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SELECTING THE RIGHT METHOD FOR THE RIGHT PROJECT

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Dedicated to Arvi and Aira. The future is yours.

Abstract

The development of information systems is constantly changing. As a background of the change, there is almost a traditional problem about the high failure rates of information systems development (ISD) projects, but it is no longer the only change-driving force. The role of information systems and their strategic significance has increased considerably due digitalization. This has happened also in the areas of business, which have not been traditionally thought as IT-oriented. Furthermore, the new agile development methods have forced ISD clients to take more responsibility for ISD than before. In practice, this means that completely outsourcing ISD is not as sensible nor as simple as before. ISD clients who acquire information systems must be aware of the different ISD methods and be able to compare and choose the most suitable for the business situation and the objectives in question.

ISD method selection is rarely studied, and the majority of publications concentrate on different selection criteria relating to the ISD method choice without a clear selection model. Only a few ISD method selection models were found in the literature. Furthermore, the earlier ISD method selection models are restricted by two factors: firstly, the recommendations behind the prior ISD selection models do not correspond to today's thoughts about the ISD methods; secondly, prior ISD selection models concentrate only on the properties of the ISD projects, and attention is not really given to the business environment or the business to be developed.

In a situation like this, it was considered necessary to develop and study an ISD selection framework which takes the business development and business environment into account as well. Furthermore, it was seen as necessary to study both the customer and supplier practices related to the ISD method choice. The objective was to understand the present situation and estimate how the developed ISD selection framework could be utilized in the future.

The study was carried out in several stages. Firstly, two unsuccessful ISD projects were studied in the case study, and it was found that the ISD method used in the projects did not correspond to the properties of the business environment in either case. After that, a contingency theory-motivated ISD selection framework was developed, and a systematic literature review was conducted to study earlier ISD method selection criteria and compare them with the developed ISD method selection framework. In the next stage, expert interviews were done. Altogether, 31 ISD experts working on the borderline between the IS supplier and client were interviewed and asked their opinions on existing ISD method selection practices by both the client and the supplier. Furthermore, the experts were asked for their opinions on the recommendations of earlier ISD method selection models and on the developed ISD method selection framework.

As a result of the study, it can be stated that the developed ISD method framework covers both the previous ISD method selection criteria, which mainly concentrates on ISD project factors, and the business environment factors. Whereas the majority of the interviewed experts considered the developed ISD method selection framework useful, the recommendations of earlier ISD method selection models were regarded as outdated. Furthermore, it was noticed that in IS client organizations, there was almost no discussion about the ISD methods, and in the supplier organizations, the discussion was very rare. Any systematic project-specific ISD method selection practice had not been perceived in either organizations. Supplier organizations can justify their reasons for favouring a certain ISD method with the bounded rationality, whereas the operation of customer companies doing (or not doing) the ISD method selection seems to be filling the features of functional stupidity. In the future, it is important to study how to plant the ISD method selection as part of the starting stage of the ISD project. In addition, the developed ISD method selection framework should be tested in the practice.

Keywords: Information systems, information systems development methods, development method selection, success of information systems projects, project management.

Tiivistelmä

Tietojärjestelmien kehittäminen on jatkuvassa murroksessa. Muutoksen taustalla on jo perinteiseksi muodostunut ongelma tietojärjestelmäprojektien epäonnistumisesta, mutta se ei ole enää ainoa syy. Digitalisaation myötä tietojärjestelmien rooli ja strateginen merkitys on kasvanut huomattavasti myös sellaisilla liiketoiminta-alueilla, joita ei ole ajateltu IT-orientoituneina. Lisäksi uudet ketterät tietojärjestelmien kehittämismenetelmät osallistavat tietojärjestelmäprojektien asiakkaat, jotka joutuvat entistä vastuullisempaan asemaan. Käytännössä tämä kaikki merkitsee sitä, että tietojärjestelmien kehittämisen täydellinen ulkoistaminen ei enää ole yhtä mielekästä, eikä myös yhtä yksinkertaista kuin ennen. Tässä tilanteessa myös tietojärjestelmiä hankkivan asiakkaan pitää tietää erilaisista kehittämismenetelmistä ja kyetä vertailemaan ja valitsemaan kyseiseen liiketoimintatilanteeseen ja tavoitteisiin parhaiten sopiva kehittämismenetelmä.

Tietojärjestelmien kehittämismenetelmien valintaa on tutkittu vähän ja suurin osa löydetystä julkaisuista keskittyy listaamaan erilaisia menetelmävalintaan liittyviä kriteerejä. Varsinaisia tietojärjestelmien kehitysmenetelmien valintamalleja on esitetty vain muutamia. Aiempien valintamallien käyttökelpoisuutta rajoittaa kaksi tekijää: ensinnäkin mallien taustalla olevat oletukset eivät välttämättä täsmää tämän päivän ajatuksiin kehittämismenetelmistä, ja toisekseen valintamallit keskittyvät tietojärjestelmien kehittämisprojektien ominaisuuksiin, kehitettävää liiketoimintaa tai liiketoimintaympäristöä ei aikaisemmissa valintamalleissa juurikaan huomioida.

Tilanteen ollessa tämä kehitimme ja tutkimme tietojärjestelmän kehittämismenetelmien valintamallia, joka ottaa huomioon myös samaan aikaan tapahtuvan liiketoiminnan kehittämisen ja liiketoimintaympäristön. Lisäksi tutkimme tietojärjestelmän kehittämismenetelmien valintaan liittyviä käytäntöjä sekä asiakkaan että toimittajan näkökulmasta. Tavoitteena oli ymmärtää menetelmävalinnan nykytilannetta ja arvioida miten valintamallia voisi jatkossa hyödyntää.

Tutkimus toteutettiin useammassa vaiheessa. Ensimmäiseksi tapaustutkimuksin tutkittiin kahta epäonnistunutta tietojärjestelmäkehitysprojektia, ja havaittiin että kummassakaan tapauksessa valittu tietojärjestelmän kehittämismalli ei vastannut liiketoimintaympäristön tarpeita. Sen jälkeen kehitimme kontingenssiteoreettisen tietojärjestelmän kehitysmenetelmän valintamallin, jota verrattiin systemaattisella kirjallisuuskatsauksella löydettyihin aikeisempiin valintasuosituksiin. Vertailun jälkeen haastateltiin 31 asiantuntijaa. Haastatteluilla selvitettiin nykyisiä tietojärjestelmän kehitysmenetelmien valintaan liittyviä käytäntöjä, niin tietojärjestelmäasiakkaan kuin toimittajan näkökulmasta. Lisäksi asiantuntijoilta

kysyttiin heidän mielipidettään aiempien valintamallien taustalla olevista väittämistä sekä nyt kehitetystä valintamallista.

Tulos on, että ehdottamamme kontingenssimalli kattaa sekä aiemmat, projektinominaisuuksiin keskittyvät valintakriteerit, että myös liiketoimintaympäristön epävarmuuteen liittyvät tekijät. Suurin osa haastatelluista asiantuntijoista (23 vastaajaa 31 haastatellusta) piti ehdotettua valintamallia käyttökelpoisena. Aiempien valintamallien taustalla olevat väittämät koettiin ajastaan jälkeen jääneiksi. Lisäksi havaittiin, että asiakasyrityksissä keskustelua tietojärjestelmän kehittämismenetelmistä ei käytännössä ollut juuri lainkaan, eikä myöskään suurimmassa osassa toimittajayrityksiä. Mitään säännöllistä projektikohtaista valintakäytäntöä ei kummissakaan yrityksissä oltu havaittu. Haastateltujen asiantuntijoiden mukaan kehittämisprojekteissa kuitenkin pääsääntöisesti käytetään jotain tietojärjestelmän kehittämismenetelmää, ja syyt menetelmän käyttöön vaihtelevat. Toimittajayritysten syyt tietyn menetelmän suosimiseen ovat pääosin perusteltavissa rajoitetulla rationaalisuudella (bounded rationality), kun taas asiakasyritysten toiminta menetelmän valinnassa näyttää täyttävän toiminnallisen typeryyden (functional stupidity) tunnuspiirteet.

Jotta kehitetystä mallista tulee asiakasyrityksille hyödyllinen käytännön työkalu, on seuraavaksi syytä tutkia miten tietojärjestelmän kehittämismenetelmän valinta saadaan osaksi projektin käynnistämisvaiheen tehtäviä. Tärkeää on myös testata nyt esitetyn kontingenssimallin toimivuutta käytännön tilanteissa.

Asiasanat: Tietojärjestelmän kehittäminen, tietojärjestelmäkehitysmenetelmä, tietojärjestelmäkehitysmenetelmän valinta, tietojärjestelmäprojektin onnistuminen, projektinhallinta

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- Article 2. Lagstedt, A. and Dahlberg, T. (2018a) ‘A Contingency Theory Motivated Framework to Select Information System Development Methods’, in *Pacific Asia Conference on Information Systems*, pp. 1–14
- Article 3. Dahlberg, T. and Lagstedt, A. (2019) ‘The Usefulness of the Recommendations Regarding the Information System Development Method Selection during the Era of Digitalization’, in *Proceedings of the 52nd Hawaii International Conference on System Sciences*
- Article 4. Dahlberg, T. and Lagstedt, A. (20XX) “A Business-IS Development Aligned Framework for the Selection of IS Development Methods” x.x.20XX. Submitted to Information and Management.
- Article 5. Lagstedt, A. and Dahlberg, T. (2018) ‘Understanding the Rarity of ISD Method Selection – Bounded Rationality and Functional Stupidity’, in *Pacific Asia Conference on Information Systems*, pp. 1–14.

1 INTRODUCTION

Information system development (ISD) projects fail too often. There have been efforts to solve this problem for decades, but the success rate of ISD projects, nevertheless, remains low. One reason for this is that a wrong ISD method (ISDM) is used in a particular kind of ISD project. It is generally accepted that no one single ISDM suits all cases, so selecting the right ISDM for a particular project is vital. When client organizations and supplier organizations have different kind of business objectives for an ISD project, they have different perspectives for the ISDM selection, as well. Because the client organization is the final user of the developed IS and the final evaluator for the achieved business benefits, the client organization's perspective is of emphasis here.

The considerably low success rate of ISD projects is not the only reason why the client role is currently topical. Due to digitalization, the strategic importance of ISD has increased and the trend of ISD development is changing from outsourced to co-sourced development. In this new situation, both the client's responsibility of the development and the criticality of ISD project results for the client's business have increased, and it is essential for the client to know how an ISDM should be selected for an ISD project.

In the Chapter 1.1. the main points of existing theory is encapsulated as premises. Different theoretical perspectives are used in encapsulating the premises, the objective was to get as wide standpoint from each theoretical area as possible. Since formulating coherent hypotheses from different theoretical perspectives is challenging, and because the aim of the encapsulating was to get a clear baseline for this dissertation, not to test existing theory, it was seen reasoned to use premises here, instead of hypotheses.

1.1 Background and Motivation

The problems of ISD projects have a long history and even though different kinds of new ISDMs have been presented, failures are still too common (Hastie and Wojewoda 2015; Jørgensen and Moløkken-Østvold 2006; MacManus and Wood-Harper 2007; Nelson 2007; Standish Group 1995). The reasons vary but IS projects are known to have many problems: projects overrun their budgets and time schedules and projects' scopes creep. It is difficult to thoroughly plan Information system projects and their monitoring is challenging, as well. The sad outcome is

that many projects fail to adhere to the given timetables;, they exceed their budgets and the outcomes are not at all what the client needed and/or requested (Hastie and Wojewoda 2015).

Several efforts to improve the success rate of IS projects have been taken. These include e.g. the following:

- The reasons for IS project failures are often labelled as IS project risk items, which are then classified into risk categories/factors over the lifecycle of IS projects (e.g. de Bakker et al. 2010; Boehm 1991; Dahlberg and Kivijarvi 2016; MacManus and Wood-Harper 2007; Nelson 2007; Verner et al. 2008). For example, Nelson (2007) identified 36 reasons for IS project failures, he classified them into four IS project risk categories and noted that the IS project estimation was the most difficult phase. Based on the found failure factors, it is possible to provide checklists concerning potential IS project risks with means to mitigate each risk factor and item. For example, Standish Group has compiled a list of 100 potential risk items divided into 10 groups, and it has suggested risk mitigation means to each risk item (Standish Group 2013).
- Comprehensive project management methods, such as PMBOK and PRINCE2, have been crafted and become widely used. Their objective is to improve the skills of project managers, steering committees and project teams to plan and to execute projects. Project portfolio management and project management offices are seen as useful means to manage (IS) projects better.
- New kinds of IS development methods have been developed, the idea being that with these new methods, the biggest problems and risks related to the previous ISDMs are removed.

The first two of the above-mentioned efforts are based on the so-called plan-driven approach. The waterfall model (Royce 1970) is probably the best known of them. In the plan-driven approach, (IS) development steps are consecutive. The assumption is that the desired outcomes/functionalities of an IS project can be modelled/specified accurately at the beginning of the project and then developed during the consecutive steps. However, this has proved to be true quite seldom (e.g. Janes and Succi 2012). Consequently, alternative IS development methods, such as Scrum, XP and DevOps, have been introduced. The approach of these methods is labelled agile or change-driven. The latter term is used in this dissertation. The roots of the change-driven approach are in iterative and prototype IS development.

Change-driven (IS) development methods are advocated as the solution to the limitations of plan-driven methods (see e.g. Fitzgerald et al. 2006; Theocharis et al. 2015). Standish Group's annual Chaos reports partially support this claim. For example, in 2015, the success rate of change-driven projects was 39% whereas

11% of plan-driven projects succeeded (Hastie and Wojewoda 2015). Standish Group considers the use of the change-driven methods as the main driver behind the recent 5-10 % improvement in IS project success rate (Hastie and Wojewoda 2015). Nevertheless, the 2015 Chaos report showed that the majority of change-driven projects (61%) still failed or were troubled (Hastie and Wojewoda 2015).

When the reasons for failures are discussed, it is important to consider what a failure, or a success of an IS project really means. Above, the traditional project management success criteria are already mentioned: the project is within the budget, schedule and scope. This trinity is often called the project triangle (or iron triangle) and it is used as a project management tool, as well: if one of these three is changed, one or both of the two others have to be changed, as well. However, as said, these three criteria are only project performance criteria; they do not take into account the business benefits pursued by a project. There are examples where projects have remarkably exceeded their budget and schedule, but, later, the developed product is found to be very beneficial. So, the failure percentages based on the project management success criteria is not the whole truth, and project success should be measured more in terms of business perspective and during a longer period of time after project is finished, but we may assume that these percentages still offer indicative information. It seems that the success rates have not raised remarkably despite all the different kinds of new ISDMs.

There are often attempts to apply one single ISDM to all ISD projects. This could be called a “universal approach”. The method can be changed when a new method is found to solve problems of the old method, or when a new management fashion (see Abrahamson 1996) appears. However after the change, all the projects are done using the new method. The problem with this approach is that all projects are considered to be similar to each other, which they are not. Projects differ from each other, and, more importantly, organizations differ from each other. There is no proof to the claim that one IS development method would “suit all” projects (Brooks 1986; Cusumano et al. 2009; Hall and Rapanotti 2015); some ISDMs suit better to one kind of project and others to other kinds of projects.

Post mortem analyses of IS projects, where ISDM suitability for a business context situation is evaluated, are rare. However, it is possible to conclude something about ISDMs’ general suitability for an IS project from the finding that ISDMs appear to be rarely used in earnest within ISD projects. 60% - 80% of ISD projects have been executed without any ISDM (Carroll 2003; Fitzgerald 1998; Huisman and Iivari 2006; Iivari and Huisman 2007; Truex et al. 2000). In ISD projects with a specific ISDM, IS developers have often regarded the value of the ISDM low, and the ISDM may, therefore, have been modified and/or partly ignored (Fitzgerald 1998; Ghanbari 2017; Truex et al. 2000). If the value of the used ISDM is regarded low, i.e. the selected ISDM does not appear to suit the

needs of the ISD project, it is easy to abandon that particular ISDM. This means that no ISDM is actually used (Carroll 2003; Fitzgerald 1998).

To encapsulate the above discussed theory, the first premise (P1) is formulated as follows:

P1: To get better suited ISDMs to ISD projects, ISDMs should be selected for a project case by case.

Carroll (2003) describes an ISD project where the system analyst was familiar with a limited range of tools and selected an ISDM which was “the obvious way to go”. Eventually, the selected method was not used in the project, but I think the main point here is that the analyst (and the project) would have benefitted from a better ISDM selection tool.

However, there are not many ISDM selection tools available or discussion about method selection, and when there is, only project specific factors and selection criteria seem to be considered (see e.g. Boehm and Turner 2004; Burns and Dennis 1985; Little 2005; Mathiassen and Stage 1990), and ISD business context is mainly ignored. Similar ISD projects in different business contexts are not the same, and the business context should be taken into account in the ISDM selection. Seaman and Basili, when discussed about software development, said: “The communication and interaction problems associated with human involvement in development cannot be addressed by process improvement alone. The solution must include organizational improvement as well.” (Seaman and Basili 1993). This is in line with Dahlberg & Kivijarvi (2016), who discovered that the factors outside of the IS project domain were the most important determinants for an IS project performance and together with project factors explained close to 50 % of project performance.

Based on the above mentioned, the second premise (P2) is formulated as follows:

P2: The characteristics of the selected IS development methods should match with the characteristics of the business development context where they are used.

The method selection is not only a question of how to select it; it is also very important to consider who selects the method and at which stage. Nowadays, when the majority of ISD projects are more or less outsourced, there are normally two parties involved in IS development: a client (i.e. customer/buyer/acquirer organization) and a supplier (i.e. vendor/contractor/seller/developer organization). These two parties may have different objectives for an ISD project (Savolainen et al. 2015; Taylor 2007), and also dissimilar opinions on what is the right/appropriate ISDM for the ISD project. The business objectives of an ISD project drive the client’s behavior, while the ISD project is the business opportunity in itself for the supplier. From the supplier’s point of view, the traditional project management success criteria, time, money and scope, are preferred for project success criteria, while effectiveness, business satisfaction and

the use of the IS are more important criteria for the client (Pinto and Slevin 1988). It is possible to draw two conclusions from this: 1) the result of an ISDM selection could be different depending on the party making the selection decision, and 2) if the client's business value achieved from an ISD project is emphasized, the client should be the responsible one for the ISDM selection.

