outsourced software development projects may fail due to mistakes made before the project has actually started (Ahonen & Savolainen, 2010).

The importance of early phases of the project lifecycle have been noticed to be crucial for the success of a project (Edkins et al., 2013; Kappelman et al., 2007;

Williams & Samset, 2010). Therefore, it is important for the supplier firm to be able to manage the project from the earliest stages. The project start-up phase has been identified by Fangel (1991), and its importance for outsourced software development projects is highlighted (Savolainen et al., 2015). Furthermore, the need for effective project start-up is made clear (Halman & Burger, 2002). However, empirical research about early project phases is lacking, especially in the customer-supplier context.

The aim of this research is to offer deeper insight into the software development project start-up phase from the supplier's perspective within the customer-supplier context. This research aims to find answers to the question of how to start a software development project in this chosen context. The conducted research resulted in a project start-up model that can be applied during a start-up phase of software development projects in supplier firms, offering guidance to suppliers as they deliver projects to their customers.

This dissertation consists of an introduction and four articles. The research problem and research questions are defined in Chapter 2 and the basic concepts and previous literature are presented in Chapter 3. The methodology is described in Chapter 4 while the general description of the steps of the followed research process can be found in Chapter 5. The main contribution of this dissertation, a project start-up model, is presented in Chapter 6 while a review of the articles can be found in Chapter 7. Chapter 8 offers answers to the research problem and research questions and Chapter 9 focuses on conclusions.

2 RESEARCH PROBLEM AND RESEARCH QUESTIONS

To gain better understanding about the start-up phase of a software development project in a customer-supplier context, the overall research problem and four research questions are defined. The overall research problem of this dissertation is:

RP. How to start a software development project in a customer-supplier context?

This research attempts to find a solution to the research problem by answering four research questions RQ1-RQ4. The answers to each research question can be found in Articles I-III, which offer a partial answer to the overall research problem. When combining these partial answers, this research offers insight into the software development project start-up phase in a customer-supplier context.

The starting point of this research was to define and to find the answer to the following research question:

RQ1. How much project management effort is reserved for a software development project in a supplier firm?

Additionally, to be able to build and to present a theory about a project start-up phase from the supplier's perspective, the following research questions were defined:

RQ2. What happens in a supplier firm during the project start-up phase?
RQ3. What practices are in use in supplier firms during the project start-up phase?

Finally, to gain deeper understanding, about the challenges a supplier firm faces during a project start-up phase, the following research question was defined:

RQ4. What are the challenges associated with the project start-up phase from the supplier's perspective?

In Figure 1, the research problem, the research questions and their linkages to Articles I-III and to each other are described. The applied data-collection method is described and validated in Article IV, and thus, it relates to Articles II and III.

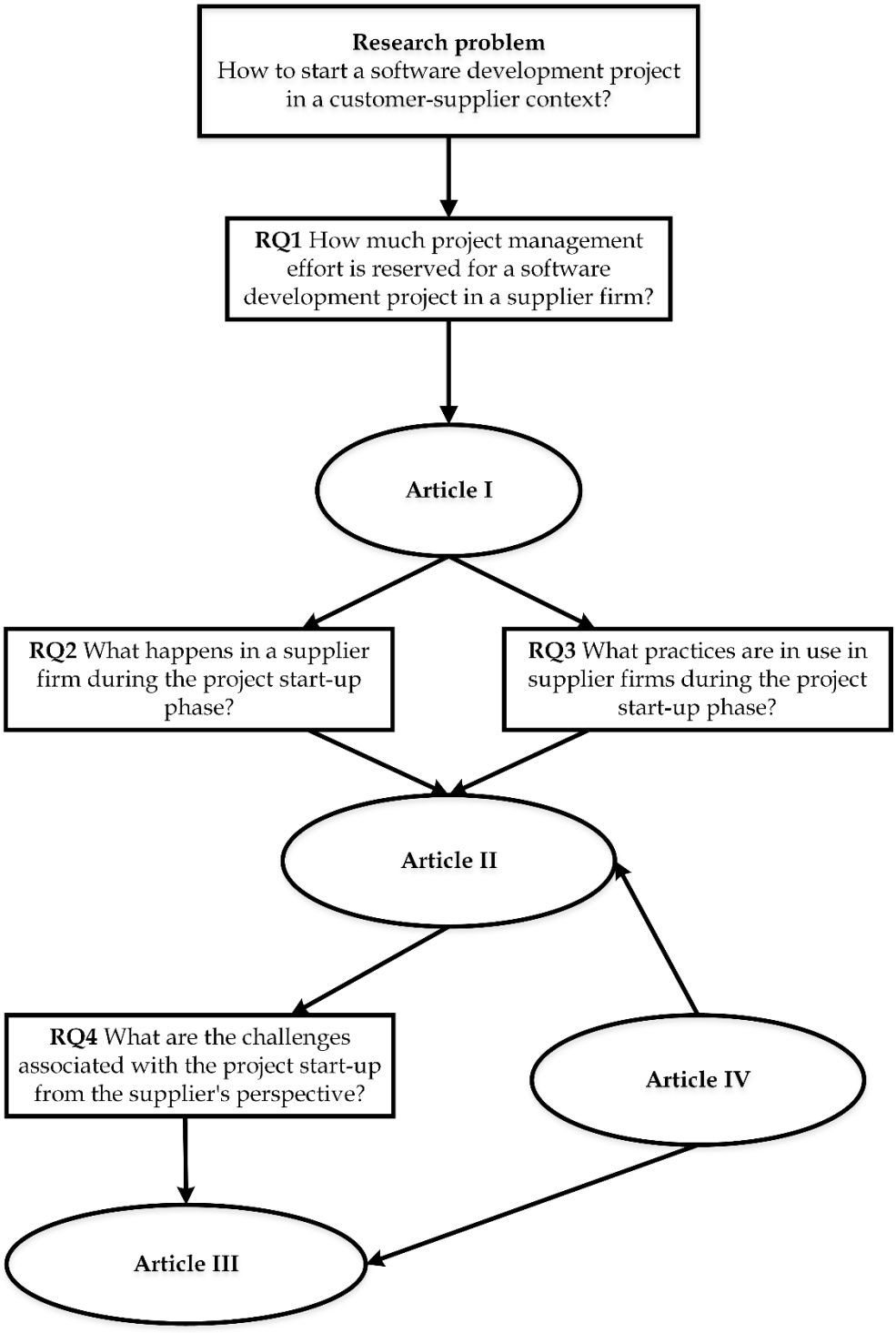

FIGURE 1 The research problem, research questions and their linkages to Articles I-IV

3 BASIC CONCEPTS

This dissertation focuses on the software development project start-up phase in the customer-supplier context. The supplier's perspective is chosen. Thus, the basic concepts for this research are found in software development, project management and project business literature and related standards. The most relevant knowledge and key concepts are discussed in the following sections.

3.1 Software development project

The software industry began to develop in the 1960s when the first software products were launched (Cusumano, 2004). Since then, the industry has evolved and grown rapidly. Today, digitalization has changed the world, and software has played a major role in this change. Thus, a wide variety of software products and related services are available for almost all areas of life.

In general, a *software product* is

> "a set of computer programs, procedures, and possibly associated documentation and data". (ISO/IEC, 2008).

To simplify, various software products can be divided into two groups: generic and customized (Sommerville, cop. 2011). Other terms for customized software are bespoke software and tailored software. In this research, the term customized software is used to describe the software that is developed for an external customer in a software development project. Today, software is not simply a single program.

Thus, most of software is developed professionally, and its development continues throughout its life cycle (Sommerville, cop. 2011). *Software development* can be defined as

> "a professional activity where software is developed for specific business purposes…". (Sommerville, cop. 2011).

Because of the complex nature of software, most software development work is conducted in projects. Several definitions for a project can be found from the literature and standards. Here, the definition of a project is adopted from the standard ISO/IEC 12207, which defines a *project* as

> "an endeavour with defined start and finish dates undertaken to create a product or service in accordance with specified resources and requirements". (ISO/IEC, 2008).

When developing a generic software product, the development work is usually conducted within one organization. Thus, a supplier develops a software product which can be sold to several customers. This so-called software product business is based on the volume of sales (Cusumano, 2004), and hence, the development of generic software products differs radically from the development of customized software.

The customized software business is heavily dependent on the creation and maintenance of customer relationships (Cusumano, 2004). With customization, a supplier develops software for a specific customer, which has its own requirements for the end product of the project. Thus, the supplier firm fulfils the needs of one specific customer by delivering a software development project as agreed with the customer.

Since software products (generic versus customized) represent various types of software, the software development projects do as well. Although software development projects have been undertaken for decades, lack of well-established terms and definitions exists to clearly describe various project types and the differences between them. However, it is important to identify different project types, because they must be managed differently (Dekkers & Forselius, 2007).

Seven different types of software development-related projects have been identified (Dekkers & Forselius, 2007):

1. Customer-specific new development project, where new customer-specific software is developed.
2. Software product new development project, where a new software product is developed for more than one customer.
3. Software version enhancement project, where a new version of existing software is developed.
4. ICT service development project, where a continuous or temporary service is developed.
5. Package-software configuration project, where a software package is installed and parametrized for a customer.
6. Data-conversion project, where data is moved from a data storage of a system to a data storage of another system.
7. Software integration development project, where the software is developed to provide interface services between different systems.

The main difference between the different types of projects listed above is whether they result in a software or a service. The results of different project

types can be also divided into two categories in the same way Sommerville (cop. 2011) categorized software products as generic and customized: developed for a single customer or more than a one customer.

Because the focus of this research is on a project itself, the term *end product* is used to describe the result. Here, the end product of a project may be a complete system, a part of a system or development of some aspect of the R&D project of the external customer (Ahonen et al., 2015). In this thesis, the focus is on software development projects delivered to the external customer. Thus, the relevant project types from the list above are 1. Customer specific new development project, 3. Software version enhancement project, 5. Package software configuration project, 6. Data conversion project and 7. Software integration development project. Therefore, any other types of projects are excluded from this research.

3.2 Customer-supplier context

When studying projects, it is important to consider the context in which the project is implemented (Engwall, 2003; P. W. Morris & Geraldi, 2011). In this research, the focus is on software development projects that are carried out in a customer-supplier context. This context is presented in Figure 2.

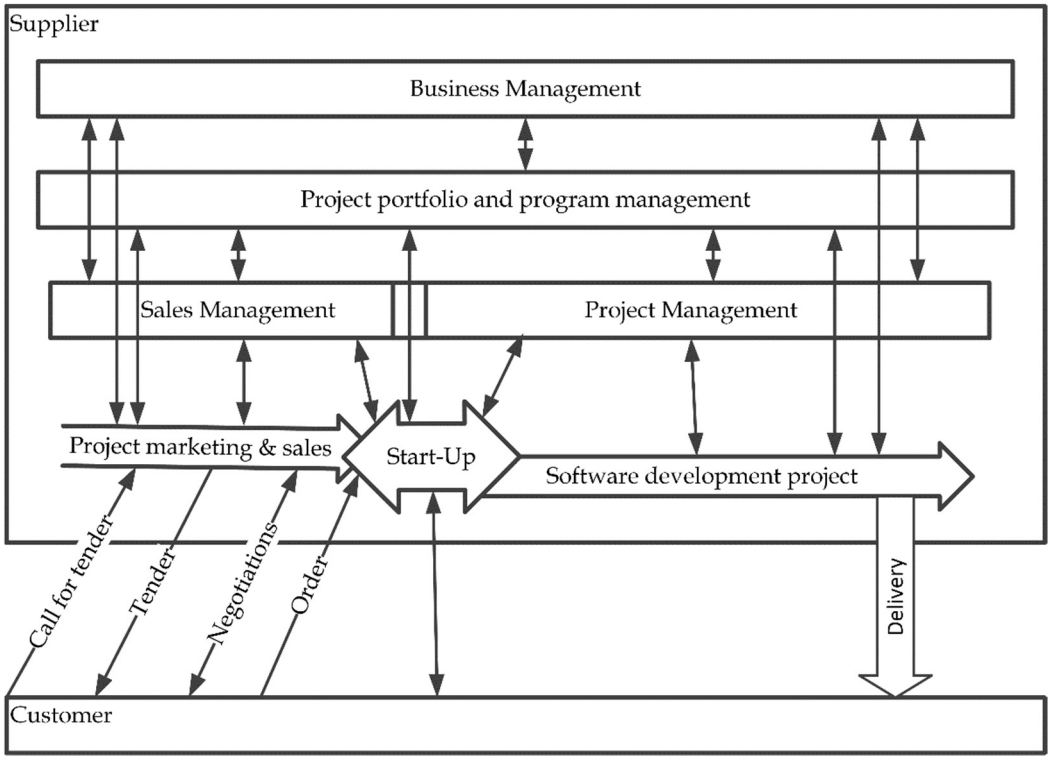

FIGURE 2 A customer-supplier context of the research

As can be seen in Figure 2, at least two parties are involved in the project: a customer and a supplier. Here, *a customer* is

> "the person(s) or organization (s) that will pay for the project's product, service or result" (PMI, 2013b).

Here, *a supplier* is

> "an organization or individual that enters into an agreement with the acquirer for the supply of a product or service". (ISO/IEC, 2008).

Simplified, the situation here is, when a customer has identified a development need, it acquires a software development work from an external supplier. Then the supplier delivers the software, which fulfils both the requirements of the customer and the objectives of the supplier's business.

Earlier studies have highlighted the importance of the distinction in perspectives of the different parties involved in a project. This research distinguishes between customer's and supplier's perspectives by adopting the supplier's viewpoint. Therefore, in Figure 2, the context of this research is described from the supplier's point of view.

As can be seen from Figure 2, the supplier and the customer are not part of the same organization. It means that the customer acquires and the supplier delivers the software that is developed during the project. Therefore, these two parties have different motives and objectives for the project. In general, a customer wants to fulfil its development need by acquiring a software or an information system from the external supplier. Likewise, a supplier wants to fulfil its business objectives by delivering the software development project to the customer.

In any case, the strategy of a supplier firm defines what types of projects are included in its project programs and portfolios (Milosevic & Srivannaboon, 2006). In the software industry in general, two different business logics can be found, one focused on software products and the other focused on software development projects (Helander & Ulkuniemi, 2012). However, many software supplier firms which operate in the project business have chosen a hybrid business model (Cusumano, 2004), where the marketing of customized software products and related services together constitutes the core of the business.

3.3 Project business and project marketing

A supplier firm, which delivers software development projects to its customer, carries out the project business. Artto and Wikström have defined the *project business* as follows:

> "project business is the part of business that relates directly or indirectly to projects, with a purpose to achieve objectives of a firm or several firms". (Artto & Wikström, 2005).

In accordance with this definition, project deliveries are the source of a software supplier's revenues and the backbone of the business. In the project business, it is essential for the supplier firm to be able to market and sell projects to customers

(Jalkala et al., 2010). Therefore, project marketing and sales operations play a major role in supplier firms that operate in project business (Jalkala et al., 2010).

However, project marketing and project management as traditional disciplines have been developed and studied separately (Cova & Salle, 2005). Yet, the understanding about the connection between project marketing and project management is increased in the project business context, and the interest in the topic among researchers is growing (Jalkala et al., 2010).

In addition to project deliveries, it is common that supplier firms supplement their offerings with various services (Wikström et al., 2010). Services can be used to support the project business of the software supplier firm (Kujala et al., 2013), and thus, these services are often linked to end products of delivered projects. In recent years, the integration of project business and service business has become popular among supplier firms which have previously operated in project business (Artto et al., 2015). Thus, these firms can offer comprehensive solutions for their customers. Since the software industry is highly competitive, and for example, cloud computing and software as a service phenomenon have made the software market increasingly global, suppliers must constantly develop new ways to operate in competitive markets (Ojala, 2016).

When delivering a software development project to an external customer, a notable amount of work must be completed within the supplier firm before the project actually begins. Understandably, there is no project before a sales is closed successfully and the customer has placed an order (Cova & Salle, 2005; Turkulainen et al., 2013). Therefore, project marketing and sales are core operations of a software supplier firm. *Project marketing* can be defined as

> "a set of processes enabling suppliers selling projects-to-order to identify customer projects long before the invitation to tender, in order to better prepare for them". (Cova & Salle, 2005).

In general, each project goes through a project marketing cycle, which consists of six phases: search, preparation, bidding, negotiation, implementation and transition (Cova & Holstius, 1993). After the sales operations of a supplier firm have identified the project opportunity, the active phase of the project marketing and sales begins (Skaates et al., 2002).

How the project sales process proceeds to the negotiation phase varies. In general, the customer may send a call for tender to the supplier, or the supplier may have actively marketed the project to the potential customer (Ryynänen et al., 2013). If the supplier has received a call for tender from the potential customer and the project is suitable for business and the current situation, the supplier prepares and sends the tender to the customer (Cova & Salle, 2005). Further, if the customer considers the supplier's tender to be adequate, the detailed negotiations between the two parties begin. From the supplier's perspective, the negotiations come to a successful end if the customer places an order.

After the supplier has received an order from the customer, preparation for project implementation begins and the project becomes visible to its stakeholders.

From the supplier's point of view, the project is transferred from the sales operations to the project operations. This preparation work for a software development project takes place during the project start-up phase, which is placed in the interface between the supplier's sales operations and project operations.

3.4 Interface between supplier's sales operations and project operations

Because project marketing and sales precede every project in a customer-supplier context, there is an interface between a supplier's marketing operations and project operations. Cooper and Budd (2007) have introduced a model that describes this interface, which has a central role in every project, because after the sales case is closed successfully, the future project is transferred from the sales operations to the project operations within the supplier firm (Skaates et al., 2002). This so-called project handover acts as a final trigger to begin the project preparation work in the supplier firm.

The marketing and sales of projects are usually time-consuming, and it may take months or even years before the project is implemented (Ryynänen et al., 2013). Despite the massive marketing and sales efforts, the supplier does not always win the agreement. Additionally, when the sales operations of the supplier firm are under pressure to close the deal, a project might be sold with unrealistic schedules or promises to the customer (P. W. Morris & Geraldi, 2011).

The project environment in a customer-supplier context is dynamic and complex. Various parties are involved, who interact with each other through different interfaces during the project life cycle from the beginning of the sales process. In a customer-supplier context, *stakeholders* can be defined as

> "individuals or groups who have an interest or some aspect of rights or ownership in the project, and can contribute to, or be impacted by, the outcomes of the project". (Bourne & Walker, 2006).

In practice, several different stakeholder groups are usually involved in a single project. Thus, the supplier must ensure that the coordination of project work and communication between the stakeholders are adequate from the project's early stages. This is especially important in the customer-supplier context, because the cooperation between project stakeholders is a prerequisite for the effective management of projects (P. W. Morris & Geraldi, 2011).

In summary, the interface between a supplier's sales operations and project operations can be seen as a bridge that enables the customer's order to become a visible project delivery. Through this interface, the project is handed over from the supplier's sales operations to project operations, and the project start-up phase begins.

3.5 Project start-up phase

Before a software development project is up and running, it must be first started. In practice, various mobilization activities must be performed before it is possible to commence a project (P. Morris & Hough, 1987). Thus far, the project start-up phase has gained little attention in the literature. However, some researchers have discovered this small but important phase of a project's life cycle.

One of the first was Morten Fangel, who has defined a project start-up as

> "a unified and systematic management process which quickly generates a platform for taking off and getting going effectively". (Fangel, 1991).

This definition highlights the importance of the straightforward and rapid start-up of a project. It is especially important for software supplier firms, which are constantly struggling to maintain the profitability of their project deliveries.

Egginton (1996) has described the start-up of large international infrastructure projects emphasizing the transfer of the project from the sales organization to the project organization. It is noteworthy that the sales process precedes every outsourced software development project, so the cooperation between the supplier's sales team and project team plays an important role during the project start-up phase.

Halman and Burger (2002) have studied the effectiveness of project start-up in the electronics industry. Their study indicates that investment of time and energy in project start-up helps to build a deep understanding about the future project. However, their study does not offer descriptions of the practices that the supplier firm should follow during the project start-up phase. Instead, their focus is on product-development projects implemented within one organization, which differ from projects in the customer-supplier context.

Turner (2009) has described project start-up in general and suggested three methods for it (a workshop, a review report and the use of ad hoc assistance). Fangel (1984) originally presented these three methods for project start-up, and Turner has described them in more detail. The start-up process in Turner's book is suitable not only for the start of the project but also for the other phases of the project life cycle. However, a start-up of a software development project and a start-up of other phases of a project life cycle differ from each other. During the start-up phase of a software development project, the supplier must manage the business and the customer relationship, not only the forthcoming project. Therefore, the supplier firm requires separate project start-up practices.

Savolainen (2011) has studied the software project start-up phase of outsourced software projects in supplier firms. She has identified 11 project start-up activities by interviewing project managers of software supplier firms. However, Savolainen's project start-up activities present only the project managers views, ignoring the perspectives of the sales managers and the business managers who are also involved in the project start-up phase.

In summary, there is literature in which the early phases of a project life cycle, such as project start-up, are discussed. However, the project start-up phase has not been addressed from the supplier's perspective in the customer-supplier context. Thus, the existing literature provides no support for the software project start-up phase of suppliers.

3.6 Project start-up in project management standards and methods

Over the years, many project management standards and methodologies have been developed and published (Varajão et al., 2017). Most provide overall guidance for project management and are not connected to any specific industry or project type. Such general standards and methods are, for example, the PMBOK guide (The Project Management Body of Knowledge) (PMI, 2013b), PRINCE2 (PRINCE2, 2009a) and ISO 21500 (Guidance on project management) (ISO, 2012). However, some standards and methods for the software industry have been published, such as CMMI (Capability Maturity Model Integration) (Crisis et al., 2009), ISO/IEC 12207 (Systems and software engineering – Software lifecycle processes) (ISO/IEC, 2008) and ISO/IEC/IEEE 16326 (Systems and software engineering — Lifecycle processes — Project management) (ISO/IEC, 2009).

Project management and software development are comprehensively covered in standards and methods, but project start-up has gained very little attention in them. Early phases of a project are discussed only in the PMBOK (PMI, 2013b) and PRINCE2 (PRINCE2, 2009a). Noteworthy here is that neither is specifically targeted for the software industry. Other standards and methods have excluded so-called pre-project phases.

The PMBOK

The PMBOK is a generic project management standard developed by Project Management Institute (PMI) (PMI, 2013b). The latest version, the sixth edition, was published in 2017. The PMBOK presents generally recognized project management practices and terminology that are applicable to most types of projects.

Regarding the early phases of the project life cycle, such as the project start-up phase, the Initiating process group is defined in the PMBOK (PMI, 2013b). This process group defines a new project or a new phase of an ongoing project and its practices provide authorization for the implementation of the project. Therefore, the Initiation process group and the project start-up phase of a software development project differ from each other. For example, in the customer-supplier context, the supplier has made the decision to implement the project much earlier, when it sent the tender to the customer. Therefore, the authorization for the project implementation during the project start-up is not necessary in this context. Additionally, the start of a software development project and the

start of a phase of a project also differ from each other. Therefore, from the supplier's perspective, the same process and practices are not suitable for both situations.

Even though the PMBOK is the most widely used project management standard globally, a point of criticism is raised (P. W. Morris & Geraldi, 2011). From the perspective of this thesis, the PMBOK does not offer adequate support for the supplier firm during the project start-up phase.

The software extension to the PMBOK

In addition to the PMBOK sixth edition, the Software Extension (PMI, 2013a) is available, which brings together the best practices for managing a software project. Even though the management practices are described, the Software Extension does not consider the customer-supplier context. Therefore, it does not offer guidance for supplier firms on how to start a project that is delivered to an external customer.

PRINCE2

PRINCE2 (PRINCE2, 2009a) is a general method for project management which was published by the Office Government Commerce (OGC) for the first time in 1996. PRINCE2 defines two life cycle phases and project management processes for the early phases of a project. The first is the Pre-project phase where Starting up a Project process takes place. This phase lays the foundation for the delivery of the project. The second is the Initiation phase during which the project process is launched when the project receives authorization from the project board. PRINCE2 views a project mainly from the customer's perspective. Even though the customer-supplier relationship is mentioned in PRINCE2 (PRINCE2, 2009b), the method does not consider the supplier firm's view of the project and business-related processes are not defined.

CMMI

The Capability Maturity Model Integration (CMMI) (Crisis et al., 2009) is a process improvement maturity model especially suited to the software industry. The Software Engineering Institute (SEI) established the first version of the maturity model in 1993 and it has been actively developed ever since. In the CMMI, the Project Management process area is defined, covering project management issues in general. However, this process area does not define practices applied by the supplier firm during the project start-up phase.

ISO/IEC 12207

ISO/IEC 12207 (Systems and software engineering – Software life cycle processes) is a standard for organizations that either acquire or supply software (ISO/IEC, 2008). The standard is developed especially for the acquisition and the supply of software products and systems. The standard ISO/IEC 12207 do not define concepts supply or delivery. However, *acquisition* is defined to be a

> "process of obtaining a system, software product or software service." (ISO/IEC, 2008).

Noteworthy, the standard is also applicable in situations where the customer and the supplier are from the same organization. The standard is divided into seven process groups where two main groups are System Context Processes and Software Specific Processes. Here, the former is relevant because it describes processes which are needed when managing a software development project in a customer-supplier context. Defined Agreement processes, such as the Acquisition process and Supply process, are especially important for both parties. The first mentioned is for the customer and the latter is for the supplier. Even though the ISO/IEC 12207 describes processes which are relevant in the customer-supplier context, it does not offer guidance for the supplier firm to start a project.

ISO/IEC/IEEE 16326

ISO/IEC/IEEE 16326 (Systems and software engineering — Lifecycle processes — Project management) (ISO/IEC/IEEE, 2009) is one of the standards targeted for the software industry. The standard was launched together by ISO, IEC and IEEE in 2009. The standard deals with software project management issues by combining the ISO/IEC 12207:2008 (Systems and soft-ware engineering – Software life cycle processes) and ISO/IEC 15288:2008 (Systems and software engineering – System life cycle processes) standards. The ISO/IEC/IEEE 16326 standard presents elements of the project management plan which do not consider the early phases of a project.

ISO 21500

The general standard of project management is ISO 21500 (Guidance on project management) (ISO, 2012), which was published in 2012 by the International Organization for Standardization (ISO). The ISO 21500 standard provides guidelines which help to improve the performance of projects and to manage project in different organizations (Varajão et al., 2017). The ISO 21500 standard defines an Initiating process group with the purpose of starting a project phase or a project. The Initiating process group also includes the definition of goals for the project phase or the project and authorizes the project manager to begin work on the project. However, the ISO 21500 does not consider the business context and the sales phase of the project from the supplier's point of view.

3.7 Summary of the literature

In this research, the focus is on software development projects in the customer-supplier context. Therefore, the supplier's and the customer's perspectives should be distinguished. The reason for this is that the customer acquires the project, and the supplier delivers it. Thus, these different parties cannot operate similarly in all phases of the project life cycle. Moreover, these two parties have different goals and expectations for the project. From the supplier's perspective, six characteristics affect the start-up phase of a project. These characteristics are

illustrated in Tables 1 and 2, which offer a view of current literature and standards.

If the literature or standard in Tables 1 and 2 covers the software development projects, it is marked in the first column. If the customer-supplier context is considered, it is marked in the second column. Similarly, if the supplier perspective is covered, it is marked in the third column. It should be noted that PRINCE2 (PRINCE2, 2009a, PRINCE2, 2009b) is the only project management standard where both the customer-supplier context and the supplier's perspective are mentioned, but they are not described in detail. Therefore, the marks of these columns in the third row of Table 2 are in parentheses.

Additionally, it is necessary to separate different project types, because, for example, there are differences in the management of a firm's internal product development project and the management of a project sold to an external customer (Taylor 2007). Thus, there is a mark in the fourth column of Tables 1 and 2 if different project types are separated in the literature or in the standards.

Furthermore, in the customer-supplier context, the supplier requires an order from the customer before any project exists (Turkulainen et al., 2013). Therefore, the project sales phase is important for the suppliers' project start-up phase because, in the customer-supplier context, the sales phase precedes every project. If project marketing is covered in the literature or in a standard, there is a mark in the fifth column in Tables 1 and 2.

Even though the general project management standards of the PMBOK (PMI, 2013b) and ISO21500 (ISO, 2012) identify the early phases of a project, they do not provide guidance for the project start-up phase for a supplier firm. Likewise, because of their general nature, the PMBOK and PRINCE2 do not take different contexts into account. For example, they both lack of business context where marketing and sales precedes every project.

It is somewhat surprising that the early phases of the project life cycle are not considered in software engineering related standards, such as CMMI (Crisis, Konrad et al., 2009) and ISO/IEC/IEEE 16326 (ISO/IEC/IEEE, 2009). There is a mark in the sixth column of Tables 1 and 2 if project start-up is covered.

TABLE 1 Project start-up phase in the literature

Author	**Software development projects**	**Customer-supplier context**	**Supplier's perspective**	**Project type**	**Project marketing**	**Project start-up**
Fangel (1991)						x
Egginton (1996)		x	x		x	x
Halman and Burger (2002)						x
Turner (2009)						x
Savolainen (2011)	x	x	x	x	x	x

TABLE 2 Project start-up phase in standards

Standard	**Software development projects**	**Customer-supplier context**	**Supplier's perspective**	**Project type**	**Project marketing**	**Project start-up**
The PMBOK Guide (PMI, 2013b)						x
Software Extension to the PMBOK Guide Fifth Edition (PMI, 2013a)	x			x		x
ISO/IEC 12207 (2008)	x					
PRINCE2 (PRINCE2, 2009b)		(x)	(x)			x
ISO 21500 (2012)						x
CMMI (Crisis et al., 2009)	x					
ISO/IEC/IEEE 16326 (2009)	x	x				

Tables 1 and 2 summarize the reviewed literature and disclose the gap of knowledge regarding the software development project start-up phase from the supplier's perspective. As can be seen from Tables 1 and 2, some studies and general standards and methods consider the early phases of a project. However, only Savolainen (2011) has offered support for a supplier's software project start-up in a customer-supplier context. Additionally, von Wangenheim et al. (2010) raised the concern that adoption of different project management practices is still challenging in software supplier firms.

It appears that current literature, project management standards and methods lack guidance for how to start a project in a customer-supplier context. The weakness is that the current literature leaves project marketing and sales aside, despite the fact that they have a significant impact on a software development project and a supplier's business. Thus, it can be said that gaps remain in the literature when looking at the software development project start-up phase from the supplier's perspective in the customer-supplier context (Cha et al., 2018). It can be also concluded that the current literature does not provide guidance for which practices a supplier firm should follow to create the conditions for the success of a project in its early phases. Finally, the lack of relevant literature calls for a better understanding about the project start-up phase from the supplier's point of view.

4 METHODOLOGY

Prior to conducting a study, a researcher must decide which research strategy to follow and which research methods to use (Creswell, 2014). Since a wide variety of documented and tested research methods exist, the selection of suitable research methods may not be obvious for a researcher. However, one aspect that helps to identify the most suitable research methods is that they are classified in different ways (Dingsøyr & Conradi, 2002). The traditional way to classify research methods is the distinction between qualitative and quantitative research methods (Avison & Pries-Heje, 2005; Venkatesh et al., 2013).

Although, research methods might be originally designed for a specific field, most are applicable to different types of studies in different fields. Furthermore, each research method has its own strengths and weaknesses. For example, quantitative research methods are suitable when the objective is to reveal trends or to find patterns that are applicable to various situations and contexts (Myers, 2013). However, when the topic of a study concerns a specific phenomenon in a certain context, qualitative research methods are more suitable (Avison & Pries-Heje, 2005). Therefore, the choice of the research methods and research strategy must be made only after careful consideration.

In addition to the traditional distinction between qualitative and quantitative research methods, there is a mixed methods approach which allows a researcher to combine these two research approaches - quantitative and qualitative - in one study (Creswell, 2014). Johnson and Onwuegbuzie (2004) have listed the strengths and weaknesses of both qualitative and quantitative research methods and have concluded that understanding these strengths and weaknesses helps a researcher apply the mixed methods approach.

At the beginning of this research, different research strategies and research methodologies were evaluated from the topic's point of view and from the practical perspective. The topic of this research concerns the project's start-up phase in a customer-supplier context, which lacks knowledge from empirical studies. This lack of knowledge was an important factor that guided the exploration of qualitative research methods. However, quantitative data was available from three firms, and access was possible to three other firms where qualitative data

could be collected. Therefore, both qualitative and quantitative research methods as a mixed methods approach were applied to build a detailed picture of the project start-up phase in supplier firms.

4.1 Mixed methods approach

The mixed methods approach is a comparatively young research approach. It began to develop in the late 1950s but became more common in the 1980s (Creswell, 2014). The mixed methods approach allows a researcher to combine qualitative and quantitative research methods (Venkatesh et al., 2013). Gable (1994) has analyzed the combination of the case study research and the survey and concluded that these different research methods can be seen as reinforcing elements.

Thus, the mixed methods approach helps a researcher take advantage of the strengths of both qualitative and quantitative research methods (Osbourne, 2008). As a result, mixed methods research has become a widely applied approach in various research areas, as the research work is usually complex and multidisciplinary (Johnson & Onwuegbuzie, 2004). Mixed methods research is defined as:

> "…the type of research in which researcher or team of researchers combines elements of qualitative and quantitative research approaches (e.g., use qualitative and quantitative viewpoints, data collection, analysis, inference techniques) for the broad purposes of breadth and depth of understanding and corroboration". (Johnson et al., 2007).

The mixed methods approach can be further divided into different subtypes. One example of this division is qualitative dominant, equal status and quantitative dominant mixed methods research (Johnson et al., 2007). Another way to classify mixed methods research is the division of convergent parallel, explanatory sequential and exploratory sequential mixed methods research (Creswell, 2014). The research of this dissertation fits in the definition of convergent parallel mixed methods research in which:

> "…a researcher collects both quantitative and qualitative data, analyzes them separately, and then compares the results to see if the findings confirm of disconfirm each other." (Creswell, 2014).

During this research, the quantitative study and the qualitative study were conducted separately, and the results of these studies were compared afterwards. In Figure 3, the mixed methods approach applied to this dissertation is described.

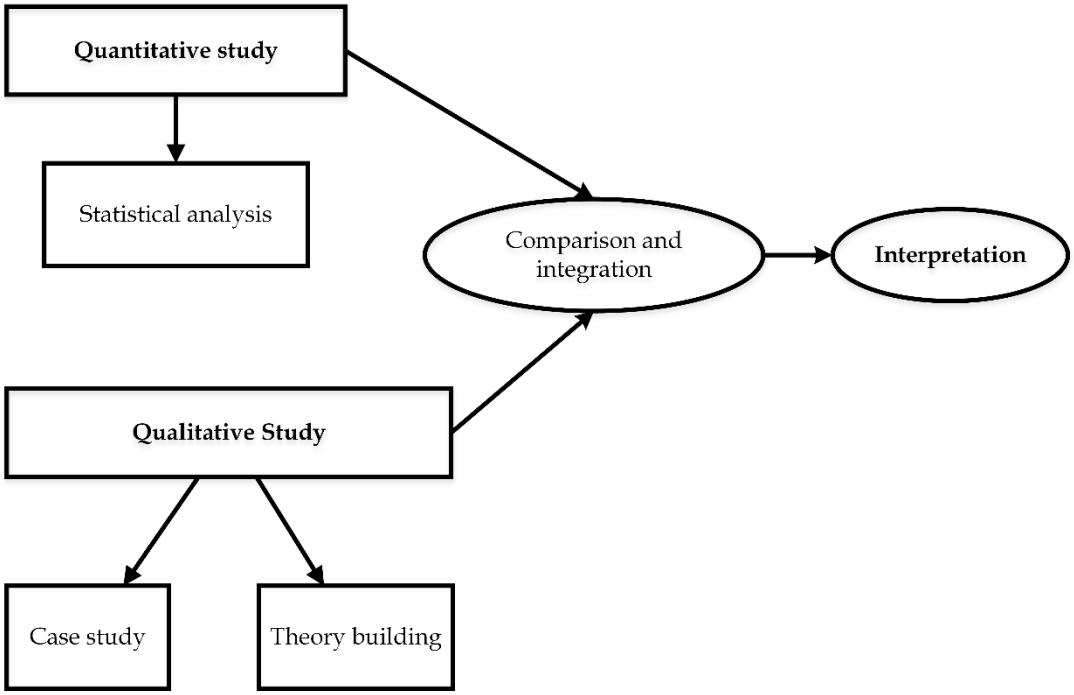

FIGURE 3 The applied mixed methods approach

As illustrated in Figure 3, the applied convergent parallel mixed methods approach consists of a qualitative study supplemented by a quantitative study. The applied quantitative research method was statistical analysis. Further, the applied qualitative research methods were case study and theory building. By integrating the results from studies obtained with different research methods, an accurate model of the project start-up phase has been created, and empirical evidence about the use of project management practices in supplier firms was revealed.

4.2 Quantitative research methods

Quantitative research methods are focused on analyzing numerical research data by applying different statistical procedures (Creswell, 2014). Quantitative research is defined in general as:

> "the research process aimed to disproving or lending credence to existing theories; involves measuring variables and testing relationships between variable in order to reveal patterns, correlations, or causal relationships; results in statistical data (generally from large sample)." (Leavy, 2017).

The examples of quantitative research methods are survey, laboratory experiments, simulation, mathematical modelling and statistical analysis (Avison & Pries-Heje, 2005; Myers, 2013). In quantitative research, the results are usually presented in graphical form, such as bar graphs or pie graphs (Singh, 2016).

Statistical analysis is a commonly used quantitative research method to analyze quantitative data. It offers a cost-effective and timesaving way to analyze numerical data. Statistical analysis is useful especially when the aim is to describe, to compare or to find correlations from the numerical quantitative data (Gardener, 2012). According to Singh, statistical analysis is:

> "based on the principle of gathering data from a sample of individuals and using those data to make inferences about the wider population from which the sample was drawn." (Singh, 2016).

Statistical analysis is used to test hypotheses, which are:

> "…predictions the researcher makes about the expected outcomes of relationships among variables." (Creswell, 2014).

Various tools exist for statistical analysis. One popular and versatile tool is the R software, which is free open source software (Tattar, 2013). It offers a wide range of opportunities for a researcher to create graphical presentations from quantitative data (Gardener, 2012). The R software and related documentation may be downloaded from www.r-project.org. In this research, the R software was used to analyze data and to present the results in graphical form.

This research aims to shed light on the actions of supplier firms during software development projects. Three firms offered quantitative data for this research, and statistical analysis was used to test literature-based hypotheses. The quantitative part of this research is reported in Article I.

4.3 Qualitative research methods

Qualitative research plays an important role in many disciplines (Tracy, 2013). Qualitative research methods help researchers gain understanding of different contexts and actions of people within them (Myers, 2013; Tracy, 2013). Qualitative research methods have been categorized in three types, which are observational, historical and controlled (Zelkowitz & Wallace, 1998). Generally, qualitative research is:

> "research that produces descriptive data - people's own written or spoken words and observable behaviour." (Taylor et al., 2015).

In recent decades, various qualitative research methods have become increasingly popular among researchers in many fields. For example, interest in using a variety of qualitative research methods is growing in information systems and project management disciplines (Darke et al., 1998; Oyegoke, 2011). The examples of qualitative research methods are case study, action research, grounded theory and ethnography (Avison & Pries-Heje, 2005; Myers, 2013).

The aim of this research is to build a foundation for understanding what practices suppliers should follow during the start-up phase of a project to ensure

successful delivery of a software development project. This research is strongly linked to the actions of practitioners in the software supplier firms during the start-up phase of a software development project. Therefore, the qualitative research methods and strategies –case study and theory building– were selected and applied in this research. The qualitative part of this research is reported in Articles II, III and IV.

4.3.1 Case study research

Case study research is a widely used qualitative research method (Darke et al., 1998). Yin has defined case study research in general as follows:

> "A case study is an empirical inquiry that investigates a contemporary phenomenon (the 'case') in depth and within its real-world context, especially when the boundaries between phenomenon and context may not be clearly evident." (Yin, 2013).

When studying a phenomenon in a business context, it is important that conducted research contribute to the current knowledge in a practical manner, so the results of the research are applicable in real-life situations. Thus, as the context of this research is business-oriented, the definition of a case study research is adopted from Myers:

> "Case study research in business uses empirical evidence from one or more organizations where an attempt is made to study to the subject matter in context." (Myers, 2013).

As mentioned earlier, it is important to consider carefully which research methods are the most suitable for the research. Yin (2013) has identified three conditions that are helpful when considering the research strategy and methods: the form of research questions, the extent of control over behavioural events and the focus on contemporary events. According to Yin (2013), if the research questions start with who, what, where, how and why, then the case study is likely to be a suitable method for the research.

It has been demonstrated that the case study approach is suitable for finding answers and solutions to a wide variety of research questions and problems (Eisenhardt, 1989; Yin, 2013). Benbasat et al. (1987) stressed that the case study approach allows researchers to examine a phenomenon in its natural settings and offers a relatively full understanding about the phenomenon. According to Myers (2013), the case study is a relevant method to use especially when the aim of the study is to explain, to test, to compare or to discover. Furthermore, Myers (2013) has stated that the complexity of the real-life context can be disclosed with a research method where the researchers get to see the actions of practitioners in real-life situations. Thus, Myers (2013) has noted that the purpose of case studies is to use empirical evidence from practitioners in real organizations to contribute to the current knowledge.

However, some practical challenges concerning case studies have been reported (Darke et al., 1998; Leonard-Barton, 1990). One of these challenges is the availability of suitable case sites or organizations (Darke et al., 1998). This is a

problem especially when the aim is to study a phenomenon in a real-life context, and the study cannot be conducted in a laboratory environment. Another challenge is that case study research is time-consuming (Myers, 2013). When executing case study research in firms, time can become a problem, because the situation may change rapidly, hampering implementation of the study. Additionally, over the years, a critique towards case study research has raised (Benbasat et al., 1987; Yin, 1981).

However, some scholars have focused on the strengths of case study research and offered guidance on how to successfully apply a case study method in various studies. For example, Eisenhardt (1991) has offered some answers to the critique and highlighted the strengths of case study research. Furthermore, Gibbert (2008) has noted that a case study as a research method is suitable especially in studies where the aim is to create managerially relevant knowledge. More recently, Myers (2013) has listed strengths of case study research and noted that it offers an opportunity to determine whether the findings of a study are applicable to a real-life context.

4.3.2 Theory building from case studies

The knowledge gained from case studies can be used in various ways when the aim is to gain an in-depth understanding about the studied phenomenon. Thus, it is known that it is possible to build theories from case studies (Eisenhardt, 1989; Yin, 2013). By applying this research strategy, researchers can build a theory which is novel, testable and empirically valid (Eisenhardt, 1989). Theory building from case studies as a research strategy is suitable to study areas where existing theory is incomplete (Eisenhardt, 1989; Eisenhardt, 1991) as it is in the case of the project start-up phase as a phenomenon. Project management and project organization are said to be complex phenomena, and therefore there is a need to study them in different perspectives (Söderlund, 2004). Here, the project start-up as a phenomenon is being studied from the supplier's point of view.

The central element of building theories from cases is a replication logic (Eisenhardt, 1989; Yin, 2013). Further, the use of multiple cases helps the researcher build a more detailed theory than by using a single case as the data source (Eisenhardt, 1991). Moreover, the use of multiple cases increases the generalizability of results (Benbasat et al., 1987). During this research, multiple cases were used, and thus, the study was replicated in different organizations.

To conduct a theory building research, Eisenhardt (1989) has defined a process of building theory from case study research. This process consists of eight steps (Eisenhardt, 1989):

1. Getting started, where research problem and research questions are defined.
2. Selecting cases, where suitable case sites are selected on theoretical basis.
3. Crafting instruments and protocols, where decisions about data collection methods and the roles and tasks of investigators are made.