Based on the above mentioned, the third premise (P3) is formulated as follows:

P3: The client organization should have the main responsibility for the ISDM selection for a project

In addition, the timing is important. Because there normally are (at least) the two above-mentioned parties, the IS development is done according to the contracts made before the ISD project is started. Those contracts define or at least give a frame for a possible ISDM for a project. The decisions made before contracts are signed are important; with wrong decisions, a project will be doomed even before it is started (Ahonen and Savolainen 2010; Savolainen and Ahonen 2015). So, the ISDM discussion and selection should be done at a very early stage i.e. before the contracts are made. Rather a natural stage for the ISDM selection is after the feasibility study and requirements elicitation and analysis phases where the main business needs and requirements are perceived, but the solution is not yet designed (Bocij et al. 2015; Sommerville 2011).

Based on the above mentioned, the forth premise (P4) is formulated as follows:

P4: The ISDM selection should be done right after the main requirements are analyzed, before a supplier is selected and contracts are made.

The considerably low success rates of ISD projects are not the only reason why the client role in IS development is topical at the moment. Due to digitalization, the strategic importance of ISD has increased; ISs have become a strategic asset also for those organizations and business areas which traditionally are not considered to be IT-oriented (Von Bary and Westner 2018; Borg et al. 2018; Fuggetta and Di Nitto 2014). This is one reason why previously outsourced IS development is taken back or co-sourced. Other reasons exist, as well (see e.g. Von Bary and Westner 2018), but it is remarkable that, in this new situation, client organizations have to change their practices and processes. The practices used in a purely outsourced IS development are not valid any more. In a pure outsourcing situation, the client was buying a turnkey solution from a supplier, and the development with the related risks were moved outside the client organization. In a co-sourcing situation, the client is involved in the development, and the development risks are shared (or moved back to the client), as well. This emphasizes the importance that the client is the responsible one to select the best possible ISDM for a project.

1.2 Research Objectives and Delimitations

Due to the above-mentioned reasons, it is important to study how an ISDM selection should be done. Based on the literature review by (Lagstedt and Dahlberg 2018a), there have not been many studies on ISDM selection, and when selection criteria or models are presented, they are based mainly on project specific factors, and the ISD business context is mainly neglected. It is not known, why organizational / business context characteristics appear to have received only little attention in prior ISD method selection research. The strong influence of the plan-driven waterfall (Royce 1970) and stage-gate based methods is one possible reason (Avison and Fitzgerald 2006). In these ISD methods, business requirements are specified and agreed prior to the start of the technical ISD work, and the results of previous project phase(s) are accepted at a decision gate prior to the start of the next phase. If there are changes in business requirements, some ISD project re-planning has to be done, and this is problematic during an ongoing project. This might lead the project specific factors being overemphasized. Anyhow, due to lack of discussion, this issue constitutes a research gap. The main objective of this study is to fill this gap by formulating an ISDM selection framework which takes the above mentioned premises (P1 to P4) into account.

If IS development is viewed from a higher level, IS development projects typically consist of three phases. The first phase, called here the pre-project phase, consists of feasibility studies and scoping (requirements gathering) and other activities which prepare the organization for the two later phases. During the second phase, the actual change is made, that is, a new process(es) and an IS are developed. In the third phase, the process(es) and the IS are implemented and rolled out. Although the synchronizing of business process development and software development during the second and third phases, i.e., during the project is important, mistakes made in the beginning, in the pre-project phase, are often fatal for the project and costly or impossible to fix when discovered (Ahonen and Savolainen 2010). For this reason, this study focuses mainly on the pre-project phase, and the other two phases are not considered. Furthermore, in this study, the focus is on the client (= IS user organizations) situation: what kind of ISDM the client should select in which kind of development situation. The supplier perspective is mainly excluded from this study, and considered only when the differences of these two parties, clients and suppliers are discussed. This emphasis is selected because the IS client is the party whose business processes are developed and who is benefitting from the successful IS and process implementation. For the IS supplier, the project could be successful even if the IS is never taken in use (Savolainen et al. 2015; Taylor 2007).

As mentioned above, the challenges of ISD projects have been seen a significant and a long lasting problem. Because of this, this dissertation concentrates on IS

development done in projects. There is a lot of development work outside the projects, as well, for example, continuous improvement, such as, continuous software engineering (Fitzgerald and Stol 2017) and organizational learning, which have their advantages and challenges, as well. However, the other development approaches are excluded from this study because their challenges are not related to project based development, and, even though, in some cases, those approaches could be used to replace project based development (e.g. the use of Scaled Agile Framework (SAFE) in some cases), there is no clear indication that project based development is disappearing. Furthermore, business process development is dealt here with only to an extent that provides a better view on the IS development situation, i.e. system (/process) development that does not include software development is excluded from this study.

Even though the purpose of this dissertation is to find out how to select the best possible ISDM for a specific ISD project, it is worth emphasizing that the assumption here is not that methods are used literally, but they have to be adapted for a project. This is in line with the findings of Carroll (2003) as well as the recommendations of Avison and Fitzgerald (2003). Nevertheless, before it is possible to decide how to apply an ISDM in a project, the ISDM has to be selected first.

How the selected ISDM should be applied in a project is an important question to be studied right after a solid ISDM selection model is formulated. One interesting framework to apply an ISDM method in a project is OMG's "Essence – Kernel and Language for Software Engineering Methods" which is based on the work of Jacobson, Meyer and Soley and their SEMAT model (Object Management Group (OMG) 2018). The framework does not care what method is selected (Jacobson et al. 2013), and, in that sense, it is one potential tool to be applied after the ISDM selection. However, since the adoption of an ISDM has not been seen as a part of ISDM selection, but as a totally new research area, adapting the selected ISDM in a project is excluded from this study.

While there are myriads of different kind of ISDMs, evaluating all of them thoroughly is not possible in one dissertation. So, in this study, the classification of plan-driven and the change-driven approaches (Moe et al. 2012) is used as a basis. This classification is based on the control concept of IS development. Pure plan- and change-driven methods are the ends of this scale and this study concentrates on them. The selection and use of all the ISDMs between these two extremes, as well as their different kind of combinations such as hybrid models, are left to be investigated in future studies.

1.3 Research Problem and Research Questions

This chapter presents the generic research problem and the research questions related to it. In addition, the original publications and their contribution to the research problem are discussed.

As pointed out in Chapter 1.1, the main premises guiding this study are the following:

P1: To get better suited ISDMs to ISD projects; ISDMs should be selected for a project case by case.

P2: The characteristics of the selected IS development methods should match with the characteristics of the business development context where they are used.

P3: The client organization should have the main responsibility for ISDM selection for a project

P4: The ISDM selection should be done right after the main requirements are analyzed i.e. before a supplier is selected and contracts are made.

These premises frame the baseline of this study, and, based on the premises, the overall research problem (RP1) of this study is the following:

RP1: How should an ISDM be selected for an ISD project?

It could be seen that this research problem has two sides: what kind of ISDM selection guidelines (a framework) could help the ISDM selection, and how people and organizations should act (use the framework) in ISDM selection situation.

Keeping the limitations of this study in mind (see Chapter 1.2), the answers to the research problem were looked for by formulating several research questions and sub-questions for them. The research questions and their sub-questions are presented in Table 1.

Table 1. The research questions

| Research question id | Sub question id | Research question |
|----------------------|-----------------|--|
| RQ1 | | <i>RQ1: What can be said about the matching ISDMs and the characteristics of business contexts where they are used based on the analyses of two ISD projects (ex post)?</i> |
| | RQ1.1 | What business contexts, and/or other novel reasons for failure were related to the failure of the two projects? |
| RQ2 | | <i>What kinds of ISDM selection models and criteria are possible to find in the literature, and how well do they account for the characteristics of business contexts?</i> |
| | RQ2.1 | Is the proposed framework able to capture the results of the prior ISD method selection research? |
| | RQ2.2 | Do the interviewed ISD experts perceive the recommendations of ISDM selection studies useful? |
| RQ3 | | <i>Do the interviewed ISDM professionals consider the proposed ISDM selection framework useful for ISDM selections at an ISD project level?</i> |
| | RQ3.1 | What other criteria could be considered and how should they be taken into account in the proposed framework? |
| RQ4 | | <i>How common is it for the client and supplier organizations dealing with projects related to information system development to conduct systematic, project-specific ISDM selections?</i> |
| | RQ4.1 | What are the main reasons for client and supplier organizations dealing with projects related to information system development to conduct or not conduct systematic, project-specific ISDM selections |
| | RQ4.2 | In the ISDM selection decision-making, is it possible to describe the behavior of the ISD projects' client and supplier organizations with bounded rationality and functional stupidity theories? |

The interrelationships between the overall research problem, research questions and the original publications relating to this study are presented in Figure 1. Figure 1 also shows the main phases of this study: the pre-study phase, the analysis of two ISD projects (Publication I), the systematic literature review (Publication II) and the expert interviews (Publications III, IV and V).

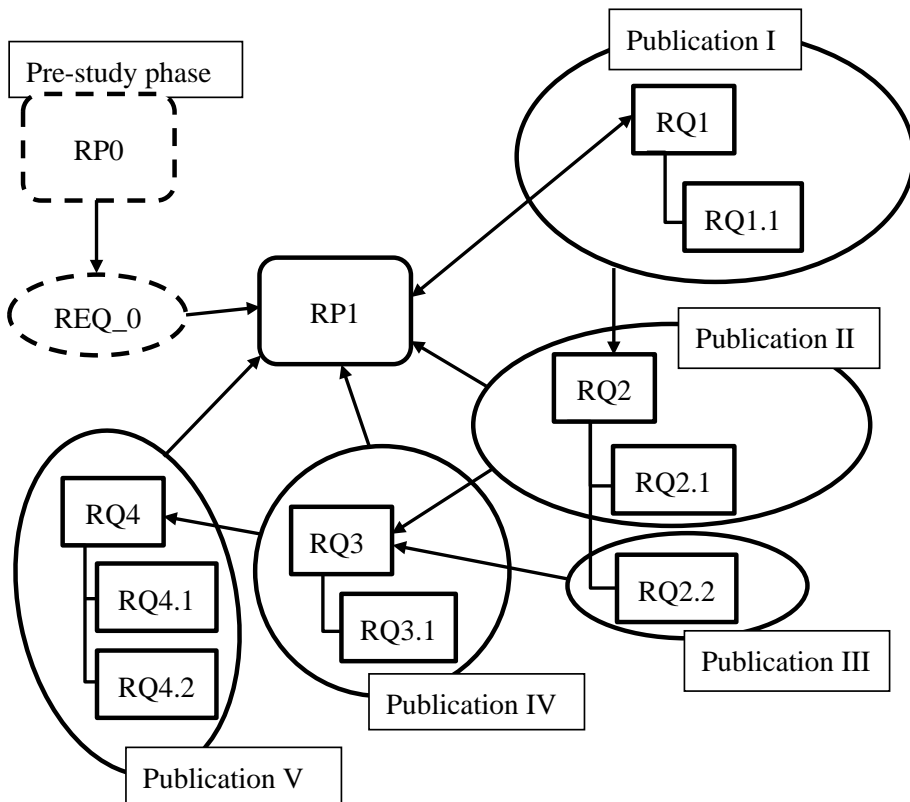


Figure 1. The interrelationships of generic research problem, research question and publications.

This study has been an evolving process. In the very beginning, in the pre-study phase, the research idea was to study how requirement engineering practices could be developed to better suit different ISD projects, and the overall research problem (RP0 in Figure 1) at that time was the following: How to align business process (BP) development and information system (IS) development with requirement engineering? The first step of the research was a study (REQ_0) about requirement engineering in a large multinational manufacturing organization (see Lagstedt and Dahlberg 2018b). In the study, it was found out that, at a higher development program level, requirement engineering has an important role in integrating the

business processes and information systems development in the case company. However, it was also found that this integration is not enough at the project level. Also other aspects, such as, IS development method suitability for a project should be considered (Lagstedt and Dahlberg 2018b). Based on this finding, the scope of this research was re-oriented, and the research problem was shaped into its final form: “How an ISDM should be selected for an ISD project?” (RP1)

When the research problem was finalized, the main research question R1 and its sub-question R1.1 were formulated and two already finished ISD projects were analyzed to find out what kind of influences different ISDMs may have on projects. The findings assured that the chosen research problem (RP1) is valid, and, after that, the following research phases of the research were planned and the research questions RQ2 and RQ3, and their sub-questions were formulated. In the following phase, the first version of the contingency-theory-motivated ISDM selection framework was constructed, and a systematic literature review was conducted to find out answers to the research questions RQ2 and RQ2.1. Based on the findings of the literature review, the research questions RQ4 and its sub-questions were formulated, and the expert interviews were planned and arranged to acquire answers to the research questions RQ3 and RQ4 and to their sub-questions.

1.4 Overview of Chapters

At the beginning of the theoretical background, in the section 2.1, the success of a project is discussed. A real success of a project is hard to measure, and several different approaches are presented and used. In this study, the business perspective for the project success is emphasized.

Project success is often closely related to project management. This is discussed in section 2.2. In the project management section, the project start-up phase is emphasized since it is the phase where the ISDM selection should be made.

After the project management, in section 2.3, business process development and business and IT alignment is briefly discussed to give an overall picture about the business side, processes, and business requirements and how they are related to IS development.

Sections 2.4 and 2.5 have a development point of view. Firstly, section 2.4 discusses different kind of development situations by presenting ideas of opportunity creation and opportunity discovery and their differences and also presenting the concept of wicked problems. Section 2.5 has a more organizational point of view presenting the ideas of decision-making and contingency theory.

In sections 2.6, 2.7 and 2.8 different aspects of IS development are discussed: section 2.6 clarifies different development methods and approaches to use them;

section 2.7 deals with previous ISDM selection models and criteria; and finally section 2.8 reveals different sourcing practices in IS development.

In Chapter 3, the proposed ISDM selection framework is presented and its theoretical backgrounds are discussed.

Chapter 4 concentrates on the research approaches and the results and publications are presented in Chapter 5. In Chapter 6, the findings are discussed and the research questions are answered. Chapter 7 concludes the study. Appendix A includes the list of articles reviewed in systematic literature review and, in Appendix B, there is the list of questions used in the expert interviews.

2 BACKGROUND

2.1 Project Success

When the rather general claim is that ISD projects fail often (see, e.g., Hastie and Wojewoda 2015), it is important to discuss how ISD project failure and success are defined and measured. Although there are some special features in ISD projects in project management research, ISD projects and their success are most often investigated similarly to projects in general (e.g., DeLone and McLean 1992; Ika 2009; Shenhar et al. 2001). I follow this tradition in this dissertation.

ISD project success is difficult to measure comprehensively. The Standish Group has reported the success of IS projects annually since the mid-1980s with consistent metrics. According to them, “a project is successful if it is completed on-time and on-budget, with all features and functions as initially specified” (Standish Group 1995). In project management literature, these project performance metrics are called “the iron triangle” (Atkinson 1999); that is, IS development project performance is evaluated through cost, time and ability to deliver agreed-upon functionalities. Project performance metrics, however, are insufficient to capture project value, such as business benefits (DeLone and McLean 1992; Ika 2009; Pinto and Slevin 1988; Shenhar et al. 2001; de Wit 1988). According to de Wit (1988), it is important to separate project success and project management success: “Good project management can contribute towards project success, but is unlikely to be able to prevent project failure.” Project performance metrics are important but secondary to, or part of, business benefits. However, measuring business benefits is possible only some time after a project has been completed (Ika 2009; Petter et al. 2012; Pinto and Slevin 1988); a reliable measurement is difficult due to the delay between a development and its benefits realization, as well as due to intervening factors such as changes in the inner and outer business circumstances. Suppliers are seldom able to influence the business benefits realization with their actions (Pinto and Slevin 1988; de Wit 1988). Hence, suppliers are reluctant to accept clients’ business value metrics into ISD project contracts even though they usually regard client satisfaction as an important factor of an ISD project. Because of this, prior research has reported examples of poorly performing projects that were later praised due to high business value creation (Ika 2009; McLeod et al. 2012). In addition, project success depends on whom you ask: there might be some success for managers and practitioners, even in projects that were considered failures from an organizational perspective (Dwivedi et al. 2015;

Procaccino and Verner 2006). All in all, the concept of a successful project is vague, and project management is only one perspective of the topic: success and failure is sometimes a question of judgment (Dwivedi et al. 2015).

To cover the various perspectives of project success, Pinto and Slevin (1988) proposed a “model for project success” with six project success areas. The first three cover project performance: time, cost and the delivery of agreed-upon outputs. The other three address project value, satisfaction and effectiveness for clients and user organization. Similarly, Shenhar et al.’s (1997) model divides project success into four dimensions: efficiency (time, money, delivery of agreed-upon outputs), impact on customers, business success and preparing for the future. Shenhar et al.’s proposition is quite in line with Howsawi et al.’s (2011) model. In a literature review they did, they collected previous models and composed a four-level framework of project success criteria: project process level, deliverables level, business level and context level (Figure 2).