4. Entering the field, where the data collection takes place.
5. Analyzing data, where the data collected from cases is analyzed.
6. Shaping hypotheses, where replication logic across cases is followed.
7. Enfolding literature, where the findings from cases are compared to existing literature.
8. Reaching closure, where reaching the point where improvement to theory becomes small.

These, eight steps of the theory building process offer guidance to a researcher to build a theory based on case studies. According to Shenhar and Dvir (1996), Eisenhardt's theory building process (Eisenhardt, 1989) is suitable especially in studies where constructs are specified in advance, cases are accompanied by multiple researchers, analysis is conducted within cases and the results are combined with existing literature.

5 RESEARCH PROCESS

The research for this dissertation consists of two parts: quantitative and qualitative. The aim of the quantitative part is to offer insight about the project management effort required for software development projects in supplier firms. The objective of the qualitative part is to visualize a project start-up phase from the supplier's point of view and highlight challenges that supplier firms face during this phase.

The data for this research was collected from six software supplier firms. Three of these firms offered data for the quantitative part of this research, and qualitative data were collected from the remaining three firms.

The quantitative part (statistical analysis) and the qualitative part (theory building from case studies) support each other and strengthen the results of this research. By comparing and integrating different types of research methods and data, this research builds a detailed picture of the project start-up phase in supplier firms in the customer-supplier context. The steps of the research process are described in general in the following sections, and more detailed descriptions can be found in Articles I-IV.

5.1 Quantitative study: Statistical analysis

The importance of the estimation of project effort has been noted especially in the software development field (Jorgensen & Shepperd, 2007; Molokken & Jorgensen, 2003), in which projects are often late due to problems with effort estimation (Jørgensen & Moløkken-Østvold, 2006). Software development projects are prone to estimation errors (Jorgensen, 2005; Kocaguneli et al., 2012; Molokken & Jorgensen, 2003), and these errors may have a significant economic impact on the project business of supplier firms. Therefore, suppliers should be able to estimate the actual costs that a project will impose on them before execution of the project begins.

Project management effort is an important part of the effort required for the implementation of a project, and earlier studies suggest that any complex activity such as a project cannot be started without spending a minimum level of effort (Barry et al., 2002). Therefore, the effort estimation of the project management activities should include at least the effort required for starting the project and its complex tasks determined in the work breakdown structure created for the project.

The purpose of the statistical analysis was to test five literature-based hypotheses, which are described in the next section and in more detail in Article I.

5.1.1 Hypotheses

To gain a better understanding of the required project management effort in supplier firms, the data from a set of 117 projects was analyzed. Five hypotheses were formulated to guide the analysis:

H1. Projects with a long duration require a greater proportion of project management effort than projects with a shorter duration.
H2. Large project teams require a greater proportion of project management effort than smaller teams.
H3. There exists a minimum proportion of project management effort that is required for the management of short projects with small teams and that minimum is higher than zero.
H4. There exists an upper limit that the average proportion of project management effort approaches when projects get larger and that limit is less than 100%.
H5. The type of contract has no impact on the proportion of project management effort.

5.1.2 Data

To test defined hypotheses, quantitative data was received from three software supplier firms. Two of the firms have operations in at least two countries, and one operates inside the borders of a single country. The divisions of the firms that provided the data have between 200 and 2000 employees. The firms operate in the project business, providing software development and related services to their customers. These firms collected the data from their time-keeping information systems; therefore, the data represents the official working hours of the employees of these firms.

The representatives of the firms selected the analyzed projects, and altogether 117 projects were analyzed. The projects were implemented during a period of five years. Most were relatively small, with a duration of less than one year. More detailed information on the data and the analyzed projects can be found in Article I.

5.1.3 Data analysis

The statistical analysis of the data was conducted, and the visual representation was created with the R software. For each hypothesis (H1-H5), the visual representation was created.

The results of data analysis provide support for some of hypotheses, but not all of them. The supported hypotheses are H1 and H2. For hypothesis H4, there was no support. Similarly, hypotheses H3 and H5 were clearly not supported by the analysis. The detailed analysis of the data and the evaluation of the hypotheses can be found in Article I.

5.2 Qualitative study: Theory building from case studies

Earlier studies have highlighted that projects must be managed differently in different contexts. This research is strongly linked to the actions of practitioners in supplier firms during the start-up phase of a software development project. A case study was conducted in three different supplier firms. Here, the unit of analysis was the project start-up phase of a software development project in a supplier firm.

Since the one aim of this research was to visualize the project start-up and shed light on the context in which outsourced software development projects are conducted, it was important to view the actions of practitioners in real-life situations. Here, the real-life situations were project start-up phases of software development projects in supplier firms, and the practitioners were employees of these firms. In this research, the theory building process presented by Eisenhardt (1989) was followed and applied.

5.2.1 Designing study

According to Eisenhardt (1989), it is important to define a research problem and research questions at the beginning of a theory building process. Thus, three research questions: ”what happens in a supplier firm during the project start-up phase?”, ”what practices are in use in supplier firms during the project start-up phase?” and “what are the challenges associated with the project start-up from the supplier’s perspective?” were defined initially.

The purpose of the initial definition of a research problem and research questions is to determine the focus of the research (Eisenhardt, 1989). As a result, it is easier to make decisions concerning the required data and cases. Here, the focus is on a software development project start-up from the supplier’s perspective. Therefore, gaining access to software supplier firms was a prerequisite for this research.

5.2.2 Gaining access to case firms

After the definition of research problem and research questions, the next step was the selection of cases and gaining access to the case firms. When the aim is to build a theory from cases, there is a need to select cases that will probably replicate or extend the theory (Eisenhardt, 1989).

At the beginning of this research, there was an ongoing research project where three software supplier firms were involved, and they were willing to participate in this research. This offered the opportunity to study a project start-up phase in its natural settings and to see what practitioners really do during this phase of a project life cycle.

Here, the selected case firms represented different software supplier firms. Although the case firms differ from each other, they also enjoy some common characteristics. For example, they all operate in Finland and supply a wide variety of software development projects and related services to their customers. The firms are labelled here as Firm A, Firm B and Firm C.

Firm A is a part of a subsidiary of a large parent firm operating globally. The subsidiary has several business units around the country, all of which operate independently. Firm A is one of these business units. Firm A offers a wide variety of software and information systems development and consultant services to its customers. A variety of continuous services supplements their project-related offerings. The customers of Firm A are mainly medium-sized and large firms and public-sector organizations. Its project deliveries are relatively large. The duration of projects varies from a few months to a few years.

Firm B is a medium-sized software supplier firm with offices in several locations. Its customers are other firms and public-sector organizations. Firm B offers software development and IT consulting services. The project deliveries of Firm B are small, and the duration of projects varies from a few days to a few months.

Firm C is a very small firm with fewer than 10 employees, all of whom work in one office. Most of the customers of Firm C operate in the construction industry. The project deliveries of Firm C include both hardware and software, and the duration of the projects varies greatly.

After the access to the case firms was confirmed, preparations were started for the data collection.

5.2.3 Planning data collection

It is common practice that the empirical evidence in case studies comes from various data sources and is collected through various methods (Eisenhardt, 1989; Eisenhardt & Graebner, 2007). Benbasat et al. (1987) have suggested that there should be two or more data sources. Additionally, Eisenhardt (1989) has highlighted the advantages of the use of multiple data collection methods and researchers in theory building research.

Here, four researchers were involved in the theory building process. Additionally, multiple data collection methods and data sources were used during this

research. The process modelling was the main data collection method and thus offered the primary data for the research. Moreover, each case firm offered different documentation for the research purposes, and semi-structured interviews were also conducted in each firm.

Process modelling was selected to be a primary data collection method for a variety of reasons. To be able to understand and to improve operations of any organization, it is important to have detailed models which describe different processes (Giaglis, 2001). Additionally, process models and process guides are found to be useful in software firms to avoid problems in software project deliveries (Dingsøyr & Moe, 2004).

A variety of techniques, tools and methods define processes (Giaglis, 2001). According to Dingsøyr and Moe (2004), it is important to define processes together with the people who will follow these processes in their daily work, thereby ensuring their usefulness. Process modelling has been used in different forms as a tool for organizational designs since 20th century (Mendling et al., 2010). Furthermore, earlier experiences have demonstrated that process modelling is an effective, quick and cost-efficient method of modelling (Dingsøyr, Moe 2004).

The process modelling technique LAPPI (a light-weight technique to practical process modelling and improvement target identification) (Raninen et al., 2013) was found to be suitable for this research, which was conducted in close cooperation with practitioners. The decision to apply this technique was made for several reasons. One advantage of the selected modelling technique was that documented and published cases of the use of the LAPPI (Raninen et al., 2015; Toroi et al., 2013) are available, and the involved researchers were familiar with it from previous work. Additionally, another advantage of the LAPPI was the fact that it allows multiple researchers to participate together with the practitioners.

After the preparations for the data collection were made, the next step was to collect the data.

5.2.4 Collecting the data

The data for the theory building was collected from three software supplier firms. The primary data was collected by conducting a process modelling separately at each case firm. The LAPPI (Raninen et al., 2013) process modelling technique was applied here. The LAPPI technique is documented in detail in the article of Raninen, Ahonen et al. (2013). Furthermore, in Article IV, the suitability of the LAPPI technique is evaluated and the technique is validated.

The LAPPI process modelling technique was applied here because it allows building a description of a real-life process as it exists in the organization at the time of the modelling in a cost-effective and time-saving way. As a result, the project start-up process modelling followed the process at each case firm, which is presented in Figure 4. Additionally, Table 3 summarizes the process modelling process and briefly describes each step.

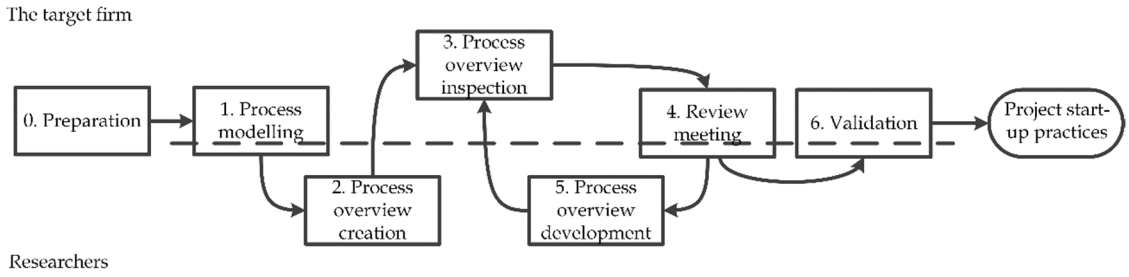

FIGURE 4 A process modelling process at case firms

TABLE 3 Description of the process modelling process

Step	Description
0. Preparation	A short planning meeting was held between the researchers and the firm's representatives. The result of the planning meeting was a decision as to when and where the process modelling would be executed, and who should participate in the modelling workshops.
1. Process modelling	Two half-day process modelling workshops were held. The output of workshops was a wall chart of roles and information flows between the identified roles during the project start-up phase. The modelling also produced a wall chart of a project start-up phase process steps and their sequence.
2. Process overview creation	The first draft of the project start-up overview was created. The result of this step was the overview of the project start-up process.
3. Process overview inspection	The target firm took over the responsibility for the development of its project start-up process overview. The output of this step was an overview of the project start-up process of the target firm which had been checked and commented on. This step was the starting point of the iterative development of process overview.
4. Review meeting	The project start-up overview was developed iteratively by the researchers and the target firm's representatives.
5. Overview development	The improved start-up process overview was used as an input in this step. After the researchers had developed a new, improved draft of the project start-up overview, they handed it back to the target firm, where the next internal meeting for the process overview inspection was organized without the researchers.
6. Validation	The results of the process modelling were validated in the target firm. For the validation, the target firm's representatives were interviewed. The outcome was the validated description of the target firm's project start-up practices.

During the process modelling process, the secondary data was collected from each firm through semi-structured interviews with project managers and sales managers. Furthermore, documentation related to the project start-up was inspected, and several informal discussions between researchers and employees of case firms took place.

5.2.5 Creating firm specific project start-up descriptions

Eisenhardt (1989) has stated that data analysis is the core of a theory building process. Additionally, it is common that data collection overlaps with data analysis during the theory building process (Eisenhardt, 1989). The use of multiple data collection methods and more than one researcher helps to triangulate the findings (Benbasat et al., 1987).

Data analysis for this research was an iterative process involving four researchers and various types of data. During this research, data analysis overlapped with data collection. The analysis of the collected data started during the process modelling workshops in each independent case, where researchers made field notes and discussed them with representatives of case firms. Furthermore, a written report was produced for each case firm.

5.2.6 Building a project start-up model

Eisenhardt (1989) has defined two steps for shaping hypotheses. The aim of this iterative process is to sharpen the constructs and to verify the emergent relationships between constructs and the evidence found from cases (Eisenhardt, 1989).

During this research, this iterative step of the theory building process resulted in a model of project start-up, which was built by comparing the firm's specific descriptions of the project start-up phase and then integrating the commonalities into the model. These commonalities are presented in Table 4.

After the process modelling was conducted at all case firms, two researchers worked independently and produced drafts of a project start-up model. Afterwards, the same researchers compared their drafts of the model and formed it into a common vision with two other researchers who had not been involved in the data collection and analysis previously.

The model of project start-up was validated separately at each case firm, and validation workshop participants offered suggestions for improvement. After the validation was done at the case firms, the researchers produced the final version of the model of project start-up, which was then compared to the literature.

TABLE 4 Commonalities in the firm specific descriptions of project start-up phase

Practice	Firm A	Firm B	Firm C
Inform Production Unit of Future Project	Sales Manager Business Manager	Sales Manager	Sales Manager
Appoint Project Manager	Sales Manager Business Manager	Business Manager	-
Transfer Project to Production	Sales Manager Project Manager	Business Manager Project Manager	Sales Manager Project Manager
Prepare Project Agreement	Sales Manager Business Manager Project Manager Customer	Sales Manager Business Manager Customer	Sales Manager Business Manager Customer
Save Order Information in System	Project Manager	Sales Manager Business Manager	-
Allocate Resources for Project	Business Manager Project Manager Project Team Customer	Business Manager Project Manager	Sales Manager Business Manager Project Manager
Manage Customer Relationship	Project Manager	Sales Manager Business Manager Project Manager	-
Meet Customer	Project Manager Project Team	Project Manager	Sales Manager Business Manager Project Manager
Define Technical Environment	Project Manager Project Team Customer	-	Project Manager Project Team Customer
Analyze Project Risks	Project Manager	Business Manager Project Manager	-
Plan Project Monitoring	Business Manager Project Manager Customer	Sales Manager Business Manager	-
Redefine Project Scope	Business Manager Project Manager Customer	Sales Manager Project Manager Customer	Sales Manager Customer
Manage 3rd Parties	Project Manager	-	Project Manager
Ensure Project Profitability	Project Manager	Business Manager Project Manager	-
Prepare Project Plan	Business Manager Project Manager Customer	Project Manager	Project Manager
Organize Internal Kick-off Meeting	Project Manager Project Team	Project Manager Project Team	-

5.2.7 Reviewing the existing literature

In a theory building process, it is important to compare the output of the process to the literature. According to Eisenhardt (1989), linking developed theory to existing knowledge is important for several reasons.

Firstly, theory-building research typically involves a limited number of cases; in this research it was three cases. Secondly, enfolding the literature increases the validity and generalizability of the research results. Therefore, the developed theory of a software development project start-up was compared to the literature and standards. The summary of the most relevant literature and the result of this comparison are presented in Tables 1 and 2 in Section 3.7.

5.2.8 Reporting the results

Eisenhardt (1989) has noted that the theory building process ends when the improvements to the developed theory become small. In this situation, the researcher must decide when to stop adding new cases and when to stop iterating between theory and collected data (Eisenhardt, 1989).

In this research, the number of cases was limited to three firms in advance, and therefore, adding new cases was not an option. The iteration between the literature and the developed theory continued after the validation was completed at the case firms. It is noteworthy that a limited amount of literature exists on the project start-up phase. Thus, at this point, the current literature did not offer new aspects to the project start-up model, which was decided to be the final output of the theory building process of this research. Finally, the results of the theory building process were reported in Articles II and III.

5.3 Data management and ethical issues

The data for this research exists in several formats, and therefore, the data was managed by following various practices during the research process. The quantitative data was existing and was collected as part of the earlier research project. The quantitative data includes data from three firms' time-keeping systems, in a spreadsheet format. The qualitative data, which was collected for the purposes of this research, includes hand-written and digital notes made by the members of the research group, photographs, recordings and the transcriptions of interviews, Excel, Word and PDF files. The data used for this dissertation is described in more detail in Articles I-IV.

During this research, research ethics and confidentiality issues were taken into account in each step of the research process. For example, the names of the firms and the names of individuals involved in the research are not mentioned in this dissertation. The data cannot be made available to third parties after this research. However, the participants in this research can use the data for further studies.

6 RESULTS IN THE FORM OF MODEL OF PROJECT START-UP

This research resulted in a model of a supplier's project start-up, which makes a software development project start-up phase visible from the supplier's perspective and answers the overall research problem of this dissertation. A project start-up model visualizes the project start-up phase, which is an early phase of a project life cycle and takes place between project sales and execution. The model is positioned in the customer-supplier context (Figure 2) in which the software development project is sold and delivered to an external customer. An overview of a model can be found in Figure 5 and more detailed description of it is published in Article II.

The model is built on 16 general project start-up practices. These practices cover various aspects of business management, sales management, project management and software development. Notable here is that each project is unique, therefore, not all practices in a model are relevant in all projects. Respectively, in some projects, there might be a need to add more practices during the start-up phase. However, from the supplier's perspective, a model covers the most important aspects of a software development project in a customer-supplier context. In the next sections, a general overview is provided of the project start-up practices and roles involved.

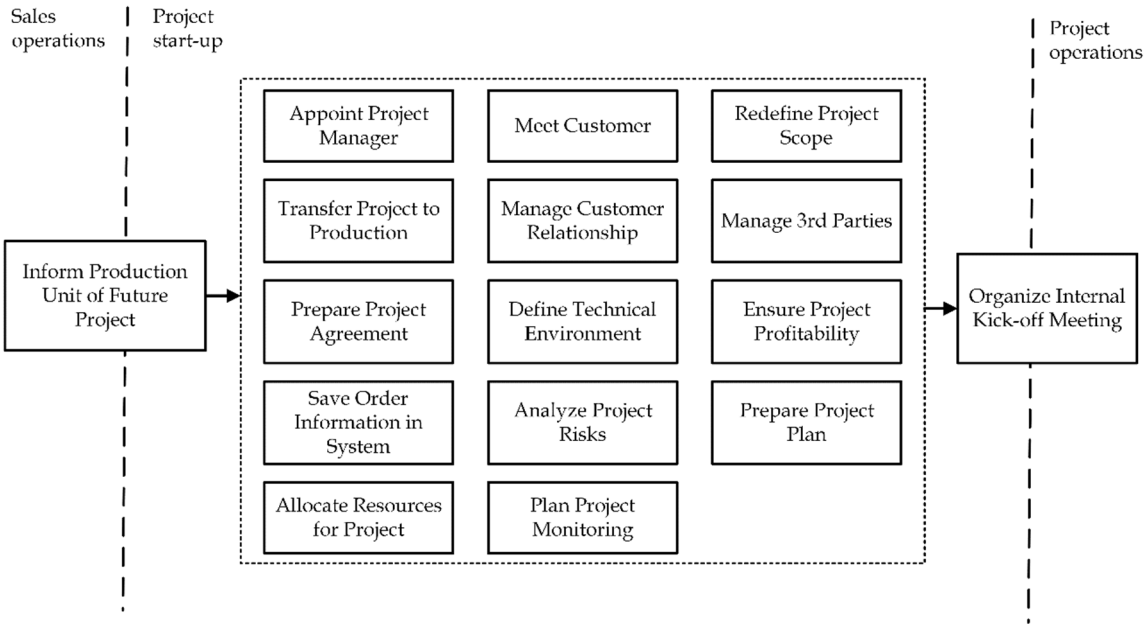

FIGURE 5 A model of a supplier's project start-up (Merikoski et al., 2017)

6.1 Project start-up practices

A model of a supplier's project start-up (Figure 5) is a collection of general project start-up practices that have been developed from a software supplier's point of view. Each project start-up practice includes activities and tasks, all of which must be completed during the project start-up phase before moving into the execution phase of a project. A general definition of a practice is adopted from CMMI where

> "practice is the description of an activity that is considered important in achieving associated goal". (Crisis et al., 2009).

In accordance with the definition of a practice, the purpose of a single project start-up practice is to ensure that the issues associated with it are considered before an actual project begins so that the possible challenges and risks can be better managed during the execution of the project. Further, the purpose of project start-up practices is to help the supplier firm ensure the success of the software development project so it can be delivered to an external customer.

Here, project start-up practices are grouped into four categories, each of which has an important role for the software development project and for the supplier's business. These categories are Business Management, Sales Management, Project Management and Software Development. Notable is that these four categories are interrelated, and they might be emphasized differently in different projects. Table 5 presents these categories and the start-up practices linked to them.

TABLE 5 Categories of project start-up practices

Category	Practices
Business Management	Save Order Information in System Prepare Project Agreement Meet the Customer Manage Customer Relationship Analyze Project Risks Redefine Project Scope Manage 3rd Parties Ensure Project Profitability
Sales Management	Inform Production Unit of Future Project Transfer Project to Production
Project Management	Appoint Project Manager Allocate Resources for Project Plan Project Monitoring Prepare Project Plan Organize Internal Kick-off Meeting
Software Development	Define Technical Environment

Table 5 highlights the important aspect that most of the project start-up practices are not the actual software development work. Even the difference between project management and business management is not explicit. Although risk management is a part of project management, it is also essential for business management from the supplier's point of view.

6.1.1 Business Management

The Business Management category and related project start-up practices concern the business operations of the supplier firm that are related to projects. In a software supplier firm, the business strategy defines which projects are included in project portfolios and programs. The strategy of a firm guides which type of projects it pursues and to which type of customers it delivers software development projects and other offerings, such as project related services. Since software development projects are the way of doing business for the supplier firms, most of the project start-up practices in a model (Figure 5) concern business, not a project itself.

The project start-up practices in the Business Management category ensure that the strategic business objectives of a single project can be achieved. This will also contribute to the achievement of the strategic business goals of the supplier firm. Therefore, each project is important from a supplier's point of view. As a result, during the project start-up phase, the supplier firm should manage not only a project but also the current business and plan business prospects from the customer relationship and overall business points of view.

6.1.2 Sales Management

The presence of the Sales Management category and related project start-up practices connects the project start-up model into the customer-supplier context. In this context, the Sales Management covers all operations related to the marketing and sales of software development projects. The project start-up phase begins in a supplier firm only after the customer has placed an order and the supplier has received confirmation that the project is realized. Therefore, the trigger to begin the project start-up procedures comes from the sales operations to the project operations within the supplier firm.

The project start-up practices in Sales Management category ensure that all knowledge about the customer and the project is transferred from sales operations to project operations. The Sales Management category is linked with the Business Management and the Project Management categories because decisions made during the marketing and sales of a project have a major impact on a single project as well as the overall business of the supplier firm.

6.1.3 Project Management

Here, the project management has a twofold meaning. On the one hand, project management refers to management of a single project as a part of the project business of a supplier firm. On the other hand, project management covers actions concerning the development of the management environment for the project which is about to start.

The project start-up practices in Project Management category ensure that the supplier firm has ability to manage the project in a successful manner. Therefore, the project management here does not mean the project management during its execution, but rather the management of project management. The Project Management category relates to three other categories (Table 5) because a single project is part of supplier firm's business where different operations of a supplier firm work together to achieve the business objectives of a project.

6.1.4 Software Development

The actual software development work is completed during the execution phase of a project. However, during the project start-up phase, the preparatory work must be done within the supplier firm and the presence of the Software Development category and related practices is justified.

The purpose of the project start-up practice in Software Development category is to ensure that the requisite technical environment is available during the execution phase of the project. During the project start-up phase, the Software Development category interrelates with the Project Management category. In the project start-up phase, the required resources for the project must be planned and acquired.

6.2 Roles in a project start-up phase

A variety of roles are involved during the start-up phase of a software development project in a customer-supplier context. A role in a project context can be defined as

> "a defined function to be performed by a project team member…" (PMI, 2013b).

Here, roles must be considered in a broader sense than only within a project team. Firstly, during the project start-up phase, members of a project team are not yet known. Secondly, in a customer-supplier context, there are external roles to a supplier's project team involved from different organizations and different units of a supplier firm. For example, the sales operations of a supplier firm are involved in a project start-up phase but representatives from sales operations are usually not involved in a project team. Thirdly, the roles during a project start-up phase differ from the roles during execution of a project. Therefore, the roles during a project start-up phase cannot be assigned only to some members of a project team.

The project start-up model (Figure 5) consist of practices that are assigned to different roles. It is noteworthy that one person can represent more than one role. However, one role can represent only one organization, either supplier, customer or 3rd party. In a customer-supplier context, and when the focus is on the supplier's perspective, roles are divided into two groups: supplier's internal roles and external roles.

6.2.1 Supplier's internal roles

During the project start-up phase, the supplier firm develops the operational environment for the project's execution. The aim is to ensure the success of a single project and plan future business prospects. In a customer-supplier context, where the project is delivered to an external customer, the development of the operational environment for the project requires cooperation between different operations within the supplier firm and with external organizations.

During this research, four supplier's internal roles were identified: Sales Manager, Business Manager, Project Manager and Project Team. In general, the Sales Manager is responsible of the sales of the project; the Business Manager is responsible for the business, which is related to the project; the Project Manager has the overall responsibility for the management of the project; and the Project Team is responsible for ensuring that it has the necessary competence to implement the project. The supplier's internal roles and their practices during the project start-up phase are described in Table 6.

TABLE 6 Supplier's internal roles during the project start-up

Role	**Practices**
Sales Manager	Inform Production Unit of Future Project Transfer Project to Production Prepare Project Agreement Allocate Resources for Project Manage Customer Relationship Plan Project Monitoring Redefine Project Scope Ensure Project Profitability
Business Manager	Inform Production Unit of Future Project Appoint Project Manager Transfer Project to Production Prepare Project Agreement Allocate Resources for Project Manage Customer Relationship Analyze Project Risks Plan Project Monitoring Redefine Project Scope Manage 3rd Parties Ensure Project Profitability Prepare Project Plan
Project Manager	Appoint Project Manager Transfer Project to Production Prepare Project Agreement Save Order Information in System Allocate Resources for Project Manage Customer Relationship Meet Customer Define Technical Environment Analyze Project Risks Plan Project Monitoring Redefine Project Scope Manage 3rd Parties Ensure Project Profitability Prepare Project Plan Organize the Internal Kick-off Meeting
Project Team	Allocate Resources for Project Meet Customer Define Technical Environment

In the customer-supplier context, the Sales Manager has a major role in the early stages of a project start-up. After the customer has placed an order, the Sales Manager begins to transfer the project to production within the supplier firm. The Sales Manager works closely with another supplier's internal role, the Business Manager, during the project start-up phase.

The Business Manager is responsible for a project from the business point of view. The Business Manager appoints the Project Manager, and thereby ensures that responsibility for the project is transferred from the sales operations to the project operations within the supplier firm.

The role of Project Manager during the project start-up phase varies. In some cases, the Project Manager may have been involved during the sales process or may have been appointed only after the sales case is closed. The point when the Project Manager is appointed has an impact on his or her the tasks during the project start-up phase.

As the actual software development work is completed later during the execution phase of a project, the role of the Project Team during the project start-up phase is to become familiar with the customer and the project. Additionally, the Project Team helps the Project Manager ensure presence of the necessary competence for the execution of the project.

6.2.2 External roles

In addition to the supplier's internal roles, two external roles were identified during this research: the Customer and the 3rd Party. These external roles are considered here from the supplier's perspective. In the customer-supplier context, the customer is not from the same organization as the supplier. Therefore, the supplier has only limited control over the decisions and actions of external roles during the project start-up phase. However, the supplier firm is responsible for ensuring that those who fill of external roles recognize their responsibilities and tasks during the project start-up phase.

From the supplier's perspective, the relevant responsibilities of external roles during the project start-up phase concern mainly project management and other practical issues, for example, project planning and project monitoring. In Table 7, the external roles and related practices from the supplier's point of view are described.

In a customer-supplier context, the Customer as a role is obligatory in a start-up phase of a software development project. Without a customer, there is no project. From the supplier's perspective, the Customer is a person or an organization acquiring the software development project. The Customer has its own goals for the project, and those differ from the goals of the supplier. Additionally, the supplier and the customer might have shared goals for the project.

TABLE 7 External roles during the project start-up

Role	**Practices**
Customer	Prepare Project Agreement Allocate Resources for Project Plan Project Monitoring Redefine Project Scope Prepare Project Plan
3rd Party	Manage 3rd Parties

The other external role is labelled here in general terms as the 3rd Party. In practice, the 3rd Party can be, for example, a sub-contractor of the supplier, a customer of the customer, a consultant who works for the customer or a representative of a state authority. All representatives of the 3rd Party role have different motives and goals for the project, and the supplier must manage them carefully in the early stages of a project.

7 OVERVIEW OF THE ARTICLES AND AUTHOR'S CONTRIBUTION

7.1 Article I: Reported project management effort, project size, and contract type

Article

Ahonen J. J., Savolainen P., Merikoski H., Nevalainen J. (2015) Reported project management effort, project size, and contract type. Journal of Systems and Software, Vol. 9, pp. 205–213.

Abstract

Literature based hypotheses on the proportion of project management effort were tested with reported effort data from 117 projects by three software supplier firms. The results support most of the literature-based hypotheses, but not all. The supported hypotheses are the correlations between project management effort, project size and team size. The unsupported hypotheses are the necessity of spending at least some project management effort on a project, and the insignificance of contract type. The conflict with previous studies and practical experience may be a result of market pressures and skewed reporting. The analysis implies that there is a pattern of inaccurate reporting of effort data and some possible explanations for the pattern are discussed. The results suggest that we do not properly understand the internal dynamics and actions of supplier firms.

Author's contribution

The author of this dissertation designed the study and defined hypotheses together with Ahonen. The author of this dissertation, Ahonen, Savolainen and Nevalainen contributed in the writing process of this article.

7.2 Article II: Supplier's software development project start-up practices

Article

Merikoski H., Savolainen P., Ahonen J.J. (2017) Supplier's Software Development Project Start-up Practices. International Journal of Managing Projects in Business, Vol. 10, pp. 880-896.

Abstract

The purpose of this paper is to present a life cycle phase of a software development project, which contributes substantially to the success of the project. This paper visualizes the project start-up phase from the supplier's perspective. The method is a theory building from case studies. The data were collected from three software supplier firms by conducting process modelling separately in each firm. The study resulted in a model of a supplier's software project start-up, which includes start-up practices and involved roles. The results indicate that project start-up is an integral and structured phase of a project life cycle, which influences the execution of a software development project, especially from the supplier's perspective in the project business context. The study focuses on the start-up phase of software development projects delivered to external customers. Therefore, a developed project start-up model is applicable as such in software supplier firms. The project start-up model presented in this paper indicates that project start-up is a complex and multi-dimensional activity in a supplier firm. This study suggests that if the project start-up phase is clearly defined, planned and followed in a supplier firm, it reduces confusion and miscommunication among the people involved in the project and helps to achieve the business goals of a project.

Author's contribution

The author of this dissertation planned and conducted the study, collected the data and analyzed the data with the help of Savolainen. The author of this dissertation was the main contributor during the writing process of this article. Ahonen and Savolainen reviewed the article and suggested modifications.

7.3 Article III: Perspective matters: challenges during handover in supplier firms and their linkage to influential factors

Article

Merikoski H., Savolainen P., Ahonen J.J. (2019) Perspective matters: Challenges during handover in supplier firms and their linkage to influential factors. Submitted to Project Management Journal.

Abstract

This article explores challenges that software supplier firms encounter when the project is handed over from the sales team to the project team within the supplier firm. Problematic information flows and challenges encountered by the supplier's project managers were identified. The framework of factors influencing the end product of the project and factors connected to challenges was utilized. Factors differentiated perspectives when studying projects in a business context where projects are delivered to external customers. The study suggests that researchers must be careful while studying project management success and the factors influencing project success when the output of the project is delivered to an external customer. This study emphasizes that it is necessary to make a distinction between the perspectives of the customer and the supplier when studying projects in the project business context.

Author's contribution

The article is based on the research made for Article II. The author of this dissertation collected the data and had the main responsibility for the analysis of this study and the writing process of this article. Savolainen and Ahonen contributed in the writing process of this article.

7.4 Article IV: Applying software process modeling to improve customer support processes

Article

Raninen A., Merikoski H., Ahonen J.J., Beecham S., (2015) Applying software process modeling to improve customer support processes. Journal of software evolution and process, Vol. 27, pp. 274-293.

Abstract

The quality of an organization's support services can be key to maintaining and extending its customer base and to assuring its future survival. As such, support services must be considered in software process improvement initiatives and not left as an afterthought or stand-alone effort. However, to identify areas in need of improvement requires a full understanding of the current process. To meet this need, we have developed a process modeling technique called LAPPI that documents current "as-is" processes.

This study explores whether LAPPI can identify opportunities for improvement in the customer service process. LAPPI is applied, step by step, in small-to-medium-sized enterprise. Results are validated through an analysis of customer satisfaction questionnaires administered before and after LAPPI intervention. Applying LAPPI highlighted several problems with the customer support service, which was subsequently streamlined. The validation reveals an improvement in

customer satisfaction in several areas, with significant improvement in customer response times and in customer query resolution.

Software development organizations can use LAPPI to highlight where improvements are needed in support services. This study demonstrates that making the best use of support resources and ensuring that customers receive prompt and clear help throughout the product's lifetime can improve an organization's image and future prosperity.

Author's contribution

Raninen planned and conducted the study together with Ahonen and the author of this dissertation. The author of this dissertation analyzed the customer satisfaction surveys and contributed to the writing process. Beecham conducted the statistical analysis and supported the writing process.

8 RESEARCH SUMMARY

This chapter summarizes research by offering answers to the research questions and research problem and discusses the limitations and validity issues. Additionally, the implications for practice and for research are discussed.

8.1 Answers to the research questions and research problem

8.1.1 Answer to RQ1

Answer to

RQ1. How much project management effort is reserved for a software development project in a supplier firm?

was determined after conducting a study that was reported in Article I.

Project management effort is one of the necessary types of effort required for successful completion of software development projects. Prior knowledge about the relative amount of project management effort would assist estimation of effort required and the work-breakdown-structure building for a project. To gain a better understanding of the relationship of relative project management effort to the size of a project and the size of a team, data from three supplier firms was analyzed.

The analysis revealed that the size of the team correlates positively to the relative project management effort required. The duration of the project also correlates positively with the relative project management effort. However, analysis creates more new questions than it provides answers. It seems that there is a pattern in the effort reporting, and that pattern may assign a common tendency for inaccurate or misleading reporting. Therefore, the most interesting open questions consider the ways of reporting the effort spent and the truthfulness of that reporting, the impact of commercial issues on reporting and the usability and accuracy of the historical data used for estimation of effort.

It can be concluded that invoicing contributes to the project reporting in supplier firms, with invoices including work that the customer will accept. Therefore, the time sheets may not reflect the actual distribution of effort. Further, the findings also highlight the issue that systems may have several purposes in supplier firms. For example, the time-keeping system may be use as a tool for invoicing, and at the same time, it may be used as a tool for the supplier's internal project reporting. The data from this type of multipurpose system may be biased depending on the angle from which it is observed. This observation undermines the reliability of different forecast models and effort estimates because the design models are generally based on historical data (Yannibelli & Amandi, 2011). Therefore, this analysis indicates that the historical data may not be reliable. Consequently, this may influence the business of supplier firms, especially their tendering processes, where effort estimates are usually calculated based on earlier experience with similar projects. To obtain reliable information about the projects, the data from different sources is needed. Therefore, to avoid unwanted impacts on business in the long term, the supplier needs reliable and up-to-date information about its projects.

8.1.2 Answers to RQ2 and RQ3

Answers to

RQ2. What happens in a supplier firm during the project start-up phase?
RQ3. What practices are in use in supplier firms during the project start-up phase?

were determined after conducting case studies at three supplier firms. This study is described in Article II.

The project start-up phase in a supplier firm begins when the customer has placed an order or when the sales case of the project is near closure, and the supplier firm can be sure that it will win the deal. This research indicates that the project start-up phase is a complex, multi-dimensional and structured phase of a life cycle of a project and includes several practices where various internal and external roles are involved. This phase precedes every project that is delivered to an external customer.

Additionally, this study revealed that during the project start-up phase, a set of predefined practices is performed. Each project start-up practice includes activities and tasks that all must be completed during the project start-up phase before moving into the execution phase of a project. Notable is that the project start-up practices may be emphasized differently in different projects.

Several roles are involved during the start-up phase of a software development project. During this research, these different roles were identified divided into two groups: the supplier's internal roles and external roles. As the project start-up phase is a hectic time for the supplier firm and is important for the success of the project, it is essential that the responsibility for the different start-up practices is allocated clearly among the different roles. This will ensure that all necessary tasks will be completed before the execution of the project begins.

8.1.3 Answer to RQ4

The answer to

> RQ4. What are the challenges associated with the project start-up phase from the supplier's perspective?

was determined when the problematic information flows were revealed and analyzed. Additionally, challenges encountered by the supplier's project managers were identified. This study is reported in Article III.

With the help of the framework of influential factors of McLeod and MacDonell (2011), it was identified to which project success factors the analyzed challenges are connected. This study resulted in three different groups of challenges: one where factors related to challenges are the same on both the customer's and supplier's side, one where there are no factors related to challenges on the customer's side, and one with almost identical factors on both sides.

The existence of the second group is the most intriguing finding. It means there are challenges that are totally the supplier's concern and are not seen by the customer. However, they require the attention of the supplier's project manager, exert and influence on the project and may endanger the project's success. Therefore, the identification of challenges related to information flows between the supplier's sales team and the project team during the project start-up phase is particularly important for the supplier to be able to successfully deliver the software development project to the customer.

8.1.4 Answer to RP

The overall RP of this dissertation is

> RP. How to start a software development project in a customer-supplier context?

Articles I-III answer to RQ1-RQ4 and provide answers to the RP.

In this research, the supplier and the customer are not part of the same organization, and thus the focus is on projects that are undertaken and delivered in the customer-supplier context. This context distinguishes software development projects delivered to external customers from projects carried out in other contexts. Therefore, one of the key findings of this research is the observation that projects in a variety of contexts must be managed differently, and this should be considered in project management research as well as in practice.

In addition to context, it is important to distinguish between a customer's and a supplier's perspective when studying software development projects. This research makes a clear distinction between the two perspectives by adopting the supplier's viewpoint in the customer-supplier context. In this context, a supplier delivers software, which is developed during a project, to an external customer. This means that these two parties have different motives and objectives for the project, and therefore, the perspectives of the parties should be distinguished when projects in the customer-supplier context are studied.

When the supplier perspective is chosen, each project is preceded by a sales phase, as each project is part of the supplier's business. After the supplier's sales case is closed successfully, the project is handed over from the supplier's sales operations to its project operations. This means that in the customer-supplier context, there is the interface otherwise known the handover that connects sales operations and project operations of the supplier firms. Thus, the handover is the trigger, which begins the project start-up phase within the supplier firm.

The need for guidance for the project start-up phase was identified. The description of the customer-supplier context (Figure 2) was created and the project start-up model was developed (Figure 5). The model is a collection of 16 general project start-up practices that have been developed from the software supplier's point of view. The model offers guidance to software supplier firms as they start the software development projects that are delivered to an external customer in such a way that conditions for the project success are created before the project execution begins.

To be able to start a project quickly and cost-effectively, the supplier firm should follow predefined steps and implement several project start-up practices before moving into the project execution phase. The practices should be repeated in every project that is delivered to an external customer to create conditions for the project success. This research indicates that if the project start-up phase and practices are clearly defined and followed in the supplier firm, confusion and miscommunication among the people involved in the project are reduced. This further minimizes challenges and risks during project execution and helps the supplier achieve the business goals of a project.

8.2 Validity and limitations

The validity of the results is an important aspect of any study. A significant amount of literature exists about the validity of qualitative and quantitative research. However, in the case of mixed methods research, it is more difficult to find guidance for validation (Venkatesh et al., 2013). In the case of the convergent parallel mixed method approach, there are some threats to validity (Creswell, 2014), which are discussed in Articles I-IV.

The construct validity means that operational measures for the concepts have been identified (Yin, 2009). The threats to construct validity were managed by following guidelines proposed by Yin (2009). Firstly, multiple sources of evidence were used in both parts of this research. Quantitative data and qualitative data were collected from six firms altogether. Additionally, the applied process modelling technique was tested and validated separately at a seventh firm. Secondly, a chain of evidence was established as the research process of both parts of this research was reported and published in Articles I-IV. Thirdly, the key informants (representatives of the studied firms) reviewed and commented on the study reports.

Internal validity refers to whether the interpretations made from the data are correct (Creswell, 2014). Yin (2009) suggests alternatives to test internal validity. Here, the threats to internal validity were managed by involving several researchers in the interpretation and reporting of results of this research. Moreover, the findings of this research are in line with the previous research on project start-up (Ahonen & Savolainen, 2010; Savolainen, 2010; Savolainen et al., 2011; Savolainen et al., 2012; Savolainen & Ahonen, 2015; Savolainen, 2011).

External validity refers to whether the findings of the research are generalizable (Yin, 2009). To manage the threats to external validity, the multiple sources of evidence with the mixed methods approach were applied during this research. The generalizability is one of the most often highlighted weaknesses of case study research (Myers, 2013). Yin (2009) proposes the use of replication logic to deal with the generalizability weakness. In this research, the replication logic was used during the theory building process. Additionally, the applied mixed methods approach, especially its quantitative part helped to avoid problems with the external validity.

Reliability means that the study should be repeatable with similar findings (2009). To strengthen the results of this research, well-known, published and tested research methods were used. Furthermore, the research process and the results were documented and published in journal articles.

Some limitations of this research have been identified and discussed in Articles I-IV. The data for this research was collected from six software supplier firms. The small number of participating firms might be a limitation. However, this flaw is difficult to overcome because most firms are unwilling to allow researchers to model the challenges present in their project start-up process. Here, the firms that participated in the research were selected partly because they were known from previous research cooperation. However, the results from participating firms do support the point of view that the challenges are common to firms that operate in project business in the software industry. Therefore, the small number of case firms is not a serious flaw considering the generalizability of the results.

The geographical location of the case firms in the same country may have affected the results of this research. The case firms of this research operate in Finland. However, four firms out of the six studied firms conduct project business in the international environment, which mitigates the impact of their geographical location.

The project start-up phase may be quite different in other contexts and other industries. Therefore, the project start-up model is applicable as such only in software supplier firms that operate in project business and in projects that are delivered to external customers. However, the presented project start-up model does not specify which methods, tools or techniques should be used during the project start-up phase, and therefore, it is also applicable to other firms in other contexts. Furthermore, the definition of the customer-supplier context of this research offers a different view of software development project management than

what has been used in the previous literature, and thus, strengthens the results of this research.

From the methodological perspective, the actual observation of real-time project start-ups was not possible, because of the confidentiality required by the case firms and their customers. Therefore, the research relies on the modelling sessions, later meetings, and additional documentation offered by the case firms. This fulfils the requirement of using multiple sources of evidence to support the analysis and theory building process, but it is not as reliable as real-time data collection of project start-up processes. However, the followed research approach, theory building from case studies, does not require significant numbers of cases, and therefore, the use of more than three case firms within the same industry may not offer additional value to the results of this research.