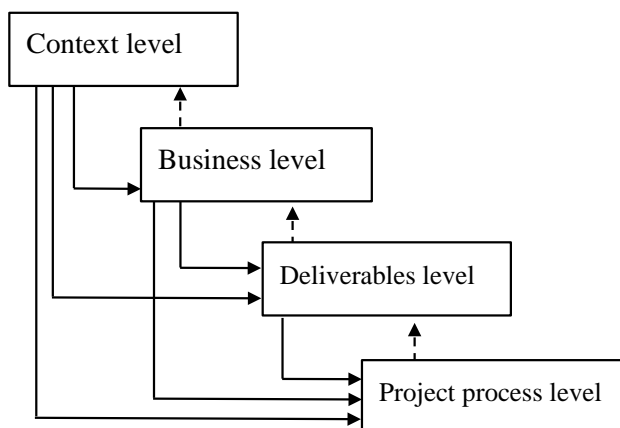


Figure 2. Four-level project success framework (Howsawi et al. 2011)

Although the mentioned models relate to general project management, they are conceptually similar to the success measure categorizations of IS business value (e.g., Schryen 2013) and IS success research (e.g., DeLone and McLean 1992).

In summary, the abilities to adhere to the timetable and budget and to deliver the agreed-upon functionality measure project performance. Other metrics, such as user satisfaction, productivity, capacity utilization, market performance and individual and organizational impact capture the present and future business value of ISD projects from individuals to diverse IS stakeholder groups (DeLone and McLean 1992; Petter et al. 2013; Schryen 2013).

It should be mentioned that, when discussing project success, critical success or failure factors are often sought, and the factors are discussed without pondering how success should be evaluated. The factors are not enough for evaluation, and

not all (IS) projects are the same, as Pinto and Mantel (1990) stated: “The factors that are predictive of project failure vary widely depending upon the type of project examined.” So, each project has to be considered individually.

2.2 Project Management

According to the Project Management Body of Knowledge (PMBOK), a project is “a temporary endeavour undertaken to create a unique product, service or result” (PMI 2013). Projects have their own budget, schedule and project team. The project team is a temporary group whose sole purpose is to perform the project; the team is created for a project and is disbanded when the project ends (PMI 2013).

Companies often have many business process development and IS development projects going on at the same time, each project having its own objectives, time schedules and resources. As mentioned above, the primary objective for project management is to keep the project within the given time frame, budget and deliverables. If one of these is changed, one or both of the others have to be changed as well (Ika 2009). Changes in one project may also affect the other projects (e.g., when resources are limited), and project portfolio management is needed to prioritize the objectives and to allocate resources of individual projects (Wallin et al. 2012).

Project management methods like PMBOK and PRINCE2 (a generally used project management method owned by Axelos) are mostly based on the stage-gate model, meaning that the project has “gates” that can be passed when all the previous stage activities are done and all the necessary results achieved (see, e.g., Cooper 1990). The gates are used as project checkpoints, and the project is re-evaluated in these gates: whether the project should continue as planned, whether it should be changed or whether it should be cancelled. If the stage-gate model is strictly followed in an ISD project, it has a tendency to change into a waterfall style of development. In waterfall projects, all the requirements should be defined before starting the project, which highlights the importance of requirements.

The requirements are often the only discussion media between ongoing business development and IS development. Using the requirements as an integration tool is very challenging, and problems in requirements management are reported as one of the most significant causes of project failures (Dwivedi et al. 2015; MacManus and Wood-Harper 2007; Verner et al. 2008). Furthermore, many of the problems in requirements management seem to be caused by problems in communication, (see, e.g., Hansen and Lyytinen 2010; MacManus and Wood-Harper 2007). In other words, business people and IS developers do not speak “the same language,” if they speak to each other at all. The requirements used to integrate the different

development projects are normally not as thorough as they should be, nor are they centrally managed, organized or well-coordinated. When requirements are elicited and a development project is started, the problem is how to manage requirements during the project. In the waterfall type of development the requirements management is quite straightforward: requirements should not be changed during the project. However, changes still happen quite often. In the waterfall type of development, this is a problem. Changes have to be discussed in a steering meeting, and they always cause the project to be replanned. Because replanning is time- and resource-consuming, requirements are not changed easily (Sommerville 1996, 2011).

2.3 Business Process Development

Business process development has roots dating back to 1911 in Frederick Taylor's book *Principles of Scientific Management*. In that book he described the key ideas for managers and postulated the significance of analyzing the work scientifically and, based on that, how to enhance the efficiency of workers (Taylor 1913). Taylor's scientific management, although it is a rather mechanical model, was clearly the first step toward "process thinking" (vom Brocke and Rosemann 2010; Harmon 2010). The idea of a process, at that time, was quite mechanistic: employees' behavior was determined almost only by work environment, and individuals themselves had an essentially passive role. That purely objectivistic approach did not account for the differences between people and the effect of an organization culture. Even so, Gibson Burrell and Gareth Morgan claimed that the theories of Taylor "are founded upon assumptions which characterize the most objectivist region of the functionalist paradigm" (Burrell and Morgan 1979).

Later, more sophisticated models were developed and different paradigms studied and tested to achieve a more realistic picture about organizations and business and, thus, about the management of business processes as well (Burrell and Morgan 1979). Organizational and management theories have had a huge effect on how business processes are understood today, but there have been also other backgrounds for business process management. Paul Harmon brings two other major process traditions to the management tradition: operations research/quality control and IT (Harmon 2010). Quality control has its roots in the 1950s, and it has had a remarkable effect on today's industrial work and on other business areas, as well, for example on the development of the Capability Maturity Model (CMM) for software development. IT has an even shorter history than quality control, but it has evolved into something large and all-embracing: computers are everywhere nowadays, and as Paul Harmon says, "within two short decades they completely changed the way we think about the work and the nature

of business” (Harmon 2010). IT has enabled the achievement of new levels of both process follow-up and process management.

Lately, business process development has been seen from different perspectives as well. In 1990, Michael Hammer published his famous article, “Reengineering Work: Don’t Automate, Obliterate,” and the same year, Thomas Davenport and James Short published their article, “The New Industrial Engineering: Information Technology and Business Process Redesign.” Together, they shaped the concept of Business Process Reengineering/(Redesign) (BPR) (Davenport and Short 1990; Hammer 1990). The idea of BPR is that companies should not just automate their existing processes but redesign them (from scratch) first. This “destructive” re-engineering was seen as risky and episodic rather than as continuous development projects that were recommended during the 1990s (Hammer 2010). Due to the known limitations of BPR, the business process concept is developed and a wider perspective to the continuous process of development management and diagnosis has been achieved along with Business Process Management (BPM) (Van Der Aalst et al. 2003).

Business process management is a considerably young and still-evolving framework. Jan vom Brocke and Michael Rosemann have composed a framework that consolidates the essential factors of BPM. They suggest six core elements for BPM: strategic alignment, governance, methods, information technology, people and culture; each of these has five capability areas (Rosemann and vom Brocke 2010). While information technology and “process-aware information systems” are seen as an essential part of the business process (Rosemann and vom Brocke 2010), process development should be tightly connected to IS development and vice versa. As we can see, the viewpoint of BPM presented by vom Brocke and Rosemann is quite wide and has developed a lot from Taylor’s “scientific management.” Furthermore, new viewpoints and methods have been included and merged so that, nowadays, BPM covers much larger areas than models before.

Although information technology has been seen as part of process management, information systems have quite often been considered ready-made tools coming from an IT supplier to either help process development (IT solutions for process design and modeling and IT-enabled process implementation and execution) or to control, manage and improve existing processes (process control and measurement solutions, tools for process improvement and innovation and process project management and program management tools) (Rosemann and vom Brocke 2010). While the business process development has been widely studied, the connection to the information development point of view is lacking; there are not many methods or tools to combine IS development and business process development projects. In addition, even though BPM could be seen as a prevailing approach to organizational development in practice, the utilization of BPM varies quite a lot in different organizations. As Michael Rosemann puts it, “It remains, in any case and

without a doubt, an ongoing challenge for the community that BPM has no classical home in an organization” (Rosemann 2010).

Business process maturity is a commonly used BPM tool, describing the structuredness and predictability of business execution and its development (Röglinger et al. 2012; Rosemann and vom Brocke 2010). Maturity models originate from product quality methods. In 1993, Paulk et al. (1993) launched the CMM (capability maturity model) model to assess the quality of IS/ISD processes. The CMMI (CMM Integration) model then generalized the CMM model to the assessment of any processes instead of the IS/ISD processes only (Harmon 2010). The CMM/CMMI models, with their idea of repeated continuous development cycles, build on the work of Stewart, Deming, Juran and Crosby. Most business process maturity models follow the widely known five maturity levels of CMM/CMMI, where processes are: 1) initial (ad hoc and occasionally chaotic), 2) repeatable (process discipline exists and processes may be repeated), 3) defined (processes are documented, standardized and integrated organization-wide), 4) managed (processes are also measured and controlled with systematic measurements) or 5) optimized (processes are also continuously improved on the basis of metrics and by piloting innovative ideas and technologies) (Paulk et al. 1993; Röglinger et al. 2012). Processes at a low maturity level are more mechanistic, and their top-down approach more or less follows Taylor’s idea of scientific management. On the other hand, especially in maturity level 5, flexibility, spontaneity and the importance of the individual are emphasized, and even the bottom-up approach is approved (Curtis and Alden 2006). So, the high-maturity processes could be seen as more human-centric and less regulated.

In an organization level, there should be strategic decisions about how business and IT should be developed. The importance of IT and Business alignment are seen for a long time (e.g., Pyburn 1983), and different ways to align IT and Business strategies are proposed (e.g., Henderson and Venkatraman 1999). It is generally agreed that IT strategy should not only support business strategy but that new IT strategies can also enhance business and open new business strategies (Broadbent et al. 1999; Henderson and Venkatraman 1999; Sallé 2004). The alignment of business and IT should extend to business development projects as well; a good (IT) infrastructure capability is important when business processes are changed or re-engineered (Broadbent et al. 1999).

Along with digitalization, the importance of business and IT alignment has grown remarkably. In development projects, information systems (IS) cannot be seen only as a tool to implement business changes, but information systems are enabling and launching new kinds of business opportunities more and more (Borg et al. 2018; Fuggetta and Di Nitto 2014). It has been noticed that BPM itself does not automatically guarantee alignment between Business and IT (see, e.g., Cleven 2011). IT infrastructure should be designed on the grounds of business. Enterprise

architecture has been seen as one tool to improve co-operation. As part of it, the engagement model should include practices to align IT and business objectives. Requirements management, which is an essential part of a development project, especially in plan-driven development, can be seen as part of this engagement model. Requirements related to business process development and IS development have to be engaged. To get that kind of engagement model working, IT should be like a strategic partner for a business rather than only a technology or service provider (Sallé 2004).

2.4 Different Development Situations

One remarkable problem with IS development is the management of uncertainties related to the development situation. A rather traditional way to recognize and reduce the uncertainties of development is to thoroughly plan, and the planning phase (especially requirements collection and analysis) is heavily emphasized, for example in a waterfall type of development (Kotonya and Sommerville 1998; Royce 1970; Sommerville 2011). The uncertainty, which cannot be reduced with thorough planning, is handled with risk management. The assumption is that if a project is thoroughly planned and relevant risks are identified early enough, uncertainties are possible to resolve with project management and risk management during a project (Boehm 1991; Sommerville 2011).

Although the planning approach is rather generally applied, especially in mechanical engineering, it should be noted that comprehensive planning is not possible in all development situations. In some cases, organizations are not willing or capable of doing comprehensive requirements gathering and project planning, but there are cases where all relating uncertainties or an optimal solution are not possible to see beforehand, even if desired. Rittel and Webber (1973) point out that some social problems are so complex, with so many related entities, that they are “wicked,” i.e., there is no clear right or wrong, and different stakeholders see the problem in different ways. Traditional comprehensive planning before development is not possible, so the problem will be thoroughly understood only as a solution is developed.

There are other points of view in development situations as well. Development situations could be considered as business opportunities, and some opportunities are easier to detect than others. Based on the uncertainties of opportunities, Sarasvathy et al. (2003) classified different kinds of opportunities into three categories: 1) opportunity recognition, 2) opportunity discovery and 3) opportunity creation. In opportunity recognition, not much development is needed; the idea is that both sources of supply and demand already exist and the only task is bringing them together. In opportunity discovery, only either demand or supply exists and

the non-existent side has to be discovered (and/or developed). In opportunity creation, neither demand nor supply exists and they have to be created (Sarasvathy et al. 2003).

Alvarez and Barney (2007) developed the ideas of Sarasvathy et al. (2003) further. In their opportunity discovery and opportunity creation concepts, there are only two categories, but the idea is in line with Sarasvathy et al. (2003). They agree that some business opportunities may be discovered, and in those cases, it is possible to evaluate business opportunity costs, profits, risks, necessary activities and other key development issues in advance and plan a development project thoroughly beforehand. In Alvarez and Barney's (2007) model, the opportunity discovery category covers Sarasvathy et al.'s (2003) first two opportunity categories, opportunity recognition and opportunity discovery. On the other hand, they point out that some business opportunities are not possible to discover beforehand, but they have to be created, and only during their creation will they take their final shape. In these kinds of cases, advanced comprehensive planning might give an illusion of control but may cause more disadvantages than benefits for a project (Alvarez and Barney 2007). In organizations with a strong traditional project culture, it is not so obvious that the nature of uncertainties relating to opportunity creation is fully recognized in the project planning phase.

However, in business development, the future situation and its uncertainties are not the only critical issues to be considered; the current situation, such as the business context of development and its uncertainties, is also important. When discussing systems development, most of the effort is often put toward the solution domain, and the current situation is neglected (Vessey and Glass 1998). In those cases, only future related uncertainty is taken into account. For example, Knight (1921, in Sarasvathy et al. 2003) divides uncertainty into three different types: a) a future whose distribution exists and is known, b) a future whose distribution exists but is not known, c) a future that is not only unknown but also unknowable. The opportunity classification of Sarasvathy et al. (2003) relies rather largely on the approach of Knight.

While presenting their opportunity discovery-creation idea, Alvarez and Barney (2007) also take the decision-making context into account, but they discuss only whether it is possible to collect enough information about potential opportunities in the current situation, not how many uncertainties are in the current work and processes. If the uncertainties of a current situation are not taken into account, it means that only the desired end state (to-be situation) is discussed, and the starting point (as-is situation), e.g., the maturity of the business process to be developed, is neglected. According to Vessey and Glass (1998), this kind of behavior produces weak problem-solving approaches that are "too general to be very powerful" (Vessey and Glass 1998).

In this dissertation, future uncertainties in development are seen as an important but insufficient factor to be considered before the development project is started. Also, uncertainties related to the current business context should be taken into account when development projects are started.

2.5 Organizational Development

I regard ISD as an integral part of organizational development. Information systems are developed to support and enable the execution of an organization's strategy and business within a specific business (processes) context. The definitions of IS reflect this rationale. For example, Avison and Fitzgerald (2006) specify IS as "an information system in an organization provides processes and information useful to its members and clients." Lyytinen and Hirschheim (1988) proposed that, in addition to being mechanisms of sociological and managerial control, IS is also a means of discourse. From their perspective, IS development is a way for people to make sense of their environment. Consequently, a (successfully developed) IS is the true representation of the organizational reality for its users within a specific use context. When an IS is developed, it always impacts the organizational/business contexts of the development; that is, it supports and/or enables business development. (R)evolving changes and uncertainties related to the changes characterize organizational/business development (Nutt 2010; Thompson 2003). Changes in their uncertainties may be related to the execution of business (processes), i.e., current business context, the outcomes of changed business execution, or both. It is necessary to describe how different ISD methods, i.e., plan-driven and change-driven ISD methods, approach these two types of uncertainties and how organizational development addresses the same issues. I further propose that, on the basis of such understanding, it is possible to craft an ISD method selection framework with the underlying principle of matching the characteristics of ISD methods and organizational/business contexts.

2.5.1 Decision-Making

I consider ISD method selection for a development project to be an organizational decision-making situation. The vast body of decision-making research and theories offers explanations for why making organizational decisions is sometimes challenging, or even not done at all. The bounded rationality (Simon 1997, p. 119) and functional stupidity (Alvesson and Spicer 2012) theories provide complementary, well-established and empirically thoroughly tested theories for the decision-making discussion. Simon (1997) points out several reasons that

prevent organizations from making fully rational decisions, assumed in the classical economics theories. He describes the following limitations related to preferences: 1) it is impossible to have enough knowledge about the consequences of each choice, 2) the probabilities of consequences can be only imperfectly anticipated, and 3) it is not possible to detect all the possible choices (Simon 1997, p. 93–94). In addition to problems with preferences, Cohen et al. (1972) add unclear technology and fluid participation as two decision situation properties complicating decision-making. Also, different kinds of decision traps (such as the status-quo trap, the sunk-cost trap and the confirming-evidence trap) characterize decision-making at the individual level (Hammond et al. 2006). In summary, organizations strive for rational decision-making but are unable to act fully rationally in every situation (Burns and Stalker 1994; Cohen et al. 1972; Hammond et al. 2006; Simon 1997; Thompson 2003). Therefore, organizations do not maximize but satisfy, i.e., look for alternatives that are “good enough.” Simon calls this approach bounded rationality (Simon 1997, p. 119). According to the bounded rationality theory, an organization tries to select a sufficiently good IS development method (ISDM). However, as explained in the Introduction section, empirical studies have discovered that only 20–40% organizations use clear ISDMs in their ISD projects (Fitzgerald 1998; Huisman and Iivari 2006; Iivari and Huisman 2007; Truex et al. 2000). According to Graham (1994) and Mohan and Ahlemann (2013), one of the reasons is that the costs of use are perceived as higher than the achievable benefits. This indicates that a wrong ISDM is selected for a project. On the other hand, it is also possible that bounded rationality may lead organizations to consider ISDM selection decisions as unimportant and/or to misjudge the benefits and costs of ISDMs. A client may also satisfy with the selection of a supplier.