8.3 Implications for research and for practice

This research highlights issues that are not covered in the earlier literature, and therefore, has several implications for research and for practice, especially in the fields of project business and project management within the software industry.

In general, the defined context of this study - a customer-supplier context - elicits a view that differs from project management tradition. Thus, this research reinforces the idea that a variety of projects should be managed with project management practices which differ from general practices which are presented in current standards.

The results of this research contribute to literature by offering a detailed view of the interface between the software supplier's sales operations and project operations. In the customer-supplier context, the handover from the supplier's sales operations to the project operations happens in every project, and thus, it is important to be aware of the presence of handover activities when researching projects in the business context.

This research describes in detail a customer-supplier context from the supplier's perspective and highlights the importance of a systematic project start-up phase in a project business context. Additionally, the results of this research indicate that there is regularity in the project start-up phase in the customer-supplier context, which has not been revealed in previous studies.

This research resulted in a model of a software development project start-up as well as detailed descriptions of start-up practices. Although the case firms were different in size and deliver a variety of projects to different customers, they all follow highly similar steps during their project start-up. Therefore, the model of project start-up offers guidance to a variety of software supplier firms, that undertake projects in the customer-supplier context. If the supplier firm wishes to promote the success of its projects, it can start them in accordance with the project start-up model. Although the projects are different, the start-up model provides a general framework for the start-up phase of software development projects in a customer-supplier context.

8.4 Future research

This dissertation revealed aspects that provide opportunities for the future research. This study has focused on the supplier's perspective; therefore, the start-up phase of a software development project from the customer's perspective in the customer-supplier context remains an unexplored area. A better understanding about the customer's viewpoint might offer solutions to the challenges faced by supplier firms during the project start-up phase and help them overcome challenges which may endanger the success of a project.

The presented project start-up model is developed for software development projects, which are conducted in the customer-supplier context. Therefore, there is a need to study the project start-up phase in other industries and other contexts to test and to develop the presented model. This would enable the addition of a project start-up phase in general project management standards and methods, which is still missing.

The applicability of the presented project start-up model is one topic that needs to be studied further. In addition, there is a need for further development of the start-up model and its practices. The various roles and their tasks during the project start-up phase are among the topics that offer opportunities for the future studies. The information flows between different roles during the project start-up phase, and the challenges related to them also demand further examination.

Since the result of this research was the project start-up model, it would be valuable to conduct further research to determine, how project start-ups implemented in accordance with the presented model affect the success of the projects from the supplier's perspective as well as the customer's perspective.

Additionally, as the project start-up includes several practices that are performed by people with different roles, it would be reasonable to develop tools that help manage a hectic project start-up phase to ensure that all relevant practices are completed before the actual project begins. One aspect which calls for further research is the evaluation of the use of historical data in a supplier firm's business and project related processes starting from the project tendering phase in the customer-supplier context.

9 CONCLUSION

There are some traditions in project management research. One tradition assumes that all projects are similar and can be managed with similar methods and tools. However, at the same time, there is an opposite tradition to classify projects in terms of industry sector, application area, project product or deliverable, being a hard or soft project, or the country where the project has been undertaken (Crawford, Pollack 2007). Furthermore, many aspects influence projects and differentiate them from each other. For example, the industry, the end product of the project and the context in which the project is undertaken are issues that distinguish various types of projects. Whether the aim of the project is to build an ocean ship or to develop information system or, whether the project is implemented within one organization or delivered to an external customer, many differences exist. The findings of this research indicate that all projects cannot be placed in the same basket and be managed by following similar processes and practices.

This research forms a detailed picture of the actions of supplier firms during the software development project start-up phase within the customer-supplier context. This knowledge deepens our understanding of why a systematic project start-up phase is necessary, and which practices it should include from the supplier's perspective to ensure the success of the project.

Additionally, this research separates the supplier's and the customer's perspectives from each other. This does not mean that the customer's perspective can be forgotten; on the contrary, the supplier should ensure that the customer understands its responsibility for tasks associated with the project during the project start-up phase. Otherwise, the supplier could find these tasks to be challenges accompanied by additional costs during the project.

Because supplier firms and their software development projects are different, it is important to discuss the applicability of the project start-up model (Figure 5) in different firms and in different projects. This research investigated the project business and software development projects of six software supplier firms. The investigation revealed that even though the firms, their project busi-

ness and their projects are different, they all follow a similar project start-up process. However, various aspects of business are emphasized differently in these firms. Therefore, the project start-up model and project start-up practices must be applied differently depending on the current situation of the firm and the project.

Although, the software supplier firms and their business are different, in the customer-supplier context (Figure 2), their project-related business has some common aspects due to the similarities of a structure of projects being delivered to external customers. These aspects are linked to business management, sales management, project management and software development, and they are all the part of the project start-up model (Figure 5).

As projects are primary method of conducting business, the management of project-related business is an important part of a project start-up phase from the supplier's viewpoint. Therefore, the project start-up practices concerning business management are relevant to all projects. In the long term, it is important to the supplier that its projects remain profitable. Thus, the supplier must ensure project profitability during the project start-up phase.

All software development projects are unique, and thus, the start-up phase of each project is different. The supplier firm's business strategy defines what types of projects are delivered to customers, and the customers influence how these projects are delivered. Furthermore, supplier's strategic choices direct the start-up phase of its projects in various ways. Therefore, it is necessary to continue studying projects in different contexts and at the same time separate various perspectives of project stakeholders. In this way, it is possible to make the project-related work and phases visible, and thus create conditions for the success of the projects.

YHTEENVETO (FINNISH SUMMARY)

Ohjelmistokehitystyö tehdään tavallisesti projektissa, jonka asiakas ostaa ulkopuoliselta toimittajalta. Toimittajayrityksen näkökulmasta ohjelmistokehitysprojektit ovat merkittävä osa yrityksen liiketoimintaa. Näin ollen jokaisen projektin onnistuminen on erittäin tärkeää, mutta samaan aikaan haasteellista ja epäonnistuneista ohjelmistokehitysprojekteista uutisoidaan säännöllisesti. Projektiliiketoimintaa harjoittavan yrityksen on kuitenkin huolehdittava siitä, että ohjelmistoprojekti saavuttaa samanaikaisesti sekä asiakkaan että toimittajan projektille asettamat tavoitteet. Tavoitteiden saavuttamiseksi toimittajayrityksen on pyrittävä luomaan projektille onnistumisen edellytykset mahdollisimman varhaisessa vaiheessa. Käytännössä onnistumisen edellytyksen on luotava jo ennen kuin projektin varsinainen toteuttaminen aloitetaan.

Aikaikkuna projektin onnistumisen edellytysten luomiselle avautuu heti, kun toimittaja on saanut tilauksen asiakkaalta ja sulkeutuu, kun projektin toteuttaminen aloitetaan. Tämä projektin myynnin ja toteutuksen väliin sijoittuva projektin elinkaaren vaihe on projektin käynnistämisvaihe. Aiempi projektinhallintaan ja projektiliiketoimintaan liittyvä tutkimus on tuonut esiin projektin käynnistämisvaiheen merkityksen projektin onnistumiselle. Aiempi tutkimus ei kuitenkaan kerro, millainen projektin käynnistämisvaihe toimittajayrityksen näkökulmasta on ja mitä tehtäviä se sisältää.

Tässä väitöstutkimuksessa pyritään löytämään ratkaisu tutkimusongelmaan: Kuinka käynnistää ohjelmistokehitysprojekti asiakas - toimittaja kontekstissa? Tutkimusongelman ratkaisemiseksi laadittiin kuvaus asiakas - toimittaja kontekstista toimittajayrityksen näkökulmasta, tutkittiin kuuden toimittajayrityksen projektiliiketoimintaa ja luotiin projektin käynnistämismalli. Malli tekee projektin käynnistämisvaiheen näkyväksi, kooten yhteen 16 käytäntöä, joiden päämääränä on auttaa toimittajayritystä luomaan projektille onnistumisen edellytykset ja siten varmistaa projektin onnistuminen. Tutkimuksessa tuotiin lisäksi esille projektin käynnistämiseen liittyviä haasteita korostaen asiakkaan ja toimittajan näkökulmien erottamisen tärkeys projekteja toteutettaessa ja tutkittaessa.

Tutkimuksen tulokset ohjaavat toimittajayrityksiä kohti systemaattista, projektin onnistumisen varmistamiseen pyrkivää tapaa käynnistää asiakkaalle toimitettavat projektit. Samaan aikaan tutkimus tarkastelee projektiliiketoimintaa ja projektinhallintaa perinteestä poikkeavalla tavalla erottamalla selkeästi asiakkaan ja toimittajan näkökulmat toisistaan. Näin ollen tutkimus vastaa esitettyyn tutkimusongelmaan ja avaa uusia tutkimusmahdollisuuksia sekä projektiliiketoiminnan että projektinhallinnan aihepiireistä niin ohjelmistokehitysprojekteihin kuin myös muissa konteksteissa ja toimialoilla toteutettaviin projekteihin liittyvän tutkimuksen näkökulmista.

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REPORTED PROJECT MANAGEMENT EFFORT, PROJECT SIZE, AND CONTRACT TYPE

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Reported project management effort, project size, and contract type

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ABSTRACT

Literature based hypotheses on the proportion of project management effort are created and tested with reported effort data from 117 projects by software supplier firms. The results support most of the literature based hypotheses, but some of the hypotheses are not supported. The supported hypotheses are the correlations between project management effort, project size, and team size. The unsupported hypotheses are the necessity of spending at least some project management effort on a project, and the insignificance of contract type. The conflict with previous studies and practical experience may be a result from market pressures and skewed reporting. The analysis implies that there is a pattern of inaccurate reporting of effort data and some possible explanations for the pattern are discussed. The results suggest that we do not properly understand the internal dynamics of supplier firms.

1. Introduction

Two important steps during project planning are the estimation of the effort required for the actual implementation of the project and the creation of the work breakdown structure (WBS). The importance of the WBS has been stressed in standards such as PRINCE2 (OGC, 2009), PMBOK (PMBOK Guide, 2013), and ISO 21500 (ISO, 2012). The importance of the estimation of effort has been noted especially in the software development field (Jørgensen and Shepperd, 2007; Moløkken and Jørgensen, 2003), in which projects are often late due to problems in effort estimation (Jørgensen and Moløkken-Østvold, 2006).

The accuracy of effort estimation is especially important for software supplier firms that operate in the project business. An important part of their business is based on selling projects and associated services to their customers (Artto and Wikström, 2005). Although those firms may not be dependent solely on selling projects, the profitability of individual projects is especially important for them (Savolainen et al., 2012). In order to be able to make a profit on projects sold to customers, the effort required by an individual project has to be estimated during the sales phase of the project marketing cycle (Cooper and Budd, 2007).

Software development projects are especially prone to estimation errors (Jørgensen, 2005; Kocaguneli et al., 2012; Moløkken and Jørgensen, 2003), and those errors may have a significant economic impact on software suppliers. Software suppliers have to be able to estimate the actual costs that a project will impose on them. For that purpose, they can use expert estimation (Jørgensen, 2005) or software effort-estimation techniques. The use of software effort-estimation techniques is based on defining the new project by some of its attributes and comparing those attributes to a historical data set (i.e., a set of past projects) containing the measures of the relevant attributes (i.e., distribution of actual effort, size, programming methodology, programming language, experience of the development team, and others) (Dejaeger et al., 2012).

We are not aware of studies that link contract type to effort estimation or effort reporting. Hence it is assumed that contract type has no impact on effort, although it has been reported to have an impact on project success (Sadeh et al., 2000).

Project management effort is an important part of the effort required for the implementation of a project, and research suggests that any complex activity such as a project or a complex task cannot be started without spending a minimum level of effort. According to Barry et al. (2002), a certain minimum level of effort is required for starting complex activities. In addition, there are cases in which the supplier encounters additional challenges (Savolainen and Ahonen, 2015), which increase the project management effort required during the start of the project. Hence the effort estimation of the project management activities for a project should include at least the effort required for starting the project and its complex tasks determined in the work breakdown structure created for the project.

The creation of a detailed work breakdown structure requires knowledge of the expected amount of project management effort that will be needed for the beginning project. For that reason, the distribution of effort between different tasks in the WBS should be known. For this study, we analyzed 117 software development

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projects in order to find out the relative minimum and maximum levels of project management effort that is required for the management of a software development project. Prior to the analysis, we created five hypotheses based on the literature and our experience.

Analysis of the data did provide support for some of our theoretical hypotheses, but some of the hypotheses turned out to be unsupported. Supported hypotheses are the correlation between project duration and the proportion of project management effort, and the correlation between team size and the proportion of project management effort. Unsupported hypotheses are the minimum amount of project management effort required and the relationship between the type of contract and the proportion of project management effort required — these results are not in accordance with previous literature and our own experience. However, the data provide a glimpse into the actual realities of supplier firms. The realities of the project business may explain the unexpected results, since commercial realities may force the supplier firms to behave in ways that make the historical data less accurate than would be preferred. The results of our study suggest that there is a systematic pattern of inaccurate reporting of project management effort.

The structure of the paper is as follows. In Section 2, we outline our hypotheses and the reasoning behind them. Section 3 briefly outlines the data, and Section 4 presents our analysis. The results of the analysis, some of which are counterintuitive, are discussed in Section 5, and some explanations for the unexpected results are speculated. Section 6 provides a conclusion.

2. Research hypotheses

The most common project management standards are PMBOK (PMBOK Guide, 2013), PRINCE2 (OGC, 2009), and ISO 21500 (ISO, 2012). These standards are fairly comprehensive, and they include several project management processes, which make up the best practice recommendation for project management. This is explicitly stated in ISO 21500, in which it is stated that "*These project management processes are appropriate to projects in all organizations. Project management requires significant coordination and, as such, requires each process used to be appropriately aligned and connected with other processes*". ISO 21500 recommends that the project management processes presented in the standards are tailored to the individual cases in which it is applied. The other standards have similar recommendations.

ISO 21500 has 39 separate project management processes. The other standards do not have the same exact number of processes, but the actions that should be performed by applying the standards have much in common. We will not, however, analyze those standards in detail from this point of view. We are content to note that every standard has a comprehensive set of processes to be applied and customized.

The number of project management processes and the activities included in them are likely to require a considerable amount of effort if performed. In addition to that, it is reasonable to assume that there is a lower level of effort that is required to perform the minimum level of project management activities for a real project. This assumption is supported by Barry et al. (2002), in which it was found that there exists a minimum amount of effort required for starting a complex activity.

Guidelines on the amount of effort that should be reserved for the management of a project would help project planning and resource allocation. However, we are aware of only one study that provides some numbers on project management effort (Haapio, 2011). Haapio's numbers are in line with the industrial "rule of thumb" we are aware of and which recommends reserving 10–15% of the total effort for project management activities. In order to get a better understanding of the required project management effort, we decided to analyze data from a set of projects, especially the timesheets provided by the individual team members. Before starting the analysis, we formulated five hypotheses to guide our analysis.

Our analysis concentrates on the *proportion of project management effort* required for executing projects. By the proportion of project management effort we mean the percentage of total effort that is used for project management activities. In our analysis, *total effort* means every type of effort that has been reported for the project, and *team size* is the number of persons who have reported hours for the project.

The duration of a project is an important factor regarding the project management activities required. The risks with projects with longer duration increase (Cooke-Davies, 2002), which may require additional effort for risk management and replanning. For a project with a longer duration, the importance of change management and replanning increases (Dvir and Lechler, 2004), which is likely to increase the proportion of project management effort. This is supported also by recent results on complex projects (Zhang, 2013).

The first hypothesis is based on the assumption that projects with longer project duration require a greater proportion of project management effort than projects with a shorter duration. Hence we formulate our first hypothesis as follows:

H1. Projects with a long duration require a greater proportion of project management effort than projects with a shorter duration.

Projects may have small teams with a simple communication structure. With a small project team, the project manager may easily have a meeting with all team members in a meeting room and be constantly aware of what is happening. Many project management activities are easy to perform and they will not take much time. The situation is likely to change when the project team gets significantly bigger.

Large project teams may require additional levels of management structure and formal channels of communication. In order to keep track of the project, the project manager may utilize formal reporting structures and other complexity-management solutions. Hence a large project team may require a greater proportion of project management effort than a smaller team. The second hypothesis is based on a similar correlation between the size of the project team and the proportion of project management effort required. Hence we formulate our second hypothesis as follows:

H2. Large project teams require a greater proportion of project management effort than smaller teams.

The results reported by Barry et al. (2002) show that there is a minimum amount of effort required in order to start a complex activity. Support for that can be found from Ahonen and Savolainen (2010) and Savolainen and Ahonen (2015), which suggest that there are necessary project management activities that have to be performed for every project. Hence it is reasonable to assume that every project requires at least that amount of project management effort.

The existence of necessary project management activities and effort required for starting a complex activity suggest that there is an absolute minimum of project management effort that is required for any project. In other words, it is not possible to execute a project without spending at least some effort on project management activities.

We assume that when projects are fairly short and have small project teams they require less project management effort than projects with longer durations and larger teams (this comes from H1 and H2). On the other hand, it has been shown that at least some project management effort is always required (Barry et al., 2002), and therefore we assume that on average there is lower limit of proportional project management effort that is approached when projects get shorter and teams smaller. That lower limit would be more than

0% and for practical project planning purposes at least this amount of effort should be reserved for project management activities. Hence we formulate our third hypothesis as follows:

H3. There exists a minimum proportion of project management effort that is required for the management of short projects with small teams and that minimum is higher than zero.

In addition to testing for the existence of the minimum level of project management effort we planned to estimate the level if possible. That estimation would provide a means to test H3. The estimate would provide a "lower limit" for practical project planning purposes.

Large projects may require a greater proportion of project management effort than small projects, but the percentage of the effort used for project management activities should not consume all the effort. Since large projects have been successfully implemented, the proportion of project management effort cannot grow constantly and consume all effort when the size of the project grows. At least the growth rate of the proportion of project management effort related to project size has to slow down.

We assume that with a sufficiently large set of data, it would be possible to estimate the level of the average proportion of project management effort that is approached when projects get larger. That estimate would provide a guideline for practical project planning purposes. Hence we formulate our fourth hypothesis as follows.

H4. There exists an upper limit that the average proportion of project management effort approaches when projects get larger and that limit is less than 100%.

The fifth hypothesis deals with the types of contracts. The main types of contracts for software development projects are fixed-price contracts and time-and-materials contracts (Fink et al., 2013). The fixed-price contract refers to a contract in which the supplier and the customer have agreed that the project has a single pre-defined price. In the time-and-materials type of contract, the supplier invoices the customer according to the reported working hours and other possible costs.

We are not aware of studies which suggest that the type of contract has an impact on project management effort, although it has an impact on project success (Sadeh et al., 2000). Since the type of contract has not been reported to have an impact on effort, we assume that the type of contract will not have an impact on the proportion of project management effort. Hence we formulate our fifth and last hypothesis as follows:

H5. The type of contract has no impact on the proportion of project management effort.

The next section will outline the data we have used in our analysis.

3. Data

The data analyzed in this article has been provided by three firms. They have collected the data from their actual time-keeping information systems, and hence the data represents the official working hours of the employees of those firms. We will use the term "timesheets" for the various methods and systems the firms use. The projects were selected by the representatives of the firms.

Two of the firms have operations in at least two countries, and one operates inside the borders of a single country. Those divisions of the firms that provided the data had 200–2000 employees, and the firms operate in the project business, providing software development and related services to their customers. We do not know whether all the projects had been implemented by the same division. All projects have been performed on the premises of the supplier and there has been an end product produced in the project. The end product may have been a complete system, a small part of a system, or partial development of some aspects of the customer's R&D project.

Table 1
The summary statistics of the data.

	Duration	Hours	Team	DevH	MgmtH	OtherH	MgmtP
Min	22	140	1	140	0	0	0.00
1st Qtr.	61	859	2	811	50	5	5.57
Median	105	3022	5	2401	411	42	11.06
Mean	142	8787	6.8	7220	1382	185	10.87
3rd Qtr.	181	8940	8	7490	1109	129	15.50
Max	495	65,380	32	50,108	13,066	4084	31.53

The projects were implemented during a period of five years. Most the projects are relatively small and their duration is less than one year. We do not know whether all projects were executed in the same country, and we assume that was not the case. The summary statistics of the data are shown in Table 1. The data not shown in Table 1 are the number of projects (117), the number of projects with a fixed-price contract (61), and the number of projects with a time-and-materials contract (56). There are 33 projects from Firm A, 59 projects from Firm B, and 25 projects from Firm C.

In Table 1, the columns denote the variables of the data. Duration is the duration of the project as effective working days. Public holidays and weekends are not included in the duration. Hours is the total number of hours reported for the project. Team is the size of the team, which has been calculated by the number of people who had reported hours for the project. DevH is the number of hours reported for the actual software development work. MgmtH is the number of hours reported for project management activities. OtherH is the number of those hours that do not fit either development or project management. We do not know what OtherH includes. MgmtP is the proportion of project management as percentage of total effort (Hours).

The basic scatter plots of the data with the most interesting variables are shown in Fig. 1. The smoothed lines drawn in the plots have been generated by using the lowess function provided by the statistical R-system. The scatter plots show that the proportion of management effort grows very rapidly when the duration, the size, or the size of the project team grows. In addition, there are several projects for which there is no project management effort reported. Those features are discussed in Section 4, in which the analysis of the data is discussed and our hypothesis evaluated, and in Section 5 (Discussion).

4. Analysis

In this section, we present the analysis of the data and the evaluation of our hypothesis. A detailed discussion of the results of the analysis is presented in Section 5.

Our first hypothesis is H1, in which we assume that projects with a longer duration require a greater proportion of management effort than projects with a shorter duration. A preliminary look at the data and the fitted smooth curve in Fig. 1A supports H1. A closer look at the possibilities of fitting a statistical model to the data provides further support.

The shape of the original data in Fig. 1A suggests that a log transformation of the data is beneficial. We have transformed the duration of the projects, as shown in Fig. 2A. The thick dashed line is a fitted smooth curve (lowess function provided by the R-system). The shape of the smooth curve suggests that a linear model would fit the transformed data. Fig. 2A shows the confidence levels (inner thin dashed lines) and prediction limits (outer thin dashed lines) of the fitted model. The actual model is shown as a continuous line.

The fitted linear model is of the form ManageP = 4.38*log (Duration) − 9.66, and the p-Value of the fit is less than 0.001. The model fits the data on a statistically significant level and supports H1.

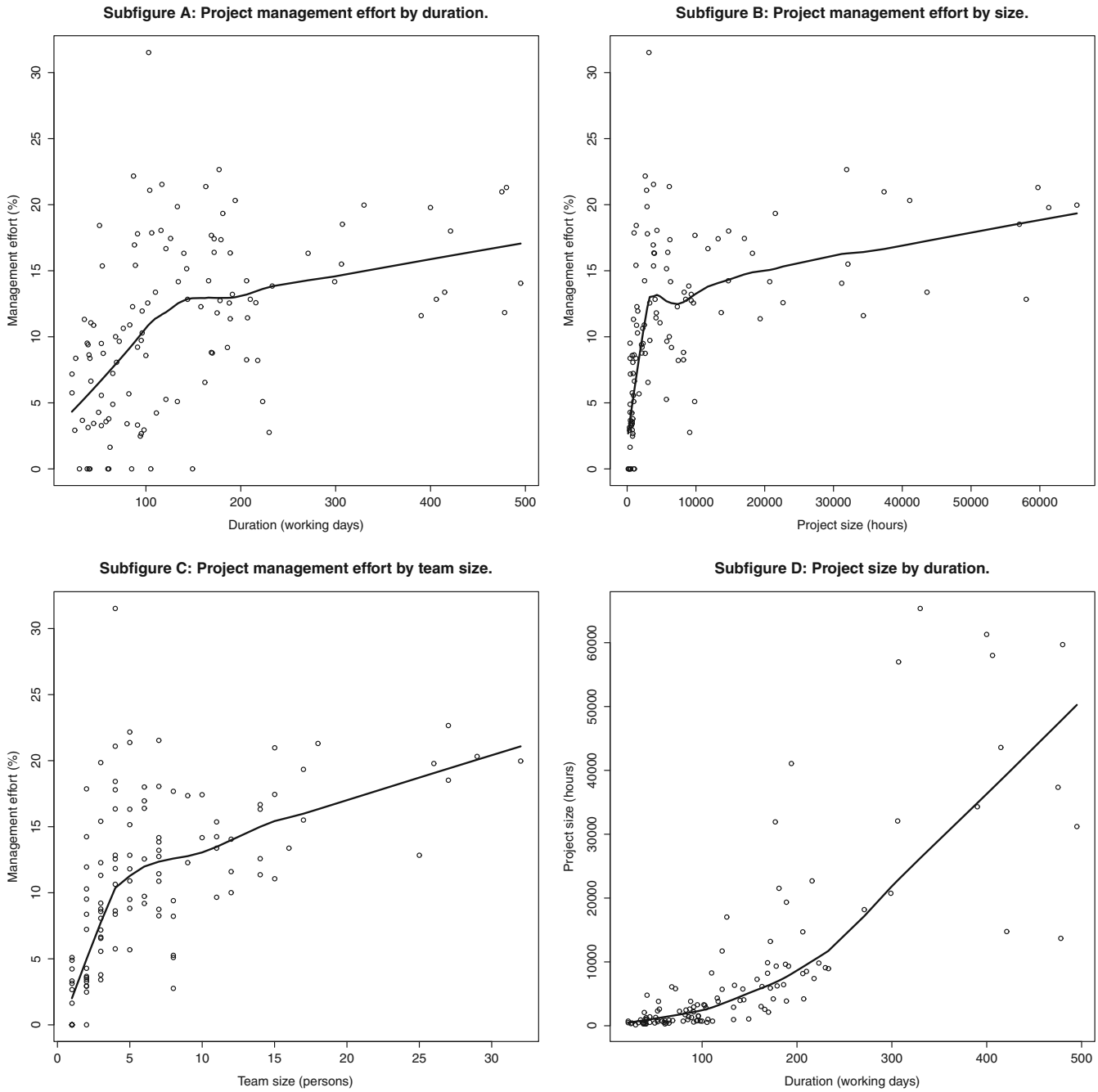

Fig. 1. Exploratory scatter plots of the data.

The second hypothesis, H2, is that projects with large project teams require more project management effort than projects with smaller teams. This assumption is supported by the smooth curve shown in Fig. 1 and the model presented in Fig. 2B. The data has also been transformed, and the model is shown with the confidence levels and prediction limits as in Fig. 2A. The fitted linear model is of the form ManageP = 4.8*log (TeamSize) + 3.58, and the *p*-Value of the fit is less than 0.001. The statistically significant fit of the model supports H2.

Hypothesis H3 (the existence of a greater than zero minimum amount of project management effort required by proper project management) is not supported by the data. The lack of support can be seen from Fig. 1 and the summary statistics in Table 1. If hypothesis H3 was supported, then the number of projects with zero hours reported for project management should not be as large as it is, and the shapes of the fitted smooth curves in Fig. 1 would be different. The number of projects with zero hours reported for project management is 13, which is over 11.1% of the projects. This number of projects with zero hours reported for project management cannot be explained by outliers only, especially since there are several projects with a low proportion of project management effort recorded, and the proportion grows very fast when projects get longer or the team larger.

The reported effort data is not the same thing as the actual effort used in project management activities. Therefore our analysis seems to suggest that there is a systematic pattern of inaccurate

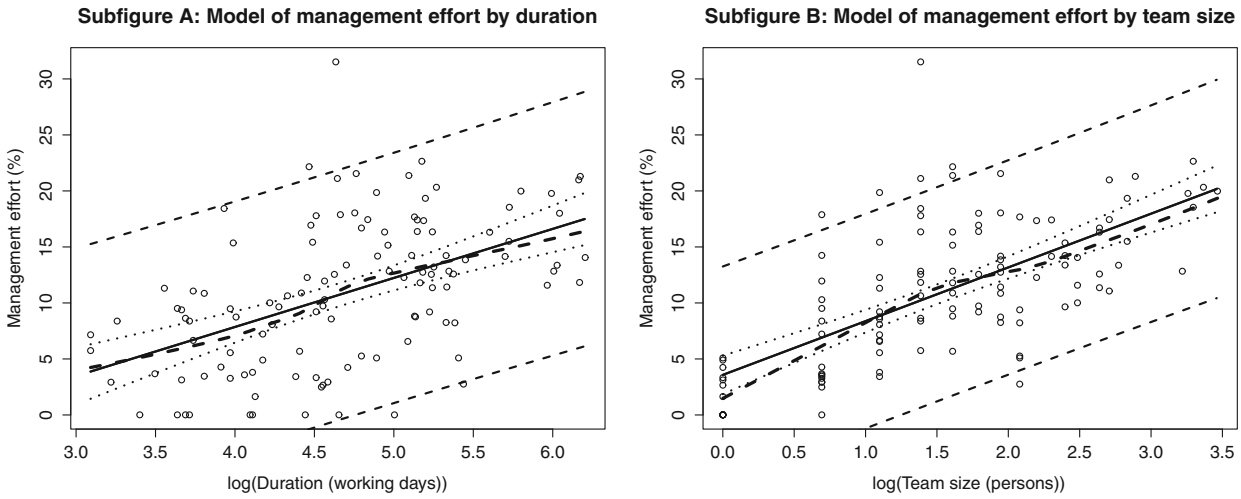

Fig. 2. Models fitted to the data for H1 and H2.

reporting the effort used for project management activities. One approach might be to drop the projects with zero project management effort reported from the analysis, but in our opinion that would hide the surprising pattern shown in the reported effort. The pattern in reporting seems to be that the proportion of project management effort start from a very low percentage, even zero, then grows quite fast, and stabilizes to a slower growth rate after a while. In other words, it seems to be the case that there is a systematic inaccuracy in the reporting of project management effort for small projects.

The fourth hypothesis, H4, assumes that there is an upper limit of average proportion of project management effort for projects. The data has one outlier with 31.5% of the total effort spent on project management activities, but that project seems to be one of a kind. We assume that project includes a very significant amount of project management on purpose, so it might be possible that the supplier has provided project management services as an important part of the supplied project. Other projects have a mean of 10.9% and a median of 11.1% of total effort spent on project management activities. We were not able to find any model that would support H4.

Graphical representation of the data implies that there may be some kind of upper and lower limits for the average relative project management effort for projects with a longer durations and larger project size. After dropping projects with a short duration and small size, the scatter plots and fitted smooth curves make it reasonable to assume that there are such limits. The plots with fitted smooth curves are shown in Fig. 3.

Another way to have a look at the possible existence of an upper limit for the average proportion of project management effort is to use the models shown in Fig. 2. Both models generate percentages up to and over 100% with large enough duration and team size. Therefore we have to conclude that the data does not support H4. We assume that the main reason for this is the small number of larger and/or longer projects in our data, and H4 should be tested with a bigger dataset that includes much larger projects. H4 should, however, be reformulated to include a size interval in order to make it easier to more testable.

The fifth hypothesis, H5, was based on the assumption that successful project management practices are similar regardless of the type of the contract. We tested H5 by applying the Wilcoxon test in order to find out whether the type of the contract has an effect on the relative project management effort. The test returned a very small *p*-Value, implying that there is a statistically significant difference between types of contracts, so a visual check was performed (shown in Fig. 4).

The visual representation shown in Fig. 4 clearly supports the results of the statistical analysis and does not support our hypothesis H5. Hence, the type of the contract is likely to correlate on the reported amount of project management effort. It is, however, possible that there are clear differences in the nature of the projects with different types of contracts. It may be that a larger part of project management related effort is performed by the customer in the case of projects with time-and-materials contracts even in the case of projects that are performed in the supplier's premises and produce an end-product.

5. Discussion

The results of our analysis have interesting implications. The results and their implications require further discussion. In this section, we discuss the results, possible explanations for the results, and the implications of the results.

5.1. Results and possible explanations

The results of our analysis provide support for some of our hypotheses, but not all of our hypotheses are supported. The supported hypotheses are H1 and H2. For hypothesis H4, there was no support. Similarly, hypotheses H3 and H5 were clearly not supported by the analysis.

The supported hypothesis H1 tells us that longer projects require a greater proportion of project management effort than projects with a shorter duration. This is in accordance with the literature, in which the management of changes is very important when the duration of a project grows (Dvir and Lechler, 2004), and longer projects are less likely to succeed due to growing uncertainty (Cooke-Davies, 2002). Hence long duration is in itself at least a partial reason for the increasing proportion of project management effort.

The supported hypothesis H2 suggests that large project teams require a greater proportion of effort for coordination and management than small teams. The results of the analysis support the view that during project planning, more effort should be directed to project management related activities when the size of the team grows. The result can be explained by the additional communication required by the management of a larger project team. Communication is especially important in the case of distributed teams, for which coordination and management effort may have to be rethought (Tannenbaum et al., 2012).

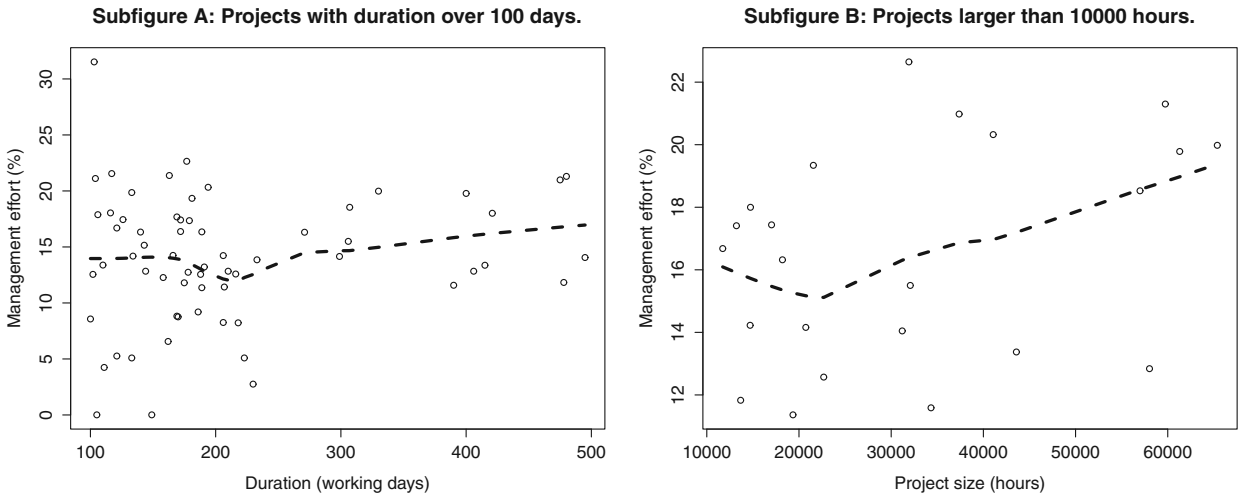

Fig. 3. Project management effort in longer or larger projects.

The data does not support H4. However, a visual analysis of the data (shown in Fig. 3) suggests that the lack of support for H4 is due more to the limited number of large projects in our data. Definite support or lack of support for H4 would require additional data, and possible reformulating of the hypothesis.

The lack of support for H3 is against our prior expectations based on the literature. Since starting a complex task requires at least some management effort (Barry et al., 2002), the projects with zero project management effort are clearly against earlier results. We are aware of only one previous study that has reported actual numbers on the project management effort used in a supplier firm. In that study, Haapio (2011) reported that the amount of project management effort varied between 2.6% (min) and 23.5% (max) of the total effort (1Q 8.1%, 3Q 14.9%, mean 11.7%, and median 11.3%). However, Haapio only classified project managers' activities as project management effort. Despite that difference, Haapio's data did not have a single project with zero hours used for project management.

It must, however, be stressed that the data consist of reported effort, not actual observed effort. Fig. 1 suggests that there is a pattern in the reporting of project management effort. The pattern suggests that project management effort may not be correctly reported in the case of small projects, and the reported proportion of project management effort is smaller than the real proportion. This pattern of inaccurate reporting is a very interesting phenomenon and clearly requires further study. The pattern of inaccurate reporting may have several reasons and some of the possible reasons for that are outlined later in this section.

The lack of support for H5 suggests following possibilities: (1) our data is not representative and no conclusions should be based on it, or (2) the project management practices should be different for projects with different types of contracts, (3) the reporting of hours spent is somehow skewed, or (4) the customer handles a greater part of project management activities in the case of time-and-materials contracts than in the case of fixed-price contracts even if the projects are performed on the supplier's premises and produce an end-product.

Our data is from three firms only. The firms may be exceptions, although that is not likely because we have no information that would make those firms exceptions in the competitive field of software suppliers. Another possibility is that the projects included in the data are exceptional. That possibility cannot be rejected, but we think that is unlikely, although the projects were selected by the representatives of the firms. The data represents how the actual timesheets had been filled in.

The data represents the actual timesheets of the projects, not the actual distribution of effort. The real distribution may be very different, especially in the case of small projects. We think that there may be various reasons for the reported distribution of effort not to be the same as the actual distribution of effort. These reasons are speculations, not researched facts. The first reason is that the members of the project team may not report some effort correctly due to a misunderstanding or insufficient guidance. The second reason is that there may be a natural tendency to report less management effort for small projects than is really spent. The third reason is that the misleading reporting may be deliberate and a consequence of the business realities in which the firms operate. An additional issue may be inaccurate reporting of overtime, which in itself may skew the data.

Accurate reporting on how employees spent their effort requires good guidelines, sufficient training, and the possibility to report the actual distribution of effort in a truthful way. We are not aware of any studies on this, but we assume that in many cases the members of a project team encounter situations in which they have difficulties in deciding how to report what they just did. This explanation may be supported by the fact that in many projects, there were at least some hours reported as belonging to the category "other", which means something else than project management activities or actual software development activities. Those hours have been reported as belonging to the project, but not belonging to project management or development.

The second possible explanation for the zero or very few hours reported as project management may be a result of people trying to look good and effective. A good member of a project team should spend his or her working time implementing the project. In that case, the team members may report the distribution of their effort in an inaccurate way. This may happen especially in small teams in which there is no dedicated project manager. A part-time project manager may perform all the necessary project management activities, but report that effort as something else than project management. That may be deliberate or subconscious. This may be a result of people's tendency to change their behavior according to the stated objectives. It has been noted that you are what you measure (Hauser and Katz, 1998).

The third possible explanation is based on the business aspects of the firms providing software development services. It is possible that during the negotiation phase of the project marketing cycle shown in Fig. 5 (the figure is adapted from Holstius (1987), the types of effort or distribution of effort presented in the agreement may differ from the real distribution of effort between different types of activities. This type of phenomenon has been studied by Glass et al. (2008), who found out that about half of software development projects included intentionally inaccurate or misleading marketing or reporting.

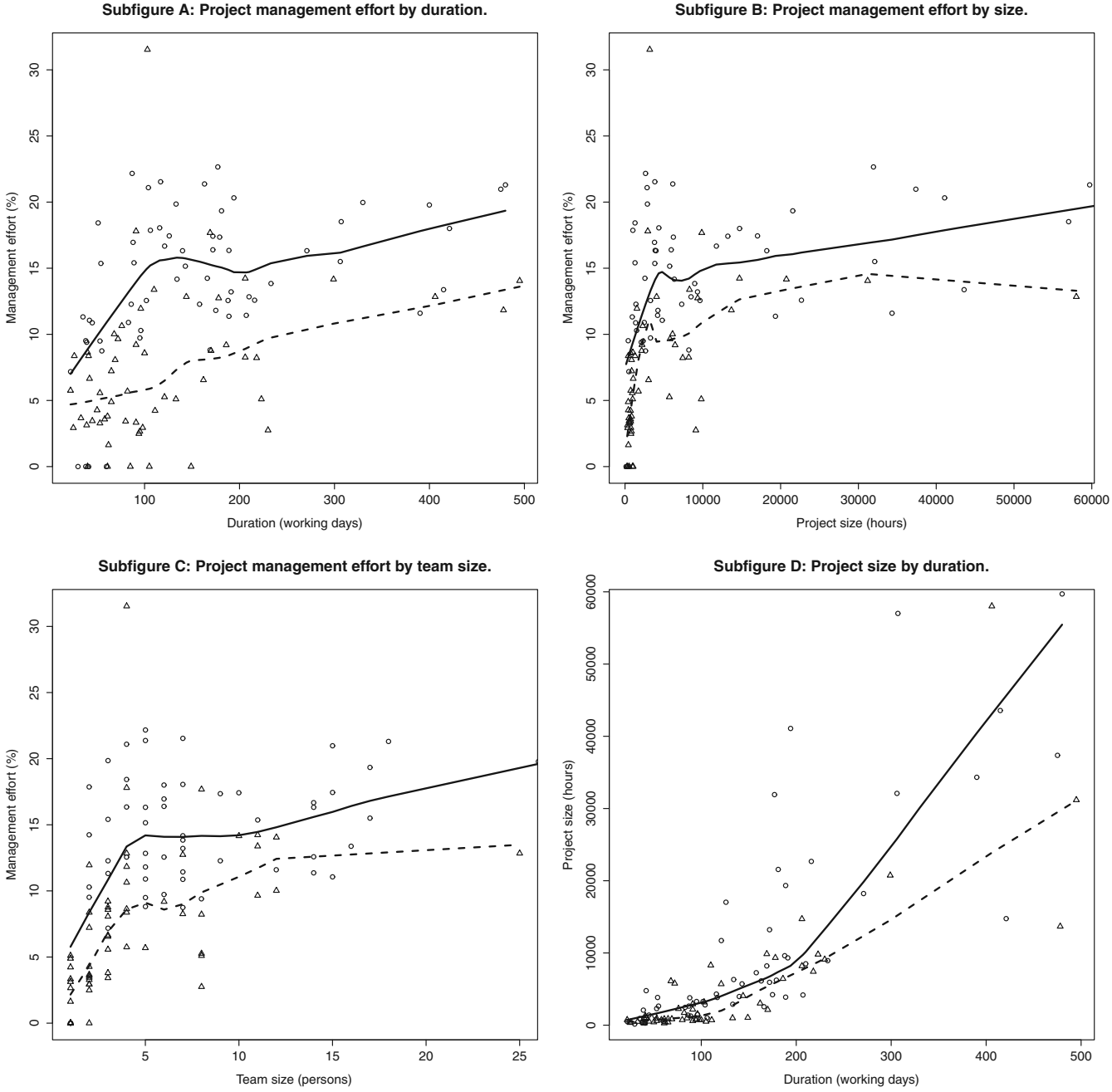

Fig. 4. Visual representation for hypothesis H5. Circles denote projects with fixed contracts, and triangles denote projects with time-and-materials contracts. A dashed line is fitted to the time-and-materials contracts, and a continuous line to fixed contracts.

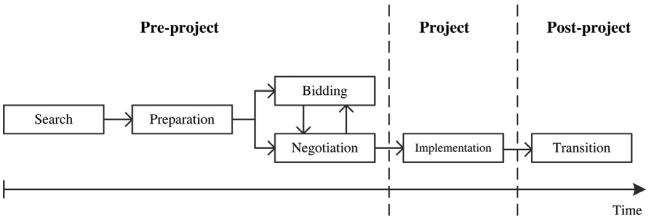

Fig. 5. Project marketing cycle.

It may be that the customers are more willing to pay for actual software development than they are willing to pay for project management. That possibility is supported by our informal discussions with the representatives of the firms. We informally asked their opinion on the number of projects with zero or very low project management effort. They told us that many customers are not willing to pay for project management even though project management effort is necessary, and that holds for small projects especially. If the customers are not willing to pay for project management, then no project management is sold. This is supported by Roels (2010), in which one of the benefits of time-and-materials contracts was the visibility of suppliers' efforts.