Alvesson and Spicer (2012) augmented the bounded rationality theory to include decision-making in situations where organizations were detected to consciously make decisions that may or may not be satisfactory in the short-term but are clearly harmful in the long-term. “Organizationally-supported lack of reflectivity, substantive reasoning, and justification” characterize these “functional stupidity” decisions (Alvesson and Spicer 2012). In this way, organizations protect themselves from “the frictions provoked by doubt and reflection,” which in turn strengthen organizational order and employees’ motivation in the short-term. In that kind of organization, work is done as it has always been done, no matter the results. Consequently, all (rational) discussion about the situation and how it could be improved is neglected (Alvesson and Spicer 2012). So, organizational stupidity could be beneficial for an organization in the short-term but may cause big problems in the long-term. In pursuit of short-term benefits, it is possible that organizations consciously avoid ISDM selection decisions because of functional stupidity reasons. In addition, in situations where clients and suppliers have

different business objectives, their ISDM selections (or reasons to not make ISDM selections at all) could be different and reflect any combination of bounded rationality and functional stupidity reasons.

2.5.2 Contingency Theory

To understand the interrelationship of an ISD project and its context, it is important to understand the basic nature and role of a project in a client organization. As already mentioned, the project team is a temporary, autonomy group whose sole purpose is to perform the project; the team is created for a project and is disbanded when the project ends (PMI 2013). This means that projects can be seen as organizations inside organizations, and it is natural to apply organization development theories and practices when ISD projects are examined.

According to contingency theory, organizational environments change all the time. An organization is unable to control the changing environmental factors, known as contingent factors. Contingent factors have two key features: 1) they influence the organization significantly and 2) the organization is, to a large extent, unable to influence or control the outcomes of contingent factors. When an organization is not able to control the environment, it has to respond to the uncertainties created by contingent factors (Drazin and Van de Ven 1985; Lawrence and Lorsch 1967). According to contingency theory, different organizational principles or strategies are appropriate responses to different environmental circumstances (Burrell and Morgan 1979). If IS development is considered an inherent part of organizational development, and the ISD project an organization inside an organization, then the contingency theory approach is a theoretically justified choice to deal with the uncertainties of organizational business development contexts.

| | | Preferences regarding possible outcomes | |
|--------------------------------------|-----------|---|-------------------------------|
| | | Certainty | Uncertainty |
| Beliefs about cause/effect relations | Certain | computational strategy | compromise strategy |
| | Uncertain | judgmental strategy | inspirational strategy |

Figure 3. Decision-making strategies of Thompson (2003).

Burns and Stalker (1994) state that the same organization may act differently in different situations. They discovered that in stable and predictable environments, mechanical (plan-driven) structures are efficient whereas organic (change-driven) structures fit better in uncertain and changing environments (Burns and Stalker

1994). So an organization should develop alternative strategies to respond to the identified contingencies (Burrell and Morgan 1979; Howell et al. 2010). In 1967, to define different decision-making strategies, Thompson (2003) crafted his two-dimensional strategy model, shown in Figure 3. The vertical dimension of the model depicts certainty-uncertainty in relation to the cause-effect relationships of organizational development, and the horizontal dimension depicts the certainty-uncertainty of development outcomes. The model identifies four distinct strategies: 1) computational strategy, where activities and outcomes may be “counted” (specified) in advance; 2) judgmental strategy, where outcomes may be specified in advance, whereas activities need “judgment” between alternatives; 3) compromise strategy, where activities may be specified in advance, but outcomes need to be negotiated for a “compromise” and 4) inspirational strategy, where “inspiration” needs to be used to find a way forward (Thompson 2003, pp. 132–143). Thompson’s model describes a useful way to match the characteristics of ISD methods and their business development contexts. Computational strategy resembles plan-driven methods and inspirational strategy follows change-driven methods. The two other alternatives are in between, and either plan-driven or change-driven methods could be used depending on the amount of certainty-uncertainty (see also Nutt 2010).

2.6 Information Systems Development Methods

An astonishing number of new ISDMs and new ISDM versions have been published during the last six decades. The motivation to launch a new method/version is typically the removal of (some) known limitations in previous method(s)/version(s) (Boehm 1988; Royce 1970; Vidgen and Wang 2009).

Earlier research has classified ISDMs in a myriad of ways (Mahmood 1987), for example on the basis of their heaviness (Khan et al. 2014), flexibility (Moløkken-østfold and Jørgensen 2005) or objectives and orientation (Boehm 2003; Hug et al. 2009). I consider these classifications to be problematic due to their overlaps and conceptual incoherencies. For example, heavyweight and change-driven ISDMs are sometimes seen as opposites, but heavyweight change-driven ISD projects have also been conducted (Henderson-Sellers and Serour 2005). Thus, I decided to follow the ISDM classification based on the control concept of ISDMs. Plan-driven (waterfall) and change-driven (agile) ISDMs are the two categories of this classification (Moe et al. 2012). Pure plan- and change-driven methods are at opposite ends of this scale, and this dissertation concentrates on them. All ISDMs between these two extremes, as well as their different kinds of combinations, like hybrid models, are excluded from this study. Although the term “agile” is fairly new, both categories have a history of over 60 years

(Benington 1983; Larman and Basili 2003). I regard this classification not only theoretically sound but also descriptive for the practical ISD work.

A recent paradigm shift is clearly visible in ISDM use. Plan-driven ISDMs dominated selections during the 1970s, 1980s and 1990s, whereas the popularity of change-driven ISDMs has grown during the last two decades and appears to be mainstream at the moment (Salo 2006; Theocharis et al. 2015). It seems that there is only one paradigm valid at the same time, and more effort is put on the development of new ISDMs than on evaluating how well existing ISDMs suit an ISD project. However, despite the paradigm shift, there seems to be a need for plan-driven ISDMs as well (Dahlberg and Lagstedt 2018; Theocharis et al. 2015).

2.6.1 *Development Method and Methodology*

Before plan-driven and change-driven methods are discussed in more detail, it is important to discuss what “method” (and “methodology”) means here and in IS literature in general.

It seems that methods and methodologies are rather often confused. The Oxford English dictionary defines methodology as “a system of methods used in a particular area of study or activity,” and method as “a particular procedure for accomplishing or approaching something, especially a systematic or established one.” Based on these definitions, when discussing procedures for accomplishing ISD projects, the word “method” is preferred in this dissertation. Here, “methodology” is a collection of methods. However, other interpretations exist as well, and it is important to understand how these terms are used in IS research to make the results of different studies understandable (Wynekoop and Russo 1995).

McDonald et al. (1986) have one clear definition for both terms: they defined “software method” as a disciplined process to produce software, and “methodology” as a collection of methods. From that point of view, a software development project is directed by its method (McDonald et al. 1986). Their definition is clearly in line with the definition used in this dissertation. Wynekoop and Russo (1995) point out that the terminology is inconsistent, which is confusing, making it difficult to evaluate or apply results of studies. In turn, they have defined methodology as “a systematic approach to conducting at least one complete phase (e.g. design or requirement analysis) of software production, consisting of a set of guidelines, activities, techniques and tools, based on a particular philosophy of system development and the target system.” Wynekoop and Russo (1995) also define the terms “technique” as “specific steps for conducting a portion of a phase of software production (e.g. design techniques)” and “software process model” as “a representation of the sequence of stages (e.g. requirements analysis, specification, planning, design, implementation,

integration, maintenance and retirement) through which a software product evolves..” They use “software process model” while discussing prototyping, waterfall and spiral models, and they use the term “information system development method” to incorporate both methodologies and process models. Wynekoop and Russo (1995) make a clear distinction between information systems development and software development. So, from their point of view, a software development project is directed by a software process model (Wynekoop and Russo 1995).

Wynekoop and Russo (1995) are in line with Avison and Fitzgerald (2003), who use only the term “methodology” and have no definition for “method” at all. They define “methodology” as “a recommended collection of phases, procedures, rules, techniques, tools, documentation, management, and training used to develop the system” (Avison and Fitzgerald 2003).

Palvia and Nosek (1990) have some kind of gathering role for the term “method.” They define methodology as an “organized and systematic approach for handling the system life cycle or its parts.” They also defined “technique” and “tools,” terms that are often confused with methods; according to them, “technique” is a “means of accomplishing a task in a system life cycle,” and a “tool” is a “software package to support one or more techniques.” “Method,” they say, is a collective reference to methodology, technology and tools. From their point of view, a software development project is directed by method (Palvia and Nosek 1990).

Other kinds of perspectives also exist. For example, Iivari and Maansaari (1998) agree with Wynekoop and Russo (1995) by stating that many definitions exist, definitions have been inconsistent, and there is no authoritative source for definitions. They also claim that in different articles, methods have different roles: a method could be a constitutive rule, a regulative rule, resource, reminder, model of the ideal process, or vehicle of learning (Iivari and Maansaari 1998). They point out that all in all, “method” (and methodology) is quite a vague term. In that situation, Iivari and Maansaari (1998) use the terms “method” and “methodology” interchangeably. Henderson-Sellers and Ralyté (2010) are in line with Iivari and Maansaari (1998), taking the words “method” and “methodology” as synonyms. Also, Berki et al. (2004) similarly conclude that the “term ‘methodology’ is pragmatically well established within the field of information systems to mean the same as ‘method.’” By method (or methodology), they mean a process model for how information systems should be developed. According to them, techniques are included with the method (or methodology) (Berki et al. 2004; Henderson-Sellers and Ralyté 2010; Iivari and Maansaari 1998).

On the other hand, Brinkkemper (1996), like McDonald et al. (1986), has quite a detailed and clear definition: “A method is an approach to perform a systems development project based on a specific way of thinking, consisting of directions

and rules, structured in a systematic way in development activities with corresponding development products.” Methodology, according to Brinkkemper (1996), is “the systematic description, explanation and evaluation of all aspects of methodical information systems development.” He accurately claims that “method” and “methodology” should not be mixed together and that the term “methodology” should not be misused to refer to the term “method.” In addition, Brinkkemper (1996) has his own definitions for “technique” and “tool” as well. According to him, a technique is a procedure to perform a development activity, and a tool is a(n) (automated) means of supporting part of a development process. Brinkkemper's (1996) definitions are quite similar to those of Truex, Baskerville and Travis (2000).

As mentioned, the term “method” in this study means a process model of how information systems should be developed. This definition is in line with those of Brinkkemper (1996), McDonald, Riddle and Youngblut (1986) and Truex, Baskerville and Travis (2000). Here, techniques and tools (or automated techniques, as Berki et al. (2004) states) are part of a method. In this study, the difference between the software development method and the software development process is that the method is the model and the process describes how the method is applied in real life.

2.6.2 Plan-driven IS Development Methods

Plan-driven IS and other development methods assume that it is possible to thoroughly plan every aspect of development work in advance, such as objectives and their metrics, tasks, money and resources needed. In plan-driven life-cycle methods, planning and development are divided into separate phases. Development starts immediately after the planning phase is completed (Salo 2006; Sommerville 2011).

Maybe the best known and still largely used plan-driven ISD method is the waterfall method, which is based on a software life-cycle concept (International Organization for Standardization 2008; see, e.g., Royce 1970). In the waterfall method, development is divided into distinct development stages (Figure 4). This method clearly follows the stage-gate concept: moving from one phase to another requires that all the activities in the previous phase are accomplished (Cooper 1990; Royce 1970). The assumption regarding the business context is that objectives and deliverables of an IS development project can and should be clearly defined in advance. Consequently, it is also assumed that project tasks and workloads, resources and risks are definable in advance and that most suitable (IS) developers can be allocated to the project since needed capabilities and competences are known. Project and steering group meetings, as well as

checkpoints (gates), are used to ensure that the project is on the right track. Continuous risk management and mitigation activities are executed to avoid the realization of risks with high probabilities and serious adverse impacts (Boehm 1991). The project is executed sequentially according to a project plan. Should changes happen, the (IS development) project is re-planned.

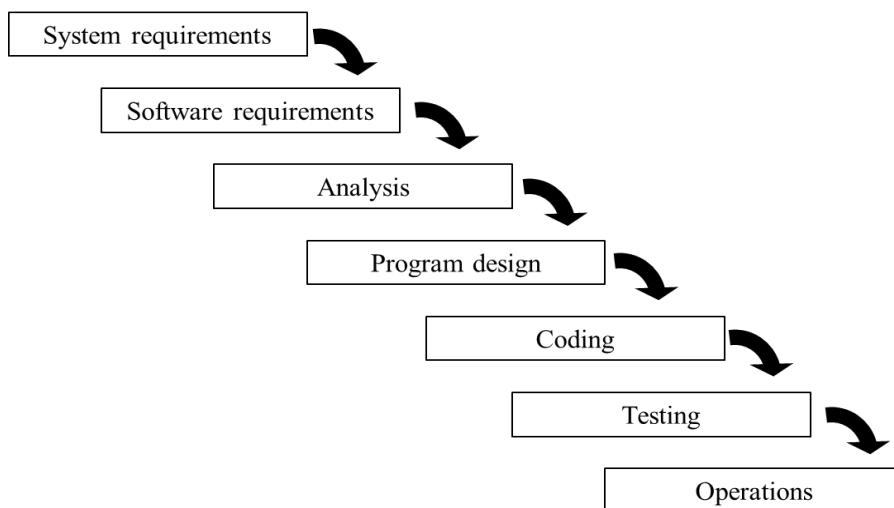


Figure 4. Waterfall method implementation steps (Royce 1970).

The waterfall method is a very straightforward way to develop software, but it has many known problems, e.g., early mistakes are found late and are difficult (and costly) to solve. The method also assumes that no changes happen during software development, i.e., what is defined in the beginning will be implemented in the later phases. Even if all the definitions have been done correctly in the first place, it does not guarantee success in IS development since circumstances might have changed during that time (Hansen and Lyytinen 2010; Jarke and Pohl 1994; Sommerville 1996).

So, the waterfall method and software life-cycle concept in general have been criticized for a long time. Royce (1970) himself already warned about the limitations of his one-directional sequential waterfall model when presenting it, and rather soon after, more criticism emerged. Gladden (1982) and McCracken and Jackson (1982) published very critical statements against the life-cycle concept, claiming that it is too rigid and that it exacerbates the requirements problem. They called after end-user involvement in all phases and flexibility to requirements management. McCracken and Jackson (1982) claim that “any form of life cycle is a project management structure imposed on system development,” and in their opinion, the life-cycle approach is too inflexible a basis for system development.

There are some known factors causing failures and above-mentioned problems of waterfall-type projects. In 1994, the Chaos report listed factors causing projects to be impaired and ultimately cancelled: 1) incomplete requirements, 2) lack of user involvement, 3) lack of resources, 4) unrealistic expectations, 5) lack of executive support, 6) changing requirements & specifications, 7) lack of planning, 8) didn't need it any longer, 9) lack of IT management and 10) technology illiteracy (Standish Group 1995). Factors 1, 4, 6, 7 and 8 could be seen to be related to requirements management, and the importance of requirements (or goals/objectives/expectations/scope) is quite largely agreed upon (Dwivedi et al. 2015; Hansen and Lyytinen 2010; MacManus and Wood-Harper 2007; Nelson 2007; Verner et al. 2008). Other failure factors exist as well, such as underestimation, resourcing problems (staff added late, inadequate staff, an aggressive schedule), communication and involvement problems (by users, top management and stakeholders), poor project management (including risk management), poor change management (including late response to problems) and technology problems (MacManus and Wood-Harper 2007; Nelson 2007; Standish Group 1995; Verner et al. 2008).

Criticism has not diminished even later, and that has made room for more flexible approaches and concepts such as evolutionary development models (e.g., spiral model), which are based more on prototyping than on specifications and are therefore more end-user-centric (Boehm 1988; Sommerville 1996).

Plan-driven methods like waterfall are in line with common project management practices (i.e., PMBOK and PRINCE2), and being rather mechanical models, they are rather well suited to “traditional” types of organizations, which, according to Burrell and Morgan (1979), quite often follow a “functionalist paradigm,” i.e., have an objectivistic approach and are relying on regulation more than radical change (Burrell and Morgan 1979). In some companies, the waterfall model is in line with organizational practices, which is why it is quite naturally used (Sommerville 2011). Problems come if the practices are not good enough for a development situation in question.

2.6.3 *Change-driven IS Development Methods*

In change-driven development, the idea is that the whole information system is not planned at once, but planning and development are done in small steps, and after each step, the situation is re-evaluated and necessary changes are made to the objectives. Each development step results in a new IS release after each cycle.

One large group of change-driven methods are agile methods, which have been developed partly as an answer to the known challenges of plan-driven methods. Although the agile IS development term was coined only some 20 years ago (Beck

et al. 2001), the concept is much older. According to Larman and Basili (2003), change-driven ISDMs, or “iterative and incremental development (IID)” as they call them, were used already in the early 1960s. In the mid-1970s, the idea of prototyping was launched (Boehm 1975), and during the 1980s, especially Boehm (1988; Boehm et al. 1984) developed the prototyping idea further as an alternative to plan-driven (waterfall) methods. He introduced the prototyping spiral model that consists of development periods with recurring tasks during each period (Boehm 1988).

The spiral model is conceptually similar to the sprints used, e.g., in the scrum method (Boehm et al. 1984; Fitzgerald et al. 2006; Larman and Basili 2003; McCracken and Jackson 1982). Scrum had been developed a couple of years before the agile manifesto, with its roots in iterative and incremental development in the Japanese manufacturing industry (Larman and Basili 2003; Takeuchi and Nonaka 1986). With the scrum method, an IS development project is executed through continuous communication between developers, users, and product owners, that is, IS project stakeholders (Schwaber and Sutherland 2017). “Rolling wave” (“phased”) project planning is conducted in two phases. Some up-front planning is carried out prior to the project start, when the first version of product backlog is composed, and further planning is done at the beginning of each sprint with sprint backlogs (Schwaber and Sutherland 2017). A clear vision about project objectives is the minimum planning requirement; otherwise, the IS development project risks losing direction (Boehm and Turner 2003; Fitzgerald et al. 2006; Sommerville 2011).

Scrum sprints could be considered as small projects (Figure 5). At the start of a sprint, stakeholders (product owners) prioritize development needs (user stories) in a sprint-planning meeting. Selected user stories are implemented during the development period (sprint), for example within 2–4 weeks. At the end of the sprint, a new IS version with new/modified functionalities is released and evaluated (Schwaber and Sutherland 2017). The next sprint is then planned on the basis of evaluative feedback and upfront planning. Even the development method is evaluated, and changes are made if needed. During a sprint, the development team members are allowed to organize their work how they see fit. There is no project manager nor a plan-driven type of project management (Sommerville 2011).

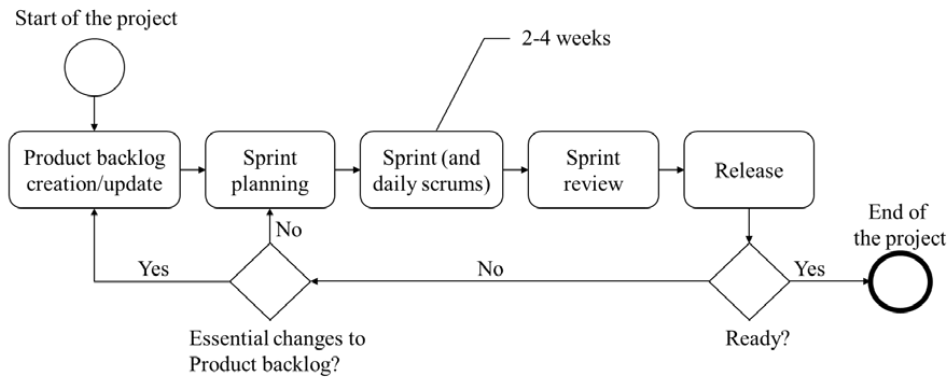


Figure 5. Scrum process.

In a scrum, the product owner (representing stakeholders of the project) discusses the relationship between IS and the business context continuously. The (business) objectives of a project are re-evaluated between each cycle and may change several times during the project. Therefore, it is possible to address uncertainties, both in business execution and in business outcomes. Business-related change management actions, for example, the remodelling and improvement of a business process, are left to process owners and are seen as part of the continuous dialogue between project stakeholders (Beck et al. 2001; Fernandez and Fernandez 2008; Henderson-Sellers and Serour 2005; Khan and Beg 2013).

Agile methods seem to succeed in enhancing IS development: according to a 2015 CHAOS report, the success rate of agile projects is 39%, while traditional plan-driven waterfall projects are successful in 11% of cases (Hastie and Wojewoda 2015). It also states that agile methods are more in line with new organizational ideas where responsibility is distributed, knowledge work has grown in importance and the hierarchical approach is changed to a more collaborative and flexible one (Christopher 2000; Fernandez and Fernandez 2008).

However, it should be noted that CHAOS reports have been widely criticized, and there are many known obscurities in them (Jørgensen and Moløkken-Østfold 2006). Also, the projects evaluated in CHAOS reports are considerably big: all projects less than 10 000 hours of productive labor are considered to be small (Lynch 2016). On the other hand, agile projects tend to be rather small, which in turn are proved to be more successful regardless of the method used. And, in spite of the good success rate of the projects done with agile methods, 61% of agile projects are still not considered to be successful (Hastie and Wojewoda 2015); agile ISDMs do not guarantee success for ISD projects.

Prior research has discovered that change-driven IS development cannot be managed with plan-driven project management methods (e.g., Sommerville 1996). Similarly, there are differences between the failure reasons (risk items) of change-driven and plan-driven IS development. Project management challenges, an approach that is too end-user-centric, messy software structures with maintenance difficulties and poor IS architecture compliance are often mentioned as reasons for the failure of agile ISD projects (Hanssen and Fægri 2006; Mitchell and Seaman 2009; Sommerville 1996; Thummadi et al. 2011). Since there are no clear plans or target descriptions, it is unclear what will be delivered at the end of a project and what the costs, resource needs and duration of the development are. How to evaluate the quality of results and other outcomes is another unsolved issue. Because change-driven development makes it impossible to predefine the architecture and code structure, new increments may introduce new and unpredictable code requirements, leading to software conflicts. Cumulative inner problems of this kind are referred to as technical debt (Cunningham 1992). Change-driven development is seen to be especially prone to technical debt (Behutiye et al. 2017; Codabux and Williams 2013; Holvitie et al. 2018; Rodríguez et al. 2017). In general, maximizing agility increases the risk of trade-offs, for example between fast deployment and poor development practices (Behutiye et al. 2017; Moe et al. 2012).

Other challenges exist as well. Customer-driven IS development projects easily lose their direction unless customers know what they want all the time. The execution of change-driven development projects rests on the availability of highly skilled individuals and their tacit knowledge since formal planning and documentation are limited. The scaling of outcome and contract negotiations have also proved challenging (Boehm and Turner 2003; Mitchell and Seaman 2009). In addition, scaling agile methods for large systems is difficult (Sommerville 2011).

The use of change-driven ISDMs underscores the importance of a client's ISDM competence in a way that is similar to the back-sourcing effect of digitalization. In change-driven ISDMs, the tasks and participation of IS user organizations (clients) are wider and more active than in plan-driven (waterfall) ISDMs. IS user organizations are responsible for use cases, user stories, user testing and feedback, and they participate daily in the ISD work. Some change-driven ISDMs actually resemble co-sourcing and/or multisourcing ISD. Their use with the resulting ISD co-sourcing may come as an unplanned and unwanted surprise to an IS user organization having outsourced its ISD with the idea of moving the development responsibility out of its own organization. This is discussed more in detail in Chapter 2.8.

2.6.4 *Different Approaches to Use IS Development Methods*

Not all organizations use ISDMs in a similar way. Organizations' traditions vary for the use of methods and for how important the ISDM use and selection are seen. In this way, organizational history and culture affect the ISDM selection. For example, Sommerville (2011) claims that it is easier for an organization to use the waterfall method, which is consistent with commonly used management models, even in projects where IS requirements are poorly understood or are likely to change radically during the project (Sommerville 2011).

From prior research, it was possible to discover five approaches to utilize ISDMs. When placed on a single scale, the first end is the "universal approach," where the idea is that a universal method (whatever that happens to be) is the proposed solution for all ISD projects. Comparisons to other ISDMs, if done at all, are a means of showing the excellence of that universally used ISDM. Literature reveals that specific dogmas or paradigms have dominated during certain periods: first, plan-driven (waterfall) and now change-driven (agile) ISDMs appear to have prevailed (Mirbel and Ralyté 2006; Salo 2006; Theocharis et al. 2015).

While it is generally agreed that there is no method "suits for all" (Boehm and Turner 2003; Brooks 1986; Cockburn 2000; Cusumano et al. 2009; Fazal-Baqaie et al. 2013; Hall and Rapanotti 2015; Henderson-Sellers and Ralyté 2010; Shenhar et al. 2001; Sommerville 2011), this kind of universal approach could be hard to justify. To some extent, the universal approach could be considered an organizational stupidity, but as Alvesson and Spicer (2012) point out, organizational stupidity is beneficial in some cases and could be a most cost-efficient way to continue in the situation. Though, as Alvesson and Spicer (2012) state, prevailing organizational stupidity can be disastrous for an organization, so it could be wise to at least challenge the universal approach from time to time.

At the other end of the scale, the "selection approach" means that no single approach or ISDM is regarded to fit the needs of all projects. Each ISDM has its place and should be selected project by project. The remaining challenge, however, is to select the most suitable, or "good enough," ISDM for a particular project (Glass 2004; Gupta and Dwivedi 2015; Howell et al. 2010).

Two other approaches fall somewhere in the middle of the above-described scale. The "tailoring approach" acknowledges the claim that no single method suits all ISD projects, but on the other hand, it also suggests that some kind of "meta-method" may exist, which could be tailored to every project (Alsaade et al. 2014; Avison and Wood-Harper 1991; Fitzgerald et al. 2003). This is a refined version of the "universal approach." On the other hand, the "engineering approach," which is closer to the "selection approach," proposes that the most suitable method for an ISD is constructed by selecting suitable fragments from the variety of ISDMs available to an ISD project (Brinkkemper 1996; Harmsen et al. 1995; Mirbel and

Ralyté 2006). The border between these two approaches is difficult to determine, and some researchers regard them to be the same approach (see, e.g., Karlsson and Ågerfalk 2004).

The final approach is the “amethodological [or ad-hoc] approach.” Fitzgerald (1998) discovered that 60+% of the organizations he studied (at the time) did not use any ISDM method, and 79% did not even intend to do so. Only 6% of investigated organizations used a method rigorously (Fitzgerald 1998). There have also been other studies supporting this claim (see, e.g., Truex et al. 2000). The literature suggests several reasons for the ignorance of ISDMs. Fitzgerald (1998) found out that some IS developers are unwilling to use any ISDM. Cockburn (2007) and Boehm and Turner (2004) detected that some developers are unable to understand the methods, and even if they are able, ISD team values may determine which ISDM is used (Cockburn 2000). Truex, Baskerville and Travis (2000) discovered that, in addition to the IS developers, this issue is related to the ISDMs themselves. There are gnawing problems about the practicability of ISDMs; they are found to be unsuitable for some individuals, and in some settings, they are considered unreliable (Truex et al. 2000).

In this dissertation, the selection approach is chosen as a premise, and the main emphasis is put on papers based on that approach. Papers with a “universal” or “tailoring” approach are left out of the systematic literature review of this study. Even though the selection approach is chosen here, the assumption is not that methods are used literally, but they have to be adapted for a project. This is in line with the findings of Carroll (2003). As Avison and Fitzgerald (2003) point out, in organizations where methods are used in their original form, there is a risk for them to be used as a fetish, which inhibits creative thinking. Iivari and Maansaari (1998), as well as Coleman and O’Connor (2008) and Kalus and Kuhrmann (2013), pointed out that in most cases, system development methods (when used) are adapted on an organizational or project basis, and, as (Theocharis et al. 2015) pointed out, it is rather common to have mixed- or hybrid approaches, as well. Adapting methods is something a good project manager should always do right after the best method for the case is selected. However, as limited in Chapter 1.2, how to adapt and apply the selected method for a specific project is not considered in this dissertation.

2.7 IS Development Method Selection

As mentioned, there seems to be a clear need for project-specific ISDM selection. The success rate of ISD projects remains low. Although the success rate has risen slightly with new agile ISDMs, most ISD projects still get challenged or have trouble (Hastie and Wojewoda 2015). New kinds of ISDMs have not solved the

situation; although some problems of plan-driven ISDMs have been solved, change-driven ISDMs have different problems of their own (Dahlberg and Lagstedt 2018). It is possible to execute a successful, troubled or totally failed ISD project with any ISDM, and no single ISDM guarantees success for every ISD project. With a situation such as this, it is important that the suitability of different ISDMs should be separately evaluated for each development case, and the most suitable ISDM should be selected for a project. In addition, it is important to understand that different parties of an ISD project, i.e., client and supplier, have different business objectives for a project, and the best possible ISDM for a supplier is not automatically the best choice for a client. In IS development projects, it is common that development methods that are familiar for developers (or the supplier organization) are used and others are silently ignored (Boehm and Turner 2004; Carroll 2003).

So, there should be discussion about methods on the part of the client well before the ISD project is started. Selecting the right IS development methods for the right projects is challenging. Some guidelines exist, but they are mainly concentrated to project-specific dimensions and parameters. The ISDM selection is not usually considered in terms of the customer's business.

In this dissertation, the aim is to fill this gap and find out how ISDMs should be chosen on the basis of project and organization characteristics during the pre-project phase.

2.7.1 The Timing of IS Development Method Selection

Selecting the right methods should be done early enough, at the start of the project (MacCormack and Verganti 2003). As Cusumano et al. (2009) stated, “a project's first stage shouldn't deal with product design but rather with designing the development process itself.” Also, Ahonen and Savolainen (2010) put a strong emphasis to stage before the official project start-up: “Even the most valiant efforts of the project manager, the project team, and the management of both the supplier and the customer may not be enough to salvage a project if a serious enough mistake has been made before the project starts” (Ahonen and Savolainen 2010). So, with wrong decisions, a project will be doomed even before it has started (Ahonen and Savolainen 2010). Because IS development is normally done according to the contracts before the ISD project is started, the ISDM discussion should be done in the very early stages, before the contracts are done. Savolainen et al. (2015) refer to the stage between sales and project implementation as the project start-up phase. This phase is both essential for project success and, often being informal, is challenging in knowledge change; project knowledge should be transferred from sales- persons to the project group, and at the same time, essential

method selections should be done (Jørgensen 2013; Savolainen et al. 2015; Savolainen and Ahonen 2015).

According to our systematic literature review (Lagstedt and Dahlberg 2018a), the timing of ISDM selection is rarely discussed. Although selection phases and practices and their relationships to project phases are mainly ignored in ISDM selection articles, some proposed criteria reveal something about presumptions related to ISDM selection. For example, the proposed “size of a development team” (change-driven with smaller teams and plan-driven with bigger teams) (Boehm and Turner 2004; Cockburn 2000; Guntamukkala et al. 2006; Sharon et al. 2010) and “developer acquirements” (change-driven with more experienced developers and plan-driven with less experienced developers) (Ahimbisibwe et al. 2015; Boehm and Turner 2004; Guntamukkala et al. 2006; Little 2005; Mahanti et al. 2012) include an assumption that ISDM should be selected only after the project group and development team are formulated. Nonetheless, in that stage, an ISDM selection is too late: the project is already planned and contracts signed, so it is not possible to suit the best ISDM to the development situation any more. The project plan and contracts, as well as the skills of developers, dictates the ISDM. So, easily, and often unconsciously, irreversible decisions are made in the project start-up phase (Ahonen and Savolainen 2010). For this reason, it is necessary for client organizations to understand the importance of correctly timed decisions in the project start-up phase (Savolainen et al. 2015).

2.7.2 Prior ISDM Selection Criteria

In our systematic literature review (Lagstedt and Dahlberg 2018a), we found only 42 publications comparing the selection of alternative ISDMs. In addition, most of the articles listed ISDM selection criteria without the proper selection model. In our review, the number of ISD method selection criteria varied from two criteria (Burns and Dennis 1985) to a sophisticated model with 8 classes, 40 criteria and 170 sub-criteria (Clarke and O'Connor 2012). Highly sophisticated models are hard to figure out and it is easy to agree with Benediktsson et al. (2006) that highly detailed models, that is, atomized ISD method selection models, are difficult to use conceptually and in practice.

In the literature review (Lagstedt and Dahlberg 2018a), we classified the ISD method selection criteria of the reviewed articles into three categories: People, Project and Environment. The number of the most often mentioned ISD method selection criteria were calculated and compiled in Table 2. The People, Project and Environment categories each have six subclasses, i.e., 18 selection criteria. The applied classification of ISD selection criteria shows that issues other than the

characteristics of ISD methods and business development contexts have mainly been investigated in prior research.

The allocations of most, but not all, ISD method selection subclasses into the three categories were self-explanatory. Some of the allocations need short explanations: the “size of the development team” was allocated into the People category instead of the Project category since prior research has typically discussed how team size impacts the behaviour of team members. The “uncertainty of results” was allocated into the Environment category, whereas “complexity” and “quality objectives” were classified under Project. In prior research, “complexity” refers to the complexity of the development (project), whereas the “uncertainty of results” describes business environment–related uncertainties of results. Although several classifications exist in the articles, they were article-specific and we were unable to find any established prior classification. So, the classification of Table 2 is inductive. It describes our best understanding of the nature of the ISD method selection criteria in the reviewed articles.

Table 2. ISD method selection criteria classes in prior research

| People, # of articles | Project, # of articles | Environment, # of articles |
|------------------------------|-------------------------------|--------------------------------------|
| Developer acquirements, 30 | Complexity, 32 | Uncertainty of results, 34 |
| Size of development team, 15 | Size of the system, 23 | Criticality of the developed IS, 22 |
| Communication, 15 | Resources (time), 19 | Uncertainty of current situation, 20 |
| End-user acquirements, 15 | Resources (money), 18 | Stakeholder involvement, 5 |
| End-user involvement, 12 | Quality objectives, 15 | Control practices, 12 |
| Developer involvement, 10 | Systems history, 7 | Business satisfaction, 5 |

It is important to notice that criteria allocated to the Environment category do not consider much about the business context of the ISD project in the starting situation but more about factors relating to project implementation and business satisfaction in achieved results. For example, “uncertainty of the current situation” relates mostly to the uncertainties of current ISs, and “control practices” refer to the extent that organization control practices dictate project management practices. However, some articles presented some development business context criteria as well, e.g., maturity (Clarke and O’Connor 2012; Episkopou and Wood-Harper 1986), but they do not present a rigid ISDM selection model.

Although most of the papers did not have a rigid ISDM selection model or framework, some general recommendations for selection could be drawn from

them. The uncertainties of an ISD project's outcomes are typical selection criteria and a model factor in the ISDM selection literature. Change-driven ISDMs are thought to be better suited to these uncertainties than plan-driven ISDMs (e.g., Boehm and Turner 2004; Burns and Dennis 1985; Howell et al. 2010; Kettunen and Laanti 2005; Palvia and Nosek 1993; Sauer and Lau 1997; De Weger and Franken 1997),

Another typical selection criterion seems to be the complexity of an ISD project. However, this is an ambiguous theoretical concept. Burns and Dennis (1985) and Saarinen (1990) define complexity almost as a synonym for the ISD project size. On the other hand, Mathiassen and Stage (1990) ask whether ISD project uncertainty and complexity are independent or whether they are elements of the same concept. Howell et al. (2010) propose that complexity could be regarded as one element of uncertainty. The ISD project size (or complexity) is often mentioned as an ISDM selection criterion or factor. Plan-driven ISDMs are thought to suit large ISD projects (Boehm and Turner 2004; Dyck and Majchrzak 2012; Guntamukkala et al. 2006; Mahmood 1987)).