Suppliers may change their behavior according to the customer's wishes (Hüttinger et al., 2012; Mortensen, 2012; Schiele et al., 2012), and if the customer is not willing to pay for project management, then project management effort is not reported. Hence the timesheets

may include information that is not accurate and the inaccuracy is made on purpose, and this is most likely to happen with time-and-materials contracts. The reason is that the customer may be more willing to accept development effort compared to other types of effort.

5.2. Implications for practice

The results of our study have some interesting implications for practice. The implications consider both the suppliers and the customers. From the supplier's point of view, the most important implications are the impact of management metrics on the behavior of employees, and the accuracy of historical data used in effort estimation. From the customer's point of view, the results stress the importance of the customer's capabilities as a buyer.

If the internal metrics of the supplier make it easier for the members of project teams to record their effort as software development effort than anything else, then the metrics and internal guidelines will make the data entered into the timesheets skewed. In our opinion, suppliers should pay attention to this possibility and re-evaluate their internal metrics and guidelines from this point of view.

The accuracy of historical data used for effort estimation may not be very good due to misleading or inaccurate reporting. This type of inaccuracy may cause underestimations or overestimations. The first remedy may be the use of total effort as the input for effort estimation, not only the reported software development effort.

Customers should understand that a project requires project management in any case. That should make it easier for the customer to evaluate the competencies of different project teams and different suppliers. We do not think that it is in the customer's interest to require the reporting to be intentionally skewed.

5.3. Implications for research

Our study opens several interesting questions for further research. It seems to be the case that we do not know the dynamics of the project business and its impact on project management in detail. The main lines of further research should deal with the actual project management effort required by small projects, the types of time reporting practices used in firms, and the pressure caused by business realities to skew reported data.

It is possible that our data does not represent other firms and other projects, in which case our data is skewed and our results are not generalizable. However, there is no reason to suspect that the data is unique. It is possible, although unlikely, that our data represents the real distribution of effort and our assumptions are wrong. In that case, some projects require no project management effort at all or only very little project management effort. We consider that highly unlikely in light of the literature and our experience. Therefore the actual distribution of effort in projects of different sizes and with different types of contracts with the customer requires further study.

The second line of research to pursue would be the actual effort in reporting practices of supplier firms. How common is it to produce skewed reports? How well is the situation understood in supplier firms? Is the skewed reporting intentional or accidental? It would be especially interesting to know whether the pattern of reporting project management effort, i.e. not all project management effort is reported as such in small projects, found in our study is a common phenomenon and what causes it.

The business side and its impact should also be better understood. Our analysis suggests that supplier firms report a significantly different distribution of effort for projects with a time-and-materials contract compared to projects with a fixed-price contract. Is there a real difference, or is it in reporting only? How intentional is this difference? What makes the team members report the effort differently? Do customers handle a greater part of the project management activities in the case of time-and-materials projects?

We assume that there is no single reason for the possible difference between the real distribution of effort and the reported distribution. It seems that many features of the software supplier firms that operate in the project business are not known, and further research is required in order to gain a better understanding of the dynamics of the project business and the internal operations of supplier firms.

6. Conclusion

Project management effort is one of the necessary types of effort required for successful completion of software development projects. Prior knowledge on the relative amount of project management effort (for example, as a percentage of the total effort required) would help effort-estimation and the work-breakdown-structure building for a project. In order to get a better understanding of the relation of relative project management effort to the size of a project and the size of a team, we analyzed data from three organizations.

The analysis revealed that the size of the team correlates positively to the relative project management effort required. The duration of the project also correlates positively with the relative project management effort. Our data has, however, several characteristics that conflict with our assumptions based on the literature and our experience. Hence our analysis creates more new questions than it provides answers for.

It seems to be the case that there is a pattern in the effort reporting, and that pattern may be a sign of a common tendency for inaccurate or misleading reporting. Hence the most interesting open questions consider the ways of reporting the effort spent and the truthfulness of that reporting, the impact of commercial issues on reporting, and the usability and accuracy of the historical data used for effort-estimation. Those questions show there are many issues regarding the behavior of firms that operate in the project business that we do not know about, and those questions require further study.

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PII

SUPPLIERS'S SOFTWARE DEVELOPMENT PROJECT START-UP PRACTICES

by

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Suppliers' Software Development Project Start-up Practices

Abstract

Purpose – The purpose of this paper is to present a life cycle phase of a software development project which is substantial for the success of the project. This paper visualizes the project start-up phase from suppliers' perspective.

Design/methodology/approach – The method is a theory building from case studies. The data was collected from three software supplier firms by conducting process modelling separately in each firm.

Findings – The study resulted in a model of a supplier's software project start-up which includes start-up practices and involved roles. The results indicate that project start-up is an integral and structured phase of project life cycle, which influences the execution of a software development project, especially from the supplier's perspective in the project business context.

Research limitations/implications – The study focuses on the start-up phase of software development projects delivered to external customers. Therefore, developed project start-up model is applicable as such in software supplier firms.

Practical implications – The project start-up model presented in this paper indicate that project start-up is a complex and multi-dimensional activity in a supplier firm. This study suggests that if the project start-up phase is clearly defined, planned and followed in a supplier firm, it reduces confusion and miscommunication among the people involved in the project and helps to achieve the business goals of a project.

Originality/value This study emphasizes that it is necessary to make a distinction between the perspectives of the customer and the supplier when studying projects in the project business context. The findings contribute the new knowledge for managing outsourced software development projects.

Keywords Supplier, Software development project, Project start-up, Practices

Paper type Research paper

Introduction

The trend of procuring software development from outside sources is increasing (Crow, Muthuswamy 2014, Lee 2008). Hence, studies on outsourced software development have been published increasingly during the last decade (Mehta, Bharadwaj 2015). In outsourcing situations, there are at least two parties involved, a customer and a supplier[1], with different roles and responsibilities (Liu, Yuliani 2016).

Having two parties involved with different roles and responsibilities means that there are two parties with different perspectives. Existence of two different perspectives has been brought out for example in studies of Taylor (2005) and Liu and Yuliani (2016) on risks in outsourced IT projects. Taylor (2005) highlighted

differences between project risks between the customer's and the supplier's side. Respectively, Liu and Yuliani (2016) found that the risks are different from the point of view of the customer and the supplier in outsourced IT projects. These studies emphasize the different perspectives of the customer and the supplier. Therefore, it is important to make difference between the customer's and the supplier's perspectives on outsourced software development projects.

Although there are numerous studies on outsourcing and software development projects in general (Alsudairi, Dwivedi 2010, Hätönen, Eriksson 2009, Aubert, Rivard et al. 2004), studies on outsourced software development projects from the supplier's perspective have been rare (Taylor 2007, Savolainen, Ahonen et al. 2012, Lee 2008, Levina, Ross 2003). Therefore, this paper concentrates on the supplier's perspective by considering the commercial relationship between two parties, a customer and a supplier.

The commercial relationship between a customer and a supplier entails that a software development project is managed and conducted by a supplier firm and the end product of the project is delivered to an external customer (Kishore, Rao et al. 2003). For a supplier operating in the software industry, outsourcing means business, where it delivers projects to external customers. Thus, project deliveries are the one source of many supplier firms' revenues and the backbone of their business (Artto, Valtakoski et al. 2015, Kujala, Ahola et al. 2013, Andersen, Jessen 2003). Hence, it is essential for the supplier firm to be able to market and sell projects to customers (Jalkala, Cova et al. 2010), because there is no project before a sales case has been successfully completed (Turkulainen, Kujala et al. 2013).

A successful sales case means that the supplier firm gets an order from the customer (Cooper, Budd 2007). After the customer has placed an order, the supplier firm starts preparations for the project. These preparations should be fast, cost-effective and cover the required steps. These preparatory actions take place between the project's sales and execution phases. The interface between the supplier firm's sales operations and project operations has started to get increasing attention at both organizational and project levels (Cova, Salle 2005, Cooper, Budd 2007, Turkulainen, Kujala et al. 2013, Artto, Valtakoski et al. 2015).

Even though the importance of the interface between the supplier firm's project sales and project execution phases has been noticed, empirical studies on the topic are sparse (Savolainen 2011). However, it is noted that the supplier firm has a great responsibility that the software development project delivery fulfils both the customer's and the supplier's objectives (Lee 2008). Therefore, it is important for the supplier firm to be able to manage the project from the beginning to the delivery.

From the supplier's perspective, the software development project begins after a successful sales case with the project start-up phase. In brief, the project start-up phase has been identified earlier (Fangel 1991) and its importance for software development projects from the supplier's perspective has been highlighted (Savolainen, Ahonen et al. 2015). However, it is still unclear what happens in a software supplier firm after it receives an order from the customer. Especially vague are the first actions that the supplier firm performs after receiving an order from an external customer. To gain a better understanding of the project start-up phase from the supplier's perspective, we formulated the following research question:

What happens in a software supplier firm during the project start-up phase?

Thus, to achieve our goal and to find the answer to our research question, we studied the software development project start-up phase in supplier firms.

In the next section, the background from the relevant literature is given. After that, the methodology of this study is described, and then the results are described in detail. Finally, the last sections concentrate on discussion, conclusions and future work.

Background

Software which is delivered to an external customer is usually developed in projects (Gottschalk, Karlsen 2005, Karlsen, Gottschalk 2006). As the focus of our study is on software development projects, we adopted the definition of a project from the standard for software development (ISO/IEC 2008a) which defines a project as an "*endeavour with defined start and finish dates undertaken to create a product or service in accordance with specified resources and requirements*". Here, the project start date is when the supplier firm receives the order from the customer, and the finish date is when the customer pays for the delivered project to the supplier.

Because the most of the software development work is conducted in projects, suppliers are often project-based firms as they organize their business operations in projects (Mutka, Aaltonen 2013, Artto, Valtakoski et al. 2015). When a supplier firm conducts all or at least some parts of its business through projects, the firm conducts project business (Artto, Wikström 2005, Hobday 2000). Project business is defined in general as (Artto, Wikström 2005): "*the part of business that relates directly or indirectly to projects, with a purpose to achieve objectives of a*

firm or several firms". From now on, we use the term 'project business context' to emphasise the supplier's perspective.

For the project business research, there is a conceptual framework supporting scholars to position their research using four major research areas. These research areas are management of a project, management of a project-based firm, management of a project network, and management of a business network (Artto, Kujala 2008). Here, as the focus of this study is the management of outsourced projects in the project business context, we found a project business framework developed by Artto and Kujala (2008) helpful to posit our research one of the four research areas which they have defined. The most relevant research area for this study is management of a project. It is for finding answers to question how to manage a single project effectively and successfully (Artto, Kujala 2008). Although the topic has been studied extensively, it is still relevant in the case of outsourced software development projects, which have a reputation to fail. Thus, our study is about how to manage a single project in a project business context and we chose the perspective of a supplier firm.

Recently, Hobbs and Besner (Hobbs, Besner 2016) have highlighted that the project delivered to internal and external customers differ in how they are managed. In the project business context, the supplier firm starts preparations for the project after a successful completion of a sales case (Turkulainen, Kujala et al. 2013). In the case of software development projects, the project agreement is usually incomplete at the very beginning of a project because of complex nature of software delivery (Kujala, Nystén-Haarala et al. 2015). In practice, after the customer has placed and order, the project is transferred from sales operations to project operations within the supplier firm (Skaates, Tikkanen et al. 2002). Thus,

the transition from sales operations to project operations within the supplier firm means that each project passes through a specific phase. In this paper, this transition is called the project start-up phase, where we adopted the terminology from Fangel (1984, 1991).

Fangel (1991) defines the project start-up phase as "*a unified and systematic management process which quickly generates a platform for taking off and getting going effectively*". Thus, the purpose of the project start-up phase is to create the conditions for the success of the project. The basis for understanding project start-up has been presented by the INTERNET Committee on Project Start-up that was founded at the end of 1984. This work can be found in the book 'Handbook of Project Start-up: How to launch any phase effectively' (Fangel 1990). It contains several abstracts, articles, and reports which were written for workshops, congresses, symposia and conferences on this theme during 1981-1988.

In addition, earlier research has described project start-up in general terms. Silvasti (1987) has studied project start-up phase in small delivery projects. Egginton (1996) has studied project start-up in large international projects. The results of a study made by Halman and Burger (2002) indicate that project start-up helps to gain a better understanding about a project. Different methods for project start-up are introduced, for example workshops, reports and ad hoc assistance (Turner 2009). More recently, a study focused on software development projects in the project business context suggested that by investing in the start-up phase of the project, the supplier firm is better placed to achieve the business objectives of the project (Savolainen, Ahonen et al. 2015). In addition to sparse research on the topic, project start-up is not described in detail in the standards.

Even though project management standards such as PMBOK (The Project Management Body of Knowledge) (PMI 2013), PRINCE2 (Office of Government Commerce 2009) and ISO21500 (Guidance on project management) (ISO 2012) identify the early phases of a project, they do not provide guidance for the project start-up phase for a supplier firm. Because of the general nature of these standards, they do not take different contexts into account. Therefore, standards lack, for example, the project business context where marketing and sales precedes every project. Thus, it is also somewhat surprising that the early phases of the project life cycle are not taken into account in software development related standards and frameworks, such as CMMI (Crisis, Konrad et al. 2009) and ISO/IEC/IEEE 16326 (ISO/IEC/IEEE 2009). The early phases of a project are discussed only in PMBOK (PMI 2013), PRINCE2 (Office of Government Commerce 2009) and ISO21500 (ISO 2012). PMBOK (PMI 2013) and ISO 21500 (ISO 2012) describe initiating activities with the term 'Initiating process group' and PRINCE2 (Office of Government Commerce 2009) defines the processes of 'Starting up a project' and 'Initiating a project'.

Although project management and software development are comprehensively covered by different standards, the project start-up phase has been given very little attention in them. In addition, current literature has not outlined what a successful supplier firm does during the project start-up phase. However, previous studies have implied that at least some administrative effort should be invested in order to get a complex task, such as a software development project up and running (Barry, Mukhopadhyay et al. 2002). Thus, the importance of early phases of project lifecycle have noticed to be crucial for the success of a project (Kappelman, McKeeman et al. 2007). In addition, it is being noticed that the

selection of a project management approach during the project start-up phase increases the probability of project success (Rolstadås, Tommelein et al. 2014). Moreover, there has been some interest on the project start-up activities of supplier firms in the project business context. Researcher have analysed failed software development projects and found that often the reason for failure can be traced to the start-up phase of the project (Ahonen, Savolainen 2010, Jørgensen 2014).

In addition, researchers have highlighted that a software supplier firm encounters several challenges during the start-up phase of software development projects (Savolainen, Ahonen 2015). Those challenges include lost knowledge, communication problems, and resource management challenges, as has been discussed in recent studies (Turkulainen, Kujala et al. 2013, Savolainen, Ahonen 2015). Challenges during the project start-up phase may endanger the supplier's business success at the organizational level as well as at the project level, and therefore, well-organized project start-up is necessary for a supplier firm.

To conclude, the results of earlier studies suggest that the project start-up phase from the supplier's perspective requires more attention than it has been given. Therefore, we conducted this study to model the structure of the project start-up phase of a software development project delivered to an external customer. Even though the need for different project management practices in different projects in different contexts has been highlighted (Besner, Hobbs 2013), references to the activities or practices which supplier firms perform during the project start-up phase were not found. Thus, it can be concluded also that there is a need for the description of the actions performed to allow a supplier firm to start up projects quickly and cost-effectively. Consequently, our paper presents project start-up practices which offer one solution for this need.

Methodology

As the project start-up phase within a supplier firm is still not well researched phenomenon and the aim of our study is to gain better understanding about it, we found it reasonable to study project start-up in natural settings together with the practitioners. Usually, firms do not want outsiders to become familiar with their business in depth. During our study, there was an ongoing research project where three software supplier firms were involved and they were willing to participate in the study. It offered the opportunity to us to study the project start-up phase in its natural settings and to see what practitioners do during this phase.

Building theories from cases

We chose a theory building from case studies as the research strategy. According to Benbasat et al. (1987), the case study approach allows researchers to study a phenomenon in its natural settings and offers a relatively full understanding about it. Rowley (2002) has stated that a case study research offers more detailed information about the studied phenomenon than a survey research. In addition, Myers (2013) has stated that the complexity of the context of real-life can be brought out with a research method where the researchers get to see the actions of practitioners in real-life situations.

Further, it is known that it is possible to build theories from case studies (Eisenhardt, 1989,Yin, 2013). By applying this research strategy, it is possible to build a theory which is novel, testable and empirically valid (Eisenhardt, 1989). This research strategy is suitable especially to research areas where existing theory is incomplete (Eisenhardt, 1989) as it is in the case of the project start-up phase

from the supplier's point of view. Thus, we found the theory building from case studies approach to be an applicable strategy for the needs of our study.

The central element of building theories from cases is a replication logic (Eisenhardt, 1989,Yin, 2013). Further, the use of multiple cases helps the researcher to build a more detailed theory than the use of a single case as the data source (Eisenhardt, 1991). Since three software supplier firms participated in our study, we got the opportunity to replicate the same study which resulted in three independent case descriptions. These case descriptions laid the foundation for the theory building process.

When conducting research in close collaboration with firms, it is important that data collection does not take more time than is needed and disturb the daily work of firms. Thus, we wanted to use a data collection method which allowed us to collect detailed information about project start-up phase efficiently. Therefore, we chose process modelling as a data collection method.

Data collection

The process modelling was the main data collection method and thus offered the primary data for our study. In addition to process modelling, firms offered us their quality manuals and other project related documentation for analysis. This additional information was the secondary data of our study.

In addition to practical reasons, there were different reasons why we selected a process modelling to be a data collection method in this study. Firstly, to be able to understand and to improve operations of any organization, it is important to have detailed models which describe different processes (Giaglis 2001). Secondly, process modelling offers detailed knowledge of different

processes of organizations (Bandara, Gable et al. 2005). Thirdly, process models and process guides are found to be useful in software firms to avoid problems in software project deliveries (Dingsøyr, Moe 2004). Fourthly, earlier experiences indicate that the process modelling is an effective method for modelling processes quickly and cost effectively (Dingsøyr, Moe 2004). In addition, it is important to define processes together with the people who will follow the defined process in their daily work (Dingsøyr, Moe 2004).

We replicated the study by applying the same process modelling technique with each case firms. We applied the process modelling technique LAPPI which started to evolve almost two decades ago 1999 (Raninen, Ahonen et al. 2013). The LAPPI technique has been developed through dozens of industrial cases, mainly in different IT organizations (Raninen, Ahonen et al. 2013). Nowadays, the LAPPI is in active use in different software supplier firms (Raninen, Ahonen et al. 2013). The applied LAPPI technique is documented in detail elsewhere (Raninen, Ahonen et al. 2013).

Case firms

We collected the empirical evidence for this study from three software supplier firms. They all operate in a small European country and supply a wide variety of software development projects and related services to their customers. The firms are labeled here as Firm A, Firm B and Firm C.

Firm A is a part of a subsidiary of a large globally operating parent firm. The subsidiary has several business units around the country which all operate independently. Each business unit operates around their own specific business area which are part of the parent firm's business. Firm A is one of these business units.

The customers of Firm A are mainly medium-sized and large firms and public sector organizations. Its project deliveries are relatively large. The duration of projects varies from a few months to a few years. In addition, Firm A offers a wide variety of continuous and consultant services to its customers to complement its services.

Since Firm A delivers large projects, it is important for the firm to ensure the profitability of the projects. If a large project fails or its financial result is not profitable, it may have a relatively significant impact on the financial performance of the firm. Therefore, Firm A wants to put effort in the start-up phase of projects when it has better opportunities to affect the profitability of the projects than during the later phases of the project life cycle.

Firm B is a medium-sized software supplier with offices in several locations. Its customers are other firms and public sector organizations. Firm B offers software development and IT consulting services. The project deliveries of Firm B are small; the duration of projects varies from a few days to a few months. This means that they have very limited time for start-up projects after the customer has placed an order.

To maintain the profitability of its projects, Firm B must start projects fast and efficiently, avoiding extra work and costs. Therefore, to be able to operate effectively, Firm B wants its project start-up phase to be well planned and carried out by following to a certain routine.

Firm C is a very small firm with less than ten employees. They have one office where all employees work. The project deliveries of Firm C include both hardware and software. Most of the customers of Firm C operate in the construction

industry. The duration of the projects of Firm C varies greatly, depending on whether it is an existing or a completely new customer to the firm.

Since Firm C is very small and can deliver only a few projects annually, the profitability of each project is important for the continuity of the firm. Therefore, Firm C must ensure that its projects are profitable and it wants to invest in the formalization of the start-up phase of its projects.

Model building

This study resulted in a model of supplier's software development project start-up phase. A model building followed a process which is presented in Figure 1.

Figure 1. A model building process

The basis of the model building was the firm specific descriptions of the project start-up phase. To begin with we conducted process modelling in all three firms (Firm A, Firm B and Firm C). We applied the same process modelling technique in each case. Process modellings resulted in descriptions of the case firms' project start-up phases.

Firm-specific process descriptions included details of project start-up practices, the roles of the people who carry them out and information flows between roles during the project start-up phase in each firm. We validated each of the firm specific descriptions separately in the case firms.

Based on the validated firm specific descriptions, we built a model of project start-up by comparing the firm specific descriptions and then integrated their commonalities into the model. In the first step of model building, two researchers

(Researcher1 and Researcher2) worked independently and produced a draft of a model. After this, during the second step, the same researchers (Researcher1 and Researcher2) compared their drafts of the model and formed it into a common vision with two other researchers (Researcher3 and Researcher4), which had not been involved in the model building previously.

In addition, we validated the model of project start-up separately in each case firm (Firm A, Firm B and Firm C). During validating workshops, each firm gave improvement suggestions on the model. After the validation was done in the case firms, we produced the final version of the model of project start-up which is described in detail in next section.