A typical ISD outcome-related proposition in prior research is that plan-driven ISDMs deliver higher-quality ISs than change-driven ISDMs. As we view IS quality as a multi-dimensional theoretical concept, I divided this concept into three different criteria, all of which follow the formulation of the general proposition that plan-driven ISDMs deliver higher-quality ISs. The first criterion addresses the criticality of the developed IS. Criticality is understood as the number of potential losses materializing from the impacts of IS and ISD project defects (Boehm and Turner 2004). Cockburn (2000) divides possible losses into four categories: loss of comfort, loss of discretionary money, loss of irreplaceable money and loss of life. Prior research recommends the use of plan-driven ISDMs in high-criticality cases as higher systematics better ensures the fulfillment of all ISD specifications (e.g., Ahimbisibwe et al. 2015; Boehm and Turner 2004; Guntamukkala et al. 2006; Howell et al. 2010; Siddique and Hussein 2014).

The security of the developed IS is another IS quality dimension. The rationale of this criterion is that the higher systematics of plan-driven ISDMs makes it easier to develop secure ISs (e.g., Guntamukkala et al. 2006; Gupta and Dwivedi 2015; Siddique and Hussein 2014).

The third common IS quality criterion deals with the maintainability of IS. Prior research proposes that plan-driven ISDMs produce more exhaustive documentation as well as better documented software code than change-driven ISDMs (Dyck and Majchrzak 2012; Guntamukkala et al. 2006; Palvia and Nosek 1993).

Prior research includes several ISDM selection criteria, factors and propositions related to IS developers. Several authors regard the skills and experience of an IS developer team as one of the key criteria or factors in ISDM selection (e.g.,

Ahimbisibwe et al. 2015; Boehm and Turner 2004; Guntamukkala et al. 2006; Tang and van Vliet 2012). Change-driven ISDMs are proposed to require better skilled and proficient IS developers than plan-driven ISDMs (e.g., Ahimbisibwe et al. 2015; Boehm and Turner 2004; Tang and van Vliet 2012). This proposition builds on the logic that higher flexibility, adaptability and creativity of change-driven ISDMs require that IS developers have higher basic knowledge and skills (e.g., Ahimbisibwe et al. 2015; Boehm and Turner 2004; Guntamukkala et al. 2006).

Team size is another criterion or factor related to IS developers. Prior literature proposes that change-driven ISD is possible only with small IS developer teams, whereas plan-driven ISDMs should be used with large teams (Ahimbisibwe et al. 2015; Boehm and Turner 2004; Dyck and Majchrzak 2012; Guntamukkala et al. 2006; Sharon et al. 2010). Although prior research does not provide any clear definition for the small team size, IS developer teams with more than a dozen members are no longer seen as small teams (Abrahamsson et al. 2002; Boehm and Turner 2004).

ISD project communication, especially IS designers' abilities to communicate and collect feedback from business users, is regarded as an essential element of change-driven ISDMs (e.g., Ahimbisibwe et al. 2015; Boehm and Turner 2004; De Weger and Franken 1997). Communication is considered to be closely related to IS users' commitment (Sharon et al. 2010). Dyck and Majchrzak (2012) define communication as part of social engineering practices in relation to a customer's co-operation culture; also, Boehm and Turner (2004) address IS user organization culture.

Control practices is a rather large concept and captures several organizational characteristics of IS user organizations. According to Jacobson, Spence and Ng (2013), large organizations are more often rigid and prescriptive. Abrahamsson et al. (2002) and Jacobson, Spence and Ng (2013) discovered that large organizations tend to prefer plan-driven ISDMs. Ahimbisibwe, Cavana and Daellenbach (2015) proposed that if mechanistic and bureaucratic structures characterize an organization, then plan-driven ISDMs are preferable. Change-driven ISDMs are preferable in organizations with organic and flexible structures (Ahimbisibwe et al. 2015). The culture factor of Boehm and Turner (Boehm and Turner 2004) suggests that in an IS user organization with many degrees of freedom, change-driven ISDMs should be favored.

2.7.3 *Prior ISDM Selection Models*

From the 42 articles found in a systematic literature review about ISDM selection criteria (Lagstedt and Dahlberg 2018a), only 16 proposed a rigid ISDM selection

model or framework. In addition, many of the models were repetitions or modifications of previously presented models. The most complex ISDM selection model included 28 factors (Ahimbisibwe et al. 2015), whereas the majority of models had two or three factors (e.g., Burns and Dennis 1985). The already mentioned Boehm and Turner model (Boehm and Turner 2004) consisted of five factors.

The most typical approach was to suggest that ISD methods should be selected on the basis of ISD project complexity and uncertainty. Figure 6 is a descriptive example of this approach. Business context characteristics are considered as if they were static factors with no impact on ISD work. In my opinion, ISD project complexity- and uncertainty-based guidelines and models do not thoroughly consider the impact of the business development context on ISD methods selection and usage. In addition to limiting ISD work and ISD project characteristics only, the ISD project complexity and uncertainty approach has been criticized as conceptually problematic. For example, Mathiassen and Stage (1990) asked if ISD project uncertainty and complexity really are independent or if they are elements of the same factor. Howell et al. (2010) stated that, in general, complexity could be seen as one element of uncertainty. In summary, in my opinion, ISD method selection models, which focus primarily or entirely on the complexity and uncertainty of ISD work, are unable to provide guidance for ISD method selection that matches the characteristics of business development.

| | | | |
|---------------------------|------|----------------------------|--------------|
| <i>Project Complexity</i> | High | System Life Cycle | Mixed Method |
| | Low | Prototyping | Prototyping |
| | | Low | High |
| | | <i>Project Uncertainty</i> | |

Figure 6. The ISDM selection model of Burns and Dennis (1985).

Although models based on project complexity and uncertainty seem somewhat mainstream, other points of view have been presented as well. Howell et al. (2010) identified five environmental themes associated with the selection of the development approach within generic project contexts. These themes are complexity, uncertainty, team empowerment, criticality and urgency. Howell et al. (2010) argued that urgency and complexity are the two elements of uncertainty and that criticality and team empowerment are the two elements of consequence. With this argumentation, they reduced the number of development method selection criteria dimensions to two, namely uncertainty and consequence of a project (Figure 7). To me, it appears that uncertainty more or less resembles “beliefs about cause/effect relations” and that consequence resembles “preferences

regarding possible outcomes,” which are the two dimensions of the Thompson contingency theory model presented in Figure 3. Howell et al. (2010) also suggested that the plan-driven approach is better in low-uncertainty contexts and that the change-driven (agile) approach is preferable for contexts with high uncertainty. However, in their model, only project-specific factors are discussed.

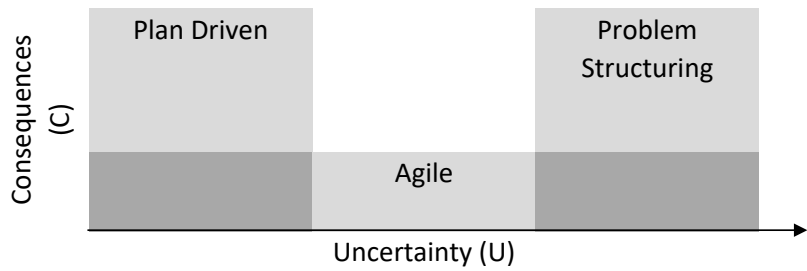


Figure 7. The ISDM selection model of Howell et al. (2010).

Perhaps the best-known ISD selection model is Boehm's and Turner's (2004) five-dimensional Home Ground Polar Chart Model (Figure 8). Their model proposes that the selection between agile and plan-driven methods should be based on dynamism, culture, size, criticality and personnel. According to them, if IS requirements are fixed (dynamism dimension), work needed is well organized (culture dimension), the number of personnel involved is high (over one hundred) (size dimension), the results of ISD are critical (criticality dimension), and personnel are not highly skilled (personnel dimension), then plan-driven methods should be used. At the other end of the scale, agile (change-driven) methods should be used. Their model, although rather comprehensive, includes only (technical) IS/IT project characteristics and builds on the assumption that development teams are “fixed,” i.e., not able to be selected for a project. This might have been true in the internal ISD projects conducted prior to this millennium but seldom describes current outsourced ISD work where a different ISD vendor could be selected for each ISD project. Moreover, in the model of Boehm and Turner (2004), the uncertainties of ISD development outcomes are measured with the dynamism of requirements, that is, changes per month. It is possible to use these metrics only after the start of an ISD project when ISDM(s) have already been selected. In addition, references to the impacts of business development context characteristics are not included explicitly.

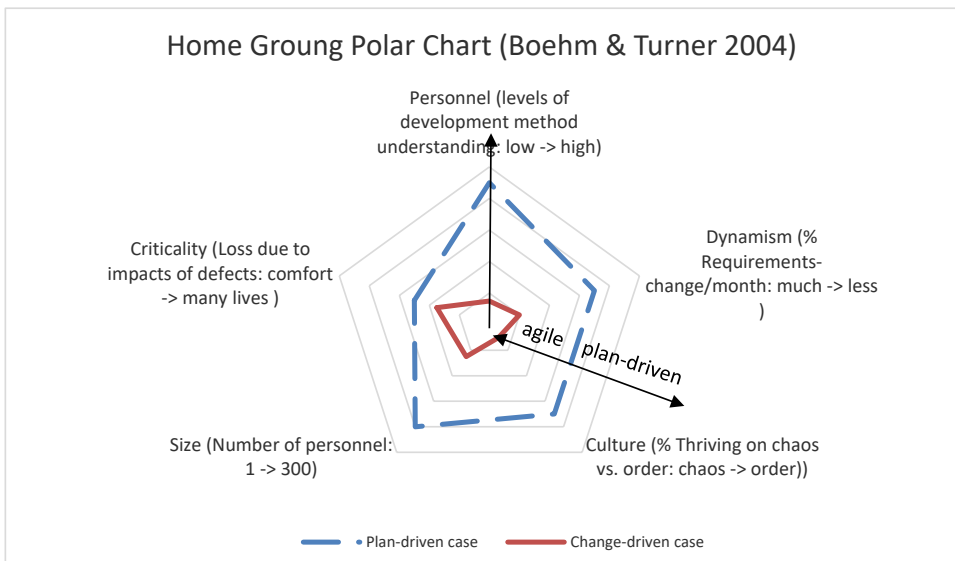


Figure 8. The ISDM selection model of Boehm and Turner (2004).

Ahimbisibwe et al. (2015) crafted a large “Home Ground Polar Chart” with 28 selection factors to guide ISD method selection. They picked the selection factors from the literature and classified them into four categories: organizational, team, customer and project. In practice, having to pay attention to 28 factors makes any the IDS method selection model conceptually and operationally difficult, especially since some of the factors are conceptually inconsistent and overlapping. I regard Ahimbisibwe et al.'s (2015) model as an extended version of the Boehm and Turner (2004) model. The discussion in the paragraph above could be repeated with one added remark. The Ahimbisibwe et al. (2015) model includes organizational culture as one of the 28 factors. They suggest that if mechanistic and bureaucratic structures characterize an organization, then plan-driven ISD methods are preferable. Change-driven ISD methods are preferable for organic and flexible structure organizations. I recognize that organizational structure may resemble business context maturity since high maturity typically requires rigid organizational structures. Investigating the impact of organizational structures offers a potential venue for future research.

Some other ISD method selection models have also been proposed. De Weger and Franken (1997) proposed a two-dimensional model where the reductions of efficiency risk (and the neglecting of future situational risks) guide the selection of plan-driven ISD methods. Correspondingly, the reductions of future situational risks guide the selection of change-driven ISD methods (should efficiency risks be unimportant) (De Weger and Franken 1997). Tang and van Vliet (2012), in turn, suggested that the developer team experience is one of the key determinants of complexity, along with the size and difficulty of the developed IS. According to

them, much experience supports the selection of solution-driven (plan-driven) ISD methods and little experience problem-driven (change-driven) ISD methods.

2.7.4 Challenges with Prior ISDM Selection Models

There are some challenges with the prior ISDM selection models, one of which is how to handle uncertainty. All development projects have some amount of uncertainty related to development outcomes, and the problem lies in how to recognize it and manage with that uncertainty. In some models, it is preferred that the project result uncertainty be evaluated after rather than before. For example, in Boehm and Turner (2004), selection model uncertainty is measured by the dynamism of requirements (change per month), which may be measured only after the project is underway (and an ISDM is already selected). However, adjusting the ISDM during a project is challenging, and as Cusumano et al. (2009) state, the project's first stage should be selecting a suitable ISDM. This means that project uncertainties should be evaluated at the project's starting point.

When ISD projects are regarded as “organizations within organizations,” and when ISD projects are deemed part of business development, then it is clear that ISD projects cannot be executed in a “vacuum.” Rather, the organizational/business context has to be taken into account in ISD method selection (and in ISD work). This approach does not, however, describe the ISD selection models of prior literature. They consider solely or primarily ISD project characteristics as the selection criteria, and environmental aspects and factors like the customer business process are disregarded. The silent assumption seems to be that a project is an implementation of its context, and by analyzing project parameters, the context will be handled automatically. The fallacy in this approach is that projects are analyzed mainly from a project management point of view and business context-specific factors are assumed to be handled in requirements, or they are totally ignored.

In addition, in our review of the literature (Lagstedt and Dahlberg 2018a), we were unable to find thorough empirical evaluations of the usefulness of ISDM selection criteria and/or models, nor of the use experience and popularity of alternative ISDM selection models. I believe that the popularity of ISD outsourcing could be the reason for this. At the time robust ISD practice and research-based ISDM models were finally proposed, IS user organizations had lost their interest in ISD and ISDMs.

2.8 Sourcing of the IS Development

During the 1990s and 2000s, the norm was to outsource ISD. IS research provided and still provides needed theoretical and empirical evidence (e.g., Alagheband et al. 2011; Lacity et al. 2009). The transaction cost theory and resource-based views explain that ISD outsourcing offers the potential to lower transaction costs and achieve other business benefits when the strategic and competitive significance of in-house ISD is low and there are well-functioning markets. As a considerable portion of ISD projects are currently outsourced, ISDM selections are outsourced as well. Clients typically pursue risk mitigation with outsourced ISD; the development risk is transferred to an external specialist organization, an IS supplier (Taylor 2007). For this reason, clients prefer to buy solutions rather than resources. However, new change-driven ISDMs require clients' continuous involvement in the ISD project and have moved the development risk back to the client side, and digitalization has increased the strategic importance of IS, so the pure outsourcing is not as obvious an option as it used to be.

Digitalization has changed the strategic and competitive significance of ISD. It now focuses on IS and applications that enable and support the development, delivery and operations of an organization's products and services, or even *are* the products and services. This happens in fully digital but also in previously non-IS or digital-intensive businesses and business areas (Borg et al. 2018). The business criticality of ISD is reborn, in a way, in IS user organizations (Von Bary and Westner 2018; Borg et al. 2018; Fuggetta and Di Nitto 2014). For ISD, the depicted change means, among other things, that organizations consider the back-sourcing of ISD activities as they seek new balances between outsourced and in-house ISD (Von Bary and Westner 2018). Prior research indicates that two main reasons cause back-sourcing considerations. Firstly, some organizations have been disappointed with the outcomes of ISD outsourcing (Von Bary and Westner 2018; Moe et al. 2012). Secondly, and more importantly, digitalization has profoundly changed the business environments of organizations, that is, the business criticality of digital data and ISs. Organizations respond to such challenges by enhancing their business strategies and, as part of that, by rethinking their IS sourcing strategies (Von Bary and Westner 2018; Borg et al. 2018; Fuggetta and Di Nitto 2014).

2.8.1 *Different Sourcing Strategies*

Although ISD outsourcing continues to be a strong ISD sourcing option (Ebert et al. 2016; Kaiser and Hawk 2004; Madsen 2017), IS user organizations (clients) consider outsourcing, insourcing, back-sourcing, co-sourcing and multisourcing as

their ISD sourcing alternatives (Von Bary and Westner 2018; Johansson et al. 2017; Madsen 2017). I define these terms in the context of ISD as follows:

- Outsourcing: an IS user organization mandates an IS supplier to develop an IS. Responsibility and risks are moved from IS client to IS supplier.
- Insourcing: an IS user organization executes the development of an IS inside the organization.
- Backsourcing: an IS user organization takes at least one outsourced ISD work from the IS supplier(s) to develop an IS back into the organization.
- Co-sourcing: an IS user organization and an IS supplier collaborate closely to develop an IS.
- Multisourcing: an IS user organization and several IS suppliers collaborate closely to develop an IS.

Co-sourcing and multisourcing can be seen as specific forms of backsourcing (and insourcing). An IS user organization needs ISDM selection competence in all these sourcing alternatives. As discussed above, attempts to solve the perceived challenges of ISD outsourcing (Von Bary and Westner 2018; Ebert et al. 2016; Johansson et al. 2017; Madsen 2017) and changes in the strategies and business models of organizations caused by digitalization (Von Bary and Westner 2018; Borg et al. 2018) are the motives behind backsourcing.

Although ISD outsourcing has a rigid theoretical and practical knowledge basis (e.g., Von Bary and Westner 2018; Lacity et al. 2009) to save money, to reduce IS development risks and to free resources for core business (Ebert et al. 2016; Ross et al. 2006; Taylor 2007), empirical research has delivered mixed results (e.g., Alagheband et al. 2011; Nyrhinen and Dahlberg 2007). Furthermore, for a long time, ISD outsourcing was a hype term and a management fashion (Abrahamson 1996; Madsen 2017), which led some organizations to have unrealistic expectations. Quality and cost problems (Von Bary and Westner 2018; Ebert et al. 2016; Madsen 2017), as well as inflexibilities in reactions to IS user organizations' radically changing business (Von Bary and Westner 2018), have been reported as typical ISD outsourcing challenges. Partial or full backsourcing is one of the means to correct past miscalculations (Von Bary and Westner 2018; Ebert et al. 2016; Madsen 2017). Finally, backsourcing is a rational preferable alternative, even according to the theoretical basis of (out)sourcing if ISD is or becomes business critical and/or part of the core business in an IS user organization (Von Bary and Westner 2018; Borg et al. 2018)

2.8.2 *Different Perspectives of Different Development Parties*

In all sourcing situations (other than insourcing), there are two different organizations involved in the software development project: a client (i.e., customer/buyer/acquirer organization) who will utilize the project's result and a supplier (i.e., vendor/contractor/seller/developer organization) who develops the result. Both organizations have their own business goals, which are contradictory in some cases (Berki et al. 2004; Savolainen et al. 2015; Taylor 2007).