A model of a supplier's software project start-up

In the model, the project start-up phase begins in the supplier firm when the supplier has received an order from the customer or when the sales case of the project is near to its closure, and the supplier can be sure that they are going to win the deal. There are altogether 16 practices in the model of project start-up which is presented in Figure 2. There were initially less practices in the firm-specific process descriptions than in the project start-up model. This was because firms initially combined several project start-up practices, but in the validation phase, these practices were divided into smaller entities. Therefore, there is more amount of practices in the project start-up model than in firm-specific descriptions.

In general, in the literature discussing the activities related to project management the term practice is widely used (Loo 2002, Besner, Hobbs 2008, Besner, Hobbs 2013). For this study, we adopted the term practice from CMMI (Crisis, Konrad et al. 2009) where "generic *practice is the description of an activity that is considered*

important in achieving the associated generic goal", because it describes the activities performed during the start-up phase of a software development project.

According to this definition of the term practice, the implementation of a single project start-up practice must be well defined, planned and organized. Further, each project start-up practice receives information either in verbal or documented form as input from a person who has a role in project start-up. The output of a project start-up practice can be, for example, a project-related document, such as a project plan. It can also be a decision relating to the project, such as information about who the project manager of the project will be.

The purpose of a single project start-up practice is to ensure that the issues associated with it are considered before the project begins so that possible challenges and risks can be better managed during the execution of the project. Further, the purpose of project start-up practices is to help the supplier firm to ensure the success of the software development project by setting up the project management environment for the project.

Start-up practices help the supplier firm to prepare for the forthcoming project during the project start-up phase and to manage and to develop its business. There is no strict execution order of project start-up practices in the model, except for two practices: Inform Production unit of Future Project and Organize Internal Kick-off Meeting. The former begins the project start-up phase and the latter closes it in the supplier firm. It is noteworthy that the emphasis of practices varies in each project.

Figure 2. Model of a supplier's software project start-up

Most of the project start-up practices are carried out only in the supplier firm. Some of the practices require cooperation with the customer and third parties, such as subcontractors. There are six different roles involved in the project start-up practices. Four of them are internal (Sales Manager, Business Manager, Project Manager, Project Team) and two of the roles are external (Customer, 3rd Party). These roles are listed and connected to project start-up practices in Table 1.

Table 1. Project start-up practices and participating roles.

Since project start-up phase is an interface between sales operations and project operations, practices in the model are mainly related to business and project management. Only a small part of the work during the start-up phase is related to the software development. Business related practices direct the supplier's business by helping to ensure the achievement of the business objectives of the project. Project management related practices establish the conditions for the successful management and execution of the project. Software development related practice ensures that there is required technical environment available for the project in the supplier's side and in the customer's side.

To achieve the business objectives, the cooperation between the project sales team and the project team within the supplier firm is very important (Turkulainen, Kujala et al. 2013). Thus, Inform Production Unit of Future Project practice is needed as it begins the project start-up phase and builds a bridge between the supplier's sales operations and project operations. When the project is transferred from the sales

operation to project operations, it is important that the project manager is appointed as soon as possible.

The project manager is one of the most important members of the project team in the supplier firm. Thus, Appoint Project Manager practice requires attention during the project start-up phase. The project manager does not only manage the project, but he or she also manages the customer relationship and the business around the project. Therefore, the selection of a project manager is an important decision for the supplier firm (Mainela, Ulkuniemi 2013). The supplier would benefit from the fact that the project manager has been appointed already during the sales of the project. Then, the project manager would be familiar with the project and the customer from the very beginning (Savolainen, Ahonen 2015).

During the project start-up, seamless cooperation between the supplier's sales team and the project team is required, so that the supplier can create the conditions for successful project delivery. The Transfer Project to Production practice helps to transfer the project and all project related information from the sales team to the project team within the supplier firm. After that, the project team has responsibility for the project, and the role of the sales team will be primarily consultative.

The cooperation between sales operations and project operations is essential to ensure that the solution, which is sold to the customer, is doable within the limits of the agreement (Ahonen, Savolainen 2010). Therefore, it is necessary to ensure that the supplier and the customer have achieved a consistent view of the content of the project agreement before project execution begins. Thus, the Prepare Project Agreement practice is necessary, when the project is delivered to an external customer.

During sales, the project is only a piece of paper (Mainela, Ulkuniemi 2013). After the sales case is successfully closed, the project becomes visible in the supplier firm when the information about the customer's order is saved in the supplier's information system. The Save Order Information in System this practice is needed to update the information about the customer in the system. The information about the customer supports customer relationship management and helps the supplier improve products, services and processes (Khodakarami, Chan 2014).

During the project start-up phase, the supplier firm needs to assign and engage the project team in the forthcoming project. If there is lack of requisite skills in the project team, the project manager should plan how they are acquired on time (Kappelman, McKeeman et al. 2007). It should be noted that usually the supplier is under pressure to allocate resources for multiple simultaneous projects (Browning, Yassine 2010). Clearly defined responsibilities of a project team help to meet cost and time targets of the project (Papke-Shields, Beise et al. 2010). The Allocate Resources for Project practice is needed to ensure that the requisite human resources are available at the right time during the execution phase of the project. In addition, if there are third parties involved to the project, the Manage 3rd Parties practice is taking place at the project start-up. This practice helps to plan and manage the cooperation which may be carried out with third parties during the forthcoming project.

In the project business context, the supplier must be able to manage the discontinuity of customer relationships (Mainela, Ulkuniemi 2013). The continuity of customer relationships requires that customers are satisfied with delivered projects (Narayanan, Balasubramanian et al. 2011). According to Bose (2002) customer relationship management involves tasks the purpose of which is to acquire, analyze and use knowledge about the customer to build and to maintain long-term customer

relationships. Therefore, Manage Customer Relationship practice takes place during the project start-up phase.

In addition to the long-term customer relationships, the supplier strives for profitable business. The Ensure Project Profitability practice helps to ensure the profitability of the project. Usually the outcome of the project can be implemented in various ways. However, the supplier firm must offer to the customer the option that produces the best possible result from the supplier's business perspective. This requires clarifying the needs of the customer during the project start-up phase.

Personal interaction between the project manager of the supplier and the representatives of the customer during the early phase of a project is not important only for the forthcoming project, it is important for the management of the customer relationship (Mainela, Ulkuniemi 2013). Meeting with the customer during project start-up helps the supplier to build trust in the customer relationship, which will help to increase the commitment of the customer to the project and eventually it may lead to higher customer satisfaction (Smyth, Gustafsson et al. 2010). The Meet Customer practice helps to organize a meeting where the supplier can refine the unclear matters related to the project with the customer.

The Define Technical Environment practice is the only practice which is directly related to software development work. This practice ensures that the requisite technical environment is available during the execution phase of the project. The supplier firm must separately define the technical environment for development and testing and for the customer. If the technical environment of the forthcoming project is not defined with sufficient care during the project start-up phase, it may lead to project failure (Ahonen, Savolainen 2010).

The identification of project risks during the project start-up phase increases the awareness of risks among the stakeholders of the project and contributes to the success of the project (De Bakker, Boonstra et al. 2010). Thus, if the supplier is prepared for the potential risks and their occurrence at the very beginning of the project, the project has a better chance of being completed in accordance with the plan (Papke-Shields, Beise et al. 2010). Therefore, Analyze Project Risks practice is necessary during the project start-up phase.

When project is delivered to an external customer, the supplier must report the progress of the project to the customer. Thus, the supplier must agree separately on its internal reporting practices and on reporting to the customer. If the supplier organizes regular project status meetings, the achievement of the project objectives is more likely (Papke-Shields, Beise et al. 2010). In addition, effective communication with the customer helps to increase the customer's understanding of the progress of the project and leads to higher customer satisfaction (Papke-Shields, Beise et al. 2010). Therefore, the Plan Project Monitoring practice takes place during the project start-up phase.

Although the project scope is defined in the project agreement, it may have changed during or after the sales phase of the project. Therefore, the scope of the project must be redefined during the start-up phase in cooperation with the customer and the supplier. The project will be more likely to be completed on time and on budget if the changes of the scope of the project are planned and implemented in accordance with formal practices (Papke-Shields, Beise et al. 2010). Thus, the Redefine Project Scope practice is necessary during the project start-up.

The customer-supplier context is the reason to re-write the project plan during the project start-up phase. It is a usual situation that after the sales case is closed, the

representatives both in the customer's and the supplier's organizations may change. Therefore, it is necessary to re-create the shared vision of the project with the customer and the supplier. Thus, the Prepare Project Plan practice ensures that the project plan is updated.

The Organize Internal Kick-off Meeting practice completes the project start-up phase, after which the project execution phase can begin.

Discussion

Previous research has revealed that the project start-up phase is essential to the success of the project. Thus, a disciplined project start-up is a prerequisite for successful project management. Further, successful project management is a prerequisite for the success of the project. Therefore, supplier firms should invest in the project start-up phase and follow formal practices.

Even though project start-up related issues can be found in standards, such as PMBOK (PMI 2013), PRINCE2 (Office of Government Commerce 2009) and ISO 21500 (ISO 2012), earlier research has left the structure and the practices performed during project start-up very vague. Thus, project start-up related issues have not been assembled together in such a manner as a supplier firm faces them after completing a successful sales case, before the actual project starts.

Earlier studies have revealed that project success can be endangered if the start-up is not properly performed (Ahonen, Savolainen 2010, Rolstadås, Tommelein et al. 2014). In addition, the boundaries for the supplier's software development project start-up phase have been defined, and action points in the project start-up process have been identified (Savolainen, Ahonen et al. 2015).

Based on our findings reported in this paper, it can be said that there is a structured project start-up phase between project sales and execution phases within the supplier firm. Our study indicates that, during the project start-up phase, the supplier firm implements several start-up practices before the project starts, and they are repeated for every project which is delivered to an external customer.

It should, however, be noted that although our study reveals practices that are essential for the project start-up phase, the Project Manager and Project Team do not perform all of them. Certain practices are performed by other internal roles and the external Customer is involved with some of the supplier's software development project start-up practices, such as Prepare Project Agreement, Allocate Resources for Project, Meet Customer, Define Technical Environment, Plan Project Monitoring, Redefine Project Scope and Prepare Project Plan. Therefore, successful project start-up requires cooperation at the organizational level as well as at the project level with different units within the supplier firm and with the customer.

As several roles are involved during the supplier's project start-up, this raises the question of costs and how they are covered. The question of costs allocation was discussed also in Fulford (2013) and Savolainen et al. (2015). Thus, we assume that the effort used for project start-up practices may not be logged as costs for the project. In other words, these costs are likely to be considered a part of the general overhead, although they are clearly related to individual projects, and will influence the profitability of the project.

The project start-up practices presented in this paper suggest that project start-up is a more complex and multi-dimensional activity in supplier firms than one would expect. However, if project start-up practices are clearly defined and followed, it reduces confusion and miscommunication among the people involved in the project. This further

reduces challenges during project implementation and helps software suppliers to achieve the business goals of a project.

Given the importance of project start-up being an interface between sales operations and project operations, it is unclear why project start-up has been a neglected subject in related standards and previous research. One of the reasons might be that research has not distinguished between suppliers' and customers' perspectives on projects. Our study is one step among others in making the supplier's project start-up phase visible.

Conclusions and future work

The aim of this study was to answer the question of what happens in a software supplier firm during the project start-up phase. To find the answer to the research question, we modelled the software development project start-up phase in three supplier firms and built a model of project start-up.

Our study contributes the knowledge of project management by building a theory of project start-up from three case studies. The project start-up model offers a missing piece to the theory of project management in the project business context. The process modelling technique we applied in this study is documented in detail and can be replicated in other supplier firms by following a similar process. Our study is a good starting point for project start-up research, and our results can be compared with both smaller and larger software supplier firms later to gain a better understanding of what happens before a software project starts. In addition, the findings of our study confirm what previous studies have shown and answer the research question.

In previous studies, project start-up has been identified and defined, but its structure and practices have not been established from the supplier's perspective in the

project business context. Thus, our study deepened our understanding about the software development project start-up phase, especially from the supplier firms' point of view. Our study was conducted in close cooperation with the practitioners working in the software supplier firms. The study was conducted as a multiple case study, and the data collection method was process modelling implemented in the software supplier firms. Finally, we followed the theory building process to develop the model of project start-up phase. The results of our study indicate that project start-up is a structured phase of a project's life cycle and includes several practices.

We used the project business framework (Artto, Kujala 2008) to posit our study in a particular research area. We found the research area on management of a project relevant for this study. The findings contribute the new knowledge for this research area which has gained wide interest among researchers and practitioners for decades. Our study emphasizes that it is necessary to make a distinction between the perspectives of the customer and the supplier when studying projects in the project business context. This point has also been highlighted recently in a study focusing on the customer's and supplier's risks in outsourced IT projects (Liu, Yuliani 2016). So far, the study of Liu and Yuliani (2016) is one of the best, where the different perspectives of the customer and the supplier have been separated from each other. As this study focused on supplier's perspective, it is important to continue to study this topic also from the customer's point of view.

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[1] Other terms meaning 'supplier' include vendor, contractor, and seller, and other terms meaning 'customer' include client, buyer, and acquirer (ISO/IEC 2008a, ISO/IEC 2008b, ISO/IEC 2009, PMI 2013).

Figure 1. A model building process

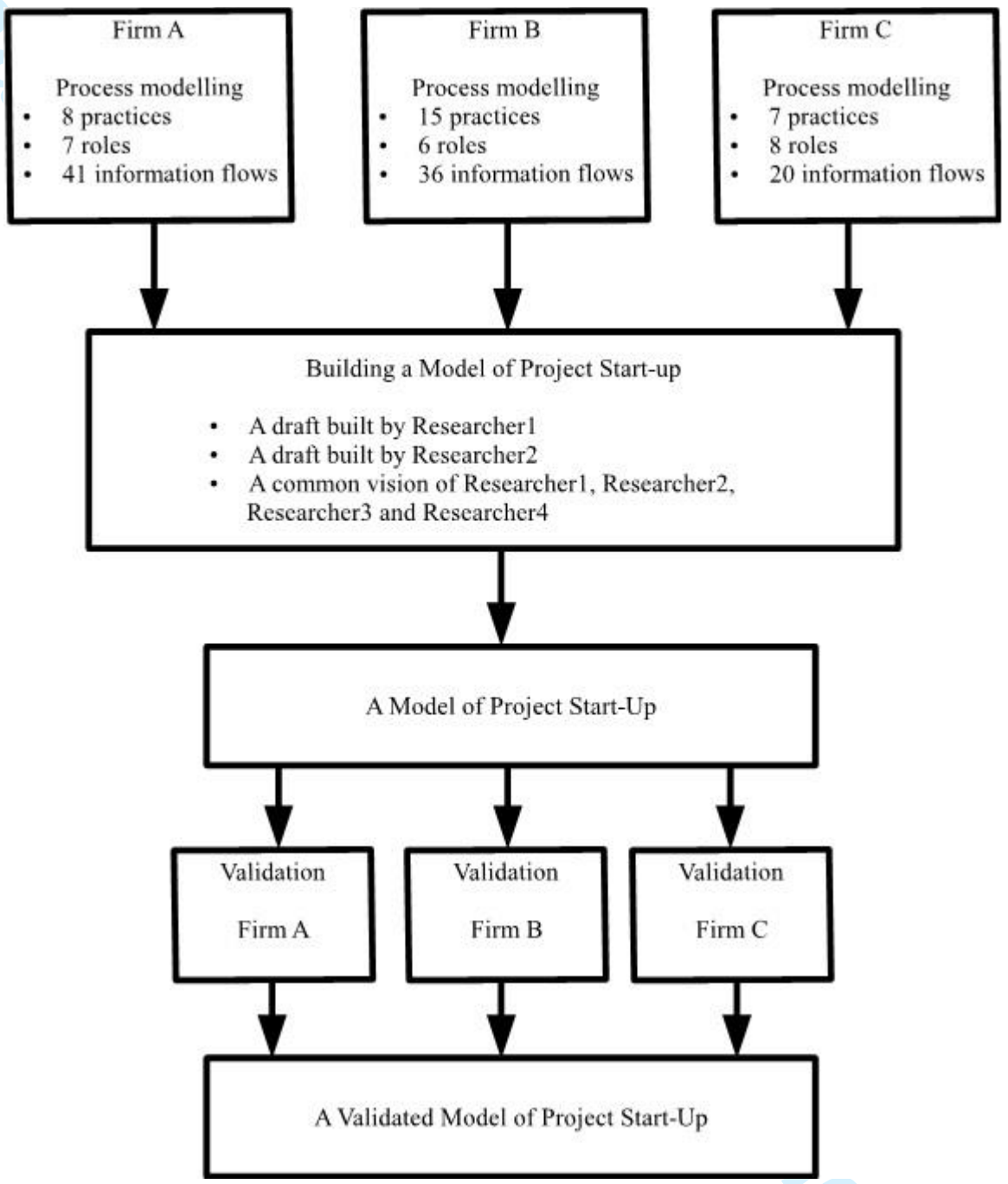

Figure 2. Model of a supplier's software project start-up

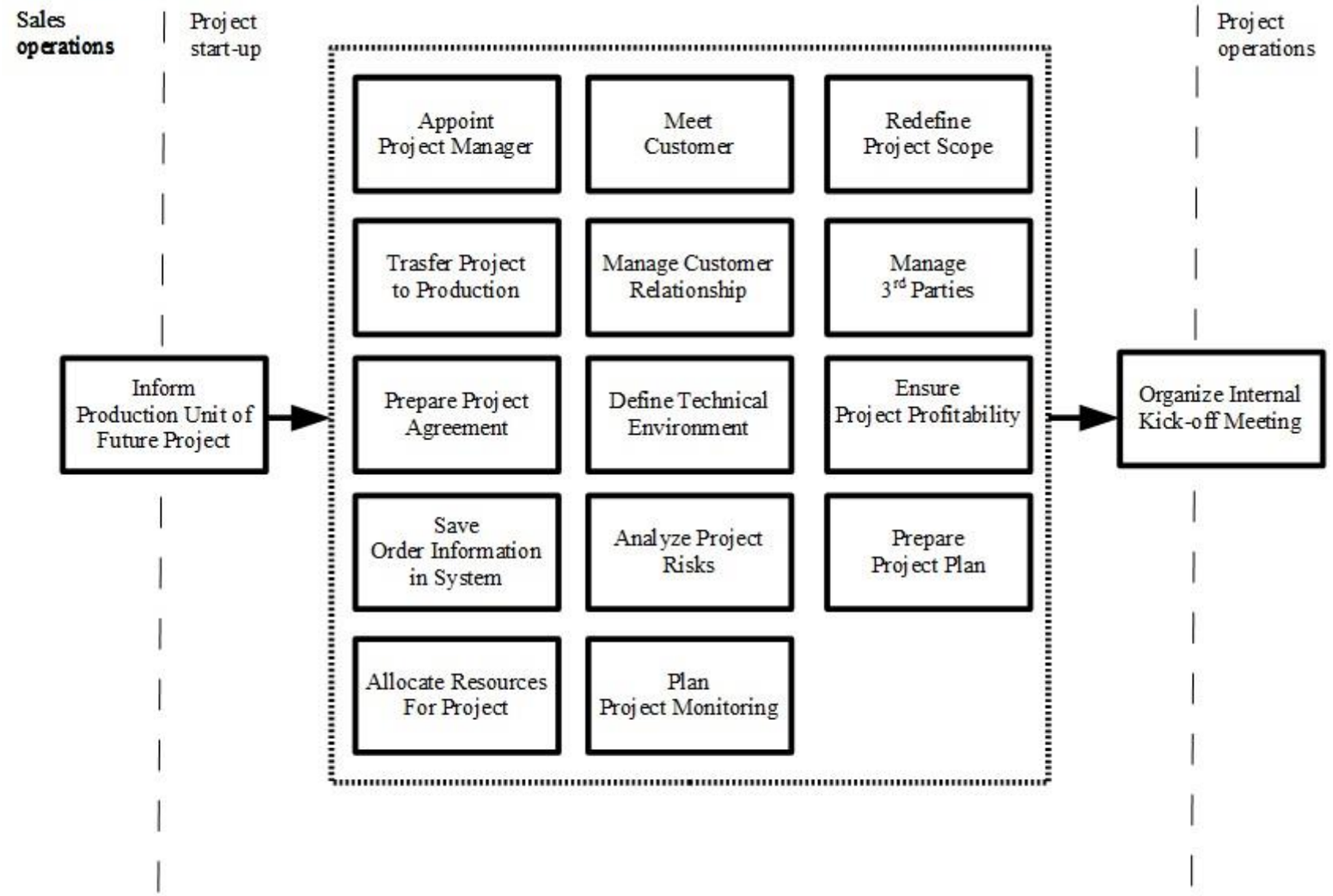

Table 1. Project start-up practices and participating roles.

Practice	Internal's role(s)	External role(s)
Inform Production Unit of Future Project	Sales Manager Business Manager	
Appoint Project Manager	Business Manager Project Manager	
Transfer Project to Production	Sales Manager Business Manager Project Manager	
Prepare Project Agreement	Sales Manager Business Manager Project Manager	Customer
Save Order Information in System	Project Manager	
Allocate Resources for Project	Sales Manager Business Manager Project Manager Project Team	Customer
Manage Customer Relationship	Sales Manager Business Manager Project Manager	
Ensure Project Profitability	Sales Manager Business Manager Project Manager	
Meet Customer	Project Manager Project Team	Customer
Define Technical Environment	Project Manager Project Team	Customer
Analyze Project Risks	Business Manager Project Manager	
Plan Project Monitoring	Sales Manager Business Manager Project Manager	Customer
Redefine Project Scope	Sales Manager Business Manager Project Manager	Customer
Manage 3rd Parties	Business Manager Project Manager	3rd Party
Prepare Project Plan	Business Manager Project Manager	Customer
Organize Internal Kick-off Meeting	Project Manager Project Team	

PIII

PERSPECTIVE MATTERS: CHALLENGES DURING HANDOVER IN SUPPLIER FIRMS AND THEIR LINKAGE TO INFLUENTIAL FACTORS

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PIV

APPLYING SOFTWARE PROCESS MODELING TO IMPROVE CUSTOMER SUPPORT PROCESSES

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