The supplier, i.e., the software development company, lives off its development projects; the projects itself are the business, and traditional project performance criteria (i.e., time, money and scope) are preferred in success measures because they are directly connected to supplier business objectives. That is understandable since IS suppliers are able to influence (only) those metrics with their own actions and perceive the high values of performance metrics as a means of generating more business. In addition, the argument is that money spent, time used and deliverables are objective, tangible and easily measurable (McLeod et al. 2012). However, as discussed in Chapter 2.1, these measures do not guarantee business success for a client, so the supplier point of view is not automatically optimal for a client. A project that has been a catastrophe for the customer, and the end product never used, could be economically successful for the software supplier.

For an IS supplier, project execution is a process, and to achieve efficiency, it is wise to harmonize and standardize this process to a reasonable extent (Ross et al. 2006, pp. 27–33). This means that all the supplier's projects will have the same process and same methods applied. In these cases, the development methodology is tailored for a company based on the company's size, the market in which they are operating and the types of projects in which they are engaged, and it is not easily changed (Coleman and O'Connor 2008). From a software development company perspective, this brings many benefits: projects are similar, comparable and, on some level, predictable; people in projects are easily replaceable, so training costs could be minimized like maintenance costs; no resources have to be used to maintain expertise with many methods (Hammer 2010; Karlsson and Ågerfalk 2009; Ramasubbu and Balan 2009; Slaughter et al. 2006). In addition, Mohan and Ahlemann (2013) point out that there are indirect costs for developers to adopt and use new methods. It is natural that suppliers would try to avoid those costs.

For a client, an ISD project itself is seldom the core business but rather a (core) business enabler, and the business objective of an ISD project is to utilize its results as profitably as possible (Savolainen et al. 2015; Taylor 2007). The client organization evaluates the outcomes of an ISD project primarily from a business benefits perspective, that is, as a means of increasing value to customers, internal efficiency and future competitiveness (Ika 2009; Pinto and Slevin 1988). The client

expects the development project to be tailored to the organization's business development situation; clients do not necessarily benefit much from the supplier's harmonized and optimized development process. For clients, especially if they seldom execute ISD projects, every project is unique, including the costs of ISD method adoption. A client, who is not so familiar with software development, is often guided by supplier, and in the worst case, the result is that projects and their objectives are fulfilled but results are not usable for the customer at all (Ahonen and Savolainen 2010; McLeod et al. 2012). In those cases, only the project perspective is taken into account, and the "organizational model" or system perspective is not understood (Lycett and Paul 1999).

If considering different organizations in different sourcing situations, it is possible to see that organizations' roles differ in different sourcing situations. It seems obvious that IS user organizations with insourced ISDs have, at the minimum, some ISDM and ISDM selection competences. These competences are needed in backsourcing as well since ISD is insourced for at least the execution period of an ISD project (Johansson et al. 2017; Kaiser and Hawk 2004). In co-sourcing and multisourcing, IS suppliers are typically responsible for the operative-level coding and implementation of software, and IS user organizations are responsible for business and use cases/requirements, user testing and business (process) development. IS user organizations also bear accountability for the success of ISD projects. Due to their accountabilities, IS user organizations need to understand the pros and cons of various ISDMs suitable for their ISD projects (Kaiser and Hawk 2004). Based on such understanding, an IS user organization is able to select the most suitable ISDM for an ISD project and the most suitable IS supplier to implement the project. So, it is risky to allow an IS supplier to select the used ISDM alone in ISD co-sourcing and multisourcing (Taylor 2007), even though the common expressed goal for both organizations is to make the project successful. The client needs to be assured that the selected ISDM suits the needs of the business development context and situation.

To summarize, digitalization drives IS client organizations toward new balances between outsourced and in-house ISD by creating strategic incentives for backsourcing and insourcing. IS client organizations, when insourcing, backsourcing, co-sourcing and multisourcing ISD, need to have a sufficient understanding of ISDMs and their selection. Sufficient understanding also helps them avoid lock-ins and high switching costs (Von Bary and Westner 2018; Kaiser and Hawk 2004), as well as management fashions (Abrahamson 1996; Alvesson and Spicer 2012) in ISD sourcing.

3 **PROPOSED IS DEVELOPMENT METHOD SELECTION FRAMEWORK**

Figure 9 shows the proposed contingency theory–motivated framework for ISD method selection. The framework is crafted by combining the above-discussed theoretical dimensions and concepts of organizational and information systems development. The vertical dimension of the framework depicts and matches the certainties (characteristics) of current and future business development and IS development, that is, how the characteristics of ISD match those of the related business/organizational development context. The horizontal dimension does the same in order to match the certainties (characteristics) of business development outcomes and ISD. For theoretical clarity, both dimensions of the framework were classified into only two classes. In reality, both dimensions may have multiple values between the two ends of the scales.

| | | |
|---|---|---|
| High business execution certainty (and high objectives predefinition certainty on how ISD supports business development) | <div>Leans toward plan driven ISDMs</div> <div>Leans toward change-driven ISDMs</div> | Plan-driven ISDMs should be selected and used |
| Low business execution certainty (and low objectives predefinition certainty on how ISD supports business development) | Change-driven ISDMs should be selected and used | <div>Leans toward plan-driven ISDMs</div> <div>Leans toward change-driven ISDMs</div> |
| | Low business development outcomes certainty (and low certainty on how ISD supports outcomes achievement) | High business development outcomes certainty (and high certainty on how ISD supports outcomes achievement) |

Figure 9. Proposed contingency theory–based framework for ISDM selection.

The framework describes four distinct business contexts and proposes how the two main categories of ISD methods fit each context. Contexts, where both certainties are either low or high, provide clear guidelines for ISD method selection. The other two are borderline contexts where either type of ISD method could be used. High uncertainties of business execution cause-effects and low business maturity and business creation, together with high uncertainties of business development outcomes (e.g., balanced scorecard metrics), describe business development contexts where change-driven ISD methods should be selected and used to support and enable business development. The characteristics of change-driven ISD methods are similar to the characteristics of these business contexts. So-called greenfield development of a new business is a descriptive example, and business opportunity creation (Alvarez and Barney 2007) describes these types of situations. However, should the uncertainties of a business context be extreme, then it could become impossible to make any meaningful ISD method decisions (Thompson 2003, p. 135). The breakdown of the development situation into its constituent parts and problem structuring are recommended for these situations (Howell et al. 2010).

The opposite corner of the framework proposes that plan-driven ISD methods be selected and used. A high certainty of business execution (Thompson 2003), high business maturity (Röglinger et al. 2012) and business opportunity discovery (Alvarez and Barney 2007) describe these business development contexts, in which the characteristics of plan-driven ISDMs fit well. Further development of a well-functioning business and its processes, with no need for disruptive changes, is a descriptive example.

Business process re-engineering with challenging, well-defined objectives and high uncertainties regarding how business processes could be changed and developed to achieve such objectives is a descriptive example of the framework's right-low corner business context. New business opportunities seeking a well-functioning business, for example, by enlarging the business into a new market, is a descriptive example of the framework's left-high corner business context. In these two contexts, the selection of change-driven ISD methods is probably always a safe bet. However, if the uncertainty is low or can be reduced, then plan-driven ISD methods probably become preferable. It might also be possible to start with one type of ISD method and then switch to another, as in the prototyping method suggested in the 1980s (Boehm et al. 1984). A lot of empirical research would be needed to define clearer ISD method selection guidelines in these two business contexts.

I concur with Benediktsson et al. (2006) that highly detailed, that is, atomized ISD method selection models, are difficult to use conceptually and also in practice. Because of that, a simplified two-dimensional selection framework is presented here (Figure 9). However, even though the selection framework is simplified, it is

solidly based on organizational development and IS development theories. Previously studied concepts like BPM and business process maturity models, as like studies and criteria relating to uncertainties of desired outcomes, can be applied here.

4 RESEARCH APPROACHES

As stated, the purpose of this dissertation is to develop and present a framework of ISDM selection and also study the organizational reasons to do or not do ISDM selection. The overall purpose is to understand the ISDM selection phenomenon in both client and supplier organizations, lower the threshold to make project-specific ISMD selections and provide a tool for it. So, it could be seen that this study has both descriptive and prescriptive elements, and it is partly normative in nature.

Traditionally, the positivist research approach is seen as “value-free;” i.e., it is possible to describe the current state of affairs, but the desired state of affairs cannot be solved scientifically (Orlikowski and Baroudi 1991). Having a very strict interpretation of “value-free,” it is impossible to make normative studies when applying the positivist research approach, and because of that, I claim that my study is not purely positivist but rather partly positivist and partly interpretive. This kind of approach has certain challenges, and as such, it is important to discuss the philosophical backgrounds and methodological choices of the study.

4.1 Ontology

IS research is seen as partly computing science and partly social science (Stowell et al. 1997), and when computing science and social science traditionally have rather different points of view to reality, it is important to have ontological discussions case by case (Orlikowski and Baroudi 1991). One of the main ontological questions is whether the reality is objective (i.e., existing without changing regardless of the observer) or subjective in nature (i.e., a product of individual consciousness) (Burrell and Morgan 1979, p.1; Eriksson and Kovalainen 2008; Orlikowski and Baroudi 1991). I do not see this question to be black and white; in my study, both perspectives are utilized. The presumption behind the proposed ISDM selection framework is that it is generalizable, i.e., applicable to all organizations (in different situations), and this could be seen as a rather objective approach. On the other hand, I agree that, ultimately, there is an individual who decides whether the framework is applied and how; these kinds of decisions are often made through social interaction. So, in addition to probing the ISDM selection framework, I have been interested in how ISDM selections are done, if at all. This, in turn, is a rather subjective approach: different organizations

and different people have different perspectives and reasons for their deeds, and the reasons are not automatically rational ones. Also, organizational situations change constantly (Alvesson and Spicer 2012; Eriksson and Kovalainen 2008; Orlikowski and Baroudi 1991).

So, it could be seen that, in my dissertation, the assumption is that reality has two different levels, the higher objective level where the ISDM selection framework is presented and the lower subjective level where the ISDM selection is considered in practice. This duality reflects the epistemological and methodological consideration as well as method selection and discussion parts of the dissertation.

4.2 Epistemology

With the two above-mentioned perspectives of reality, it is important to understand the different grounds for knowledge in different reality levels. As the framework level of the dissertation is rather abstract and general, and the reality is seen as objective, it is assumed that it is possible to find out whether the proposed framework is usable, and knowledge is “hard, real and capable of being transmitted in a tangible form” (Burrell and Morgan 1979). The framework is seen to be testable, and the objective of the study is to formulate a law-like generalization guiding ISDM selection in ISD projects. It could be said that this approach is based on positivism (Burrell and Morgan 1979; Orlikowski and Baroudi 1991; Stowell et al. 1997).

On the other hand, if ISDM selection situations are examined in practice, it is agreed that people and situations may affect how the situation is understood and how important the ISDM selection is perceived to be, or if it is understood at all. In situations like this, the reality is dependent on the actors of the situation, and detailed and accurate law-like generalizations are difficult to make. Reality in these situations is seen as a social construction, and knowledge is gained only through these constructions, through the meanings that people assign to ISDM selection. When the main emphasis here is to understand the selection situation, a positivist approach is not the most appropriate, and an interpretive approach is found to be more meaningful (Klein and Myers 1999; Orlikowski and Baroudi 1991; Stowell et al. 1997).

4.3 Methodology

As Eriksson and Kovalainen (2008) point out, epistemology and methodology are closely related, methodology having a practical point of view to question “how we

come to know the world” (Eriksson and Kovalainen 2008). A rather traditional way of connecting ontology, epistemology and methodology together is that if reality is seen as an objective and positivist approach selected on the grounds of knowledge, a quantitative methodology is the correct choice and statistic and mathematical analysis should be used (Myers 1997; Orlikowski and Baroudi 1991). Otherwise, qualitative methodology should be preferred. Burrell and Morgan (1979) put this qualitative-quantitative classification into the wider context of research related to social science: according to them, it is important to understand whether the approach is more ideographic (i.e., relying only on [qualitatively] exploring and understanding people involved in the situation) or nomothetic, (i.e., relying on systematic protocol and [quantitative] techniques employed in the natural science). They claim that the ideographic approach suits the subjectivist approach to social science, while the nomothetic approach is a more positivist approach (Burrell and Morgan 1979).

However, as Myers (1997) states, the question of ontology and epistemology of the research is not about whether numbers are used but about positioning the underlying philosophy of the research. Actual data collection and analysis methods can be independent of the underlying epistemology (Eriksson and Kovalainen 2008; Klein and Myers 1999; Myers 1997).

Although testing the proposed ISDM selection framework was seen as clearly positivist and nomothetic, searching the understanding of the existing practices of ISDM selection in organizations is a more interpretive approach. So, both qualitative and quantitative methodologies are selected and data are collected by utilizing a mixed-methods approach. Qualitative methodology makes it possible to discuss the suitability of the proposed framework and also enable reasoning and counter-arguments to be discussed. In addition, with qualitative methodology, it is possible to find information relating to ISDM selection situations, which are unknown and difficult to predict based on prior literature. So, with qualitative methodology, it is possible to find answers to questions relating to the framework and also to questions relating to its possible use.

Also, quantitative approaches were utilized in the research. With a systematic literature review, the current knowledge of ISDM selection was collected and the ISDM selection criteria were compared to the proposed ISDM selection framework. In addition, when testing the recommendations from previous ISMD selection models, survey-style Likert-scaled questions were used in the data collection, which is clearly a quantitative method of data collection. However, the purpose here was not to find any cause-effect relationships or make any other statistical analysis but to find out if the recommendations are still valid or not. In addition, voluntary comments about the recommendations were collected to get a better understanding of why they were supported or rejected. Overall, the goal was

to get a better understanding of ISDM selection situations and possible assumptions relating to them.

4.4 Methods

Although this dissertation consists of separate studies done one by one, the overall purpose has always been to answer the general research question (GRQ_1). The separate studies formulate one overall study in this dissertation, and as already stated, a mixed methods approach is utilized here. This approach is well suited for this kind of research, in which reality is viewed from different perspectives and research questions are rather complicated (Yin 2009). In addition, the ontological and epistemological assumptions of this study support the mixed methods approach. Petter and Gallivan (2004) point out that there are three camps in the “war” for dominant research paradigms: purists, situationalists and pragmatists. Purists accept only one paradigm, and they believe that positivist and post-positivist approaches (such as interpretivism) cannot be mixed. Situationalists believe that certain methods are appropriate for specific situations, i.e., qualitative and quantitative research methods could be used but not mixed in the same situation. On the contrary, pragmatists see that the integration of methods from different paradigms enhances the credibility of findings (Petter and Gallivan 2004). In this study, the reality is seen as more important than the purity, and as pointed out in ontological and epistemological considerations, both subjective and objective points of view exist, a pragmatic, mixed methods approach is a sound choice here (Greene et al. 1989; Johnson and Onwuegbuzie 2004; Petter and Gallivan 2004).

Based on the ideas of Greene et al. (1989), Petter and Gallivan (2004) have developed a framework for mixed methods research. They have found five different purposes for mixed methods: triangulation, complementarity, development, initiation and expansion. Three different approaches are used: sequential, parallel and independent see Figure 10.

| <i>Purposes</i> | <i>Approach</i> | | |
|-----------------|-----------------|----------|-------------|
| | Sequential | Parallel | Independent |
| | Triangulation | | |
| | Complementarity | | |
| | Development | X | X |
| | Initiation | | |
| | Expansion | | |

Figure 10. Framework for mixed methods research (Petter and Gallivan 2004, adapted).

In this study, the purpose is clearly the development of a new ISDM selection framework, and as presented in Figure 1, the approaches have been both sequential (i.e., first a case study, and then a systematic literature review and interviews) and parallel (i.e., testing the framework, testing the recommendations of prior research and generating understanding about ISDM selection in organizations with one interview) (Figure 10). This is in line with Cresswell and Plano Clark's (2011) multiphase mixed methods design approach, which combines a concurrent and sequential collection of qualitative and quantitative data sets; they use pragmatism as an umbrella foundation in concurrent (parallel) studies and constructivism and postpositivism for different sequential studies. In the multiphase design approach, qualitative and quantitative strands have equal emphasis, which allows each individual study to address its own research questions that evolve to address a large research problem (Cresswell and Plano Clark 2011).

4.4.1 Case Study

In the first study of this dissertation, two failed real-life IS projects were examined after their completion (ex post). An IS development project was the unit of analysis. We deemed that two cases from the ends of the project control scale are enough to achieve a limited theoretical replication (Eisenhardt 1989; Yin 2009), that is, to demonstrate our idea of matching the (certainty-uncertainty) characteristics of business contexts and IS development methods. We selected the projects from two large organizations in different industries to minimize industry and organizational culture biases.

In the empirical research, we followed the recommendations of Eisenhardt (1989) and Yin (2009). To avoid the potential risk of research questions, a priori theoretical constructs and tentative propositions biasing data analysis and limiting findings (Eisenhardt 1989), we also sought for rival theoretical explanations. We selected the explorative case study research method for data collection and analysis (Yin 2009). We used written interview and case protocols and collected data from multiple sources for triangulation (Yin 2009). In the data analysis, we focused on project failure reasons, project success expectations (that were not achieved) and the relations between the applied IS development project methods and their business contexts. A trivial result to be expected is that the failure reasons and success expectations of the projects differ due to several anticipatable reasons (Yin 2009). An important question is still whether the collected and analysed data establish a true or even reliable description of the investigated cases. The fact that the projects were discontinued, and were therefore considered failures, is important for the reliability and validity of the data since there were no reasons to indicate/claim anything else.

4.4.1.1 The Plan-Driven Project Case

A publicly listed company with operations in over 200 locations in 70+ countries and close to 20 000 employees developed an IS to replace several legacy ISs in 2009–2010. This large project was considered business critical and received strong business executive support. The project was deemed as an IS replacement project with a product data focus and no new functional requirements. The company applied waterfall- and stage-gate-based IS development and project management methods to execute its IS development projects and followed the IS project management guide crafted in the company for such purposes. The project team members of the case had a good understanding of the methods used in the project.

Nelson (2007) discovered that failures during the requirements specification phase, which precedes the actual IS development, account for a large part of IS project failures in plan-driven projects. Hence, we collected significant amounts of data on how requirements and business target specifications were done with the overall objective to reveal project outcomes and their relation to the business context of the project. We extensively used three data collection sources of the Yin basket (Yin 2009), namely, documentation, archival records and interviews. A contact person from the company helped us organize interviews and collect documents. We defined and updated a written interview protocol to guide interviews and select interviewees with different professional, organizational hierarchy and project role backgrounds. During the recorded interviews, we observed the behaviours of the interviewees and documented observations in an interview diary. We conducted eight group interview sessions and interviewed six persons individually after these sessions. The interviewees ranged from project managers to IT managers and included the project owner and the responsible system architect. Business professionals were underrepresented; we were unable to avoid that.

We prepared semi-structured interview questions for each session/interview and continued interviewing until saturation was reached with no major new findings. During these exploratory sessions, we asked interviewees to elaborate on their experiences about the various methods used in the project as well as about prior IS development projects. Our contact person and an information-gathering group screened documents before they were given to us in order to prevent access to business-critical product data that were irrelevant for our research. The analysed documents included project management guidelines, project reports, process models, taxonomies and planning documents.

During the data analysis, two researchers examined data independently and separately. The two researchers then compared and agreed upon the findings, discussed them with a third researcher and probed with the results of IS project failure/success research, reviewed above. Finally, (in)consistencies in the

alternative sources of collected data were used to triangulate the data and the findings. It is worth mentioning that a significant number of data analysis findings fall outside the scope of the present study.

4.4.1.2 The Change-Driven Project Case

A university of applied sciences with over 10 000 students and 30+ educational programs, one-third international, conducted the change-driven project in 2014–2015. We collected data in 2016. The university is well known for its IS curricula, some of which have existed for decades. The university decided to develop an IS for one of its new business areas. The objective was to later roll out the new IS to other business areas. The IS was deemed unique with no prior or comparable IS available. On the other hand, ideas were immature regarding how to execute business in the new business area and what the expected outcomes of the IS-enabled business development should be. The change-driven scrum method was selected to facilitate learning, continuous communication with stakeholders and to reduce uncertainties. The existing infrastructure and other IS technologies widely used by the university were selected to limit technology risks.

Data collection differed from the company case since one of the authors had participated in the IS development project as a product owner. During the project, however, there were no plans or even hints that its outcomes would ever be investigated. Because of this, we claim that we also followed the exploratory case study method here instead of the action research method (described in, e.g., in Baskerville 1999). In this unique situation, we had access to all project documents and archival materials, such as overall project objectives, background documents, primary use cases, process models, product backlog with prioritized user stories and test documents. The product owner/researcher's direct observation notes about the participants' behaviours during face-to-face small group and project meetings were also available to us. We still decided to use a written case protocol to guide data collection and analysis, so it became possible to establish a holistic picture of the project and to analyse descriptions about development method selection and usage, IS and business (process) development relations and project outcomes (failure reasons and success metrics). We conducted three interviews after the document analysis to validate and triangulate analysis results. We also asked interviewees to confirm in writing that their interviews were documented and interpreted correctly. The presence of a researcher as a participating observer is beneficial for data collection (Yin 2009). On the other hand, such a researcher cannot act as an external observer, and there is a risk of interpreting the researcher's activities too positively. Data analysis and findings triangulation were otherwise done as they were in the plan-driven company case.

4.4.2 *Systematic Literature Review*

The second research method in this dissertation was a systematic literature review. According to Kitchenham (2004), the reason for systematic literature review is to either summarize the existing knowledge, identify research gaps or formulate a framework/background for new research activities (Kitchenham 2004). In this study, the objectives were to verify the existence of the proposed research gap, to summarize existing knowledge of ISD method selection, and to analyze whether or not the proposed framework captures the findings of previous ISD method selection research. Based on the ideas of MacDonell et al. (2010), we deemed the systematic literature review a robust and sufficient research method to answer the research questions. The literature review results were also used as the theoretical background and basis in our following research activities.

We followed the advice of Kitchenham (2004) and formulated a written research protocol to guide the literature review. A research protocol was composed to guarantee that the research was done consistently: the protocol was clearly followed, the researcher's expectations did not affect how literature was selected or analyzed, the whole research process continued uniformly (Kitchenham 2004). The first step in formulating a research protocol was conceptualization: what is already known, what the key terms are and what could be good data sources in the review (vom Brocke et al. 2009).

The conceptualization was done by reading some seminal textbooks (i.e., Avison and Fitzgerald 2006; Bocij et al. 2015; Boehm and Turner 2004; Sommerville 2011) and scanning top information systems science (ISS) and computer science (CS) journals. Next, as Kitchenham (2004) suggests, a preliminary search was conducted in ProQuest and Google Scholar to estimate publication volumes and types and to design useful search term strings and limitations. In the preliminary search, different combinations of search terms related to software development method selection and business processes were used; articles were calculated, and the impact factors of the articles' publications were checked.

Kitchenham (2004) suggests that preliminary searches be done for a research strategy definition, but in this case, the preliminary search was helpful not only for research strategy but also for the whole research protocol formulation. It was very difficult to compose the research protocol without the preliminary search and conceptualization, so those were done first, and only after that was it possible to decide research strategy and study selection criteria and procedures, to define quality assessment procedures, and decide how the extracted data would be synthesized. Although the research protocol was defined in the beginning, abduction was used during the research process: new keywords and search strings were chosen based on the findings of searches done.

It is often suggested to concentrate only on leading journals and top conferences (if conferences are included at all) (see e.g., vom Brocke et al. 2009; Webster and Watson 2002), but the preliminary search revealed that there are quite a few articles discussing information system development methodology selection, so lower-level journals and conferences found in the selected databases were also included. In addition, even though conference proceedings often have a lower valuation (see, e.g., Vom Brocke et al. 2009), they are important in indicating research gaps and forthcoming research. The purpose here was to find as many articles related to the topic as possible.

In addition, a multidisciplinary approach was applied. Although most of the emphasis was put on information systems development in this study, it was not only information system science (ISS) or computing science (CS) publications being dealt with. While selecting good sources, Kitchenham's (2004) worry about publication bias was kept in mind. She defined publication bias as a problem where positive results are more likely to be published than negative ones (Kitchenham 2004). In this study, publication bias is seen as a wider concept; all publications may tend to publish (from their viewpoint) positive results rather than negative ones, but it is also important to realize that all publications have a limited scope of their own: they do not publish anything that is too far outside of their scope. Subjects inside the scope are preferred, and subjects partly outside it are easily avoided. The scope of a publication is related to the publication's discipline. However, as ISS and CS are interdisciplinary, research findings of ISD method selection can be found in the outlets of various academic disciplines. Publication bias in this context means that the concentration of literature research is too limited to the type of publication, so two different sources were regarded here: 1. discipline bias refers to selecting only single-discipline publications and disregarding publications in other disciplines, and 2. quality bias refers to selecting only a couple top journals, which may have too narrow a scope for the subject at hand.

To avoid publication bias, Kitchenham (2004) recommends scanning "grey literature" and conference proceedings. Consequently, instead of selecting a handful of (top) journals from selected disciplines (which might avoid subjects partly outside of their scope), different kinds of databases having a multidisciplinary approach and a wide coverage of journals and conferences were selected. Three different types of databases were used in the literature search: ISS- and CS-specific (ACM Digital Library, IEEE/IEEE Xplore Digital Library), multidisciplinary (ProQuest, ScienceDirect and Academic Search Premier EBSCO) and reference databases (Web of Science, Scopus and Google Scholar).

The preliminary search found two types of challenges. Firstly, only a handful of articles addressing ISD method selection were found. In addition, articles that mentioned both business process maturity and software development methodology selection were not found at all in the preliminary search. Secondly, some research

was poorly designed, conducted and documented, and we pondered a lot about whether they should be included. Because of these challenges, the scope was broadened by concentrating only on information systems development method selection (leaving behind business process maturity). These challenges also justified the above-mentioned decision to have a multidisciplinary approach and include both journal articles and conference proceedings.

Although some studies had clear shortages, all peer-reviewed articles were included, regardless of their quality or scientific impact. The rationale behind this is: 1. the databases are scientific, 2. the peer reviewers are assumed to be professionals, 3. in some cases, it is difficult to see if the problem is only in the report or if there have also been problems in the research, and 4. the main emphasis of the study was to find as much scientific discussion about the phenomenon as possible. If the quality criteria were too high, the number of articles found would have remained very low, and there is a risk that results would have been based on just a few researchers' points of view. Of course, when some research was at least poorly documented, there is a risk that, in those articles, only stereotypes are restated, and their value is at least questionable. After much pondering, this risk was accepted.

4.4.2.1 Literature Search

The literature search was done during autumn 2015. It was conducted database by database since databases had different search practices, for example, what search operators and operator combinations were allowed. Instead of one long search string, we had to formulate four search strings to deal with the limitations of the databases. These are shown in Table 3. Some databases have tight restrictions on how many search terms could be used. For some databases (for example, IEEE), even some of the four selected search strings were too long; the string had to be divided into shorter fragments, and the search was done in sub-searches. Altogether, 32 (8 databases and 4 search strings) different searches were done. The downside to this is that different searches returned independent results, so there were some duplicates in different results. Duplicate cleaning after each search was considered too laborious and unnecessary, so duplicates were not cleaned until the abstracts were filtered ("Filter 3," Table 5). So, the total amount of articles (1419 in Table 5) is over-optimistic; a rough approximation is that one-third were duplicates, which means that the real amount is approximately 1000 articles.

The operator NEAR was used because, in preliminary searches, it was found that if terms are too far away from each other, they are not related and the article is discussing something totally different. But, if there were less than 20 results with

NEAR, or if the NEAR operator was not available in the database, a wider search was done with the operator AND (Table 3).

Table 3. Search strings

| | search string with NEAR operator | search string without NEAR operator | Google Scholar search |
|---------------|--|--|---|
| First search | ((<i>"software development"</i> OR <i>"system* development"</i> OR <i>"application development"</i> OR <i>"software engineering"</i> OR <i>"system* engineering"</i> OR <i>"application engineering"</i> OR <i>"software production"</i> OR <i>"system* production"</i> OR <i>"application production"</i> OR <i>"software project*"</i> OR <i>"system* project*"</i> OR <i>"application project*"</i>) NEAR (<i>select* OR choos* OR choice</i>)) | ((<i>"software development"</i> OR <i>"system* development"</i> OR <i>"application development"</i> OR <i>"software engineering"</i> OR <i>"system* engineering"</i> OR <i>"application engineering"</i> OR <i>"software production"</i> OR <i>"system* production"</i> OR <i>"application production"</i> OR <i>"software project*"</i> OR <i>"system* project*"</i> OR <i>"application project*"</i>) AND (<i>method*</i>) AND (<i>select* OR choos* OR choice</i>)) | <i>allintitle:"software development method"</i> OR <i>"information system development method"</i> OR <i>"application development method"</i> OR <i>"software engineering method"</i> OR <i>"information system engineering method"</i> OR <i>"application engineering method"</i> |
| Second search | ((<i>"software development process"</i> OR <i>"software development life cycle"</i> OR <i>"system* development process"</i> OR <i>"system* development life cycle"</i>) NEAR (<i>select* OR choos* OR choice</i>)) | ((<i>"software development process"</i> OR <i>"software development life cycle"</i> OR <i>"system* development process"</i> OR <i>"system* development life cycle"</i>) AND (<i>select* OR choos* OR choice</i>)) | <i>allintitle:("software development process"</i> OR <i>"software development life cycle"</i> OR <i>"system development process"</i> OR <i>"system development life cycle"</i>) (<i>selection OR choose OR choice</i>)) |

| | | | |
|---------------|---|---|---|
| Third search | ("software process model*" OR "software life cycle*" OR "software process paradigm") NEAR (select* OR choos* OR choice) | ((("software development process" OR "software development life cycle" OR "system* development process" OR "system* development life cycle") AND (select* OR choos* OR choice)) | allintitle:(("software development process" OR "software development life cycle" OR "system development process" OR "system development life cycle") (selection OR choose OR choice)) |
| Fourth search | ((("situational factor*" OR "contingency factor*" OR "contingency model*") NEAR (software OR "information system*")) | ((("situational factor*" OR "contingency factor*" OR "contingency model*") AND (software OR "information system*")) | allintitle:(("situational factor*" OR "contingency factor*" OR "contingency model*") (software OR "information system*")) |
| Restrictions: | title –abstract, conference papers, journal articles, language English, peer-review | title –abstract, conference papers, journal articles, language English, peer-review | titles only, without patents and citations |

The Google Scholar search was done differently. In Google Scholar, it is not possible to search abstracts only, truncations are not supported, and the search field is too narrow to have a very complex search string. So, the search was done using titles only (Table 3). The restrictions used in the Google Scholar search were searching without patents and citations. Google Scholar was used as a complementary tool, the main purpose of which was to patch up the dead spots, so its different logic did not hinder the research.

Backward and forward searches are recommended to supplement the research (Webster and Watson 2002). In this study, a backward research was done by reviewing the citations to determine prior articles. Also, forward research was done in some selected articles.

No time limitation was used in this systematic literature review. Although the term “agile” became popular after “agile manifesto” 2001 (see Beck et al. 2001), the phenomenon is not so new. For example, the quite popular agile “XP method” was developed in 1996; the roots of iterative and incremental development are

much further in the past, having been utilized since the early 1960s in the project Mercury, where timeboxed iterations and test-first practices were used, and the development team was responsible for the technical review of all changes (Larman and Basili 2003). So, the change-driven idea has been around for over fifty years, even though the term “agile” is relatively new.

4.4.2.2 *Filtering the Articles*

As the selected keywords and phrases have been used in a range of articles, the found articles (1419 in the “Found” column in Table 5) were evaluated and filtered in several phases in order to assess their relevance. During the filtering, a positive dropping policy was used: in every assessment phase, only articles that were clearly out of scope were dropped off. All unsure cases were moved to the next assessment phase.

In the assessment of found articles, the following inclusion criteria were used: 1) the article addresses ISD method selection; 2) it is available in at least one of the selected scientific databases; 3) it is peer-reviewed; 4) full text is available and 5) it is in the English language. Correspondingly, the exclusion criteria were: 1) the article is out of scope, i.e., does not address ISD method selection; excluded articles could, for example, investigate ISD method engineering or method tailoring but not ISD selection; 2) it investigates only one ISD method category (for example, it compares various plan-driven methods only); 3) it shows unsubstantiated subjectivism, for example, the superiority of a particular method is presumed without evidence (Table 4).

Table 4. Inclusion and exclusion criteria

| Inclusion criteria | exclusion criteria |
|---|---|
| the article addresses ISD method selection | the article is out of scope |
| the article is available in at least one of the selected scientific databases | the article investigates only one ISD method category |
| the article is peer-reviewed | the article shows unsubstantiated subjectivism |
| full text is available | |
| the article is in the English language | |

There were some articles with limited perspectives of software development method selection; for example, they compare different agile methods to each other. Those were excluded as well because their idea is more or less “universalist,” just arguing about details of one development method approach. Only those papers discussing plan-driven methods to change-driven methods (papers with no prejudices) are included.

Table 5. Results of the searches and filtering

| | Found | Filter 1 Title | Filter 2 Abstract | Filter 3 Skimming + duplicate cleaning | Filter 4 Read through, selected for review | Backward/forward | Backward/forward selected for review |
|---|-------------|----------------|-------------------|---|---|------------------|---|
| Scopus, journal articles and conference proceedings | 185 | 81 | 54 | 17 | 15 | 10 | 2 |
| Academic Search Premier(EBSCO) | 123 | 17 | 10 | 4 | 3 | 2 | 0 |
| ACM – Association for Computing Machinery | 78 | 10 | 4 | 0 | 0 | 1 | 0 |
| Google Scholar | 219 | 67 | 19 | 6 | 3 | 7 | 4 |
| ProQuest | 252 | 50 | 20 | 3 | 2 | 4 | 1 |
| Web of Science | 191 | 43 | 23 | 9 | 8 | 4 | 2 |
| Science Direct | 134 | 23 | 13 | 0 | 0 | 0 | 0 |
| IEEE explore | 237 | 34 | 14 | 3 | 2 | 1 | 0 |
| Total | 1419 | 325 | 157 | 42 | 33 | 29 | 9 |

The first assessment (“Filter 1,” Table 5) was done based on the titles of the articles. In this assessment, only those articles that clearly deal with something else were dropped, and all unsure cases were moved to the next assessment. The second assessment (“Filter 2,” Table 5) was done based on the articles’ abstracts. The rationale behind this is that, presumably, if a topic is important for a paper, it is mentioned in the abstract. Articles that did not consider software development method selection at all were dropped off. The remaining articles became the basis for the next filtering. In the third assessment (“Filter 3,” Table 5), articles were skimmed through, and if they obviously discuss something else, they were dropped off. In the last assessment, all remaining articles were read through and if they just slightly touched on the subject, they were dropped off. The remaining articles became the basis of our review (“Filter 4,” Table 5). In the final filtering, we read the remaining 33 articles. An additional 29 articles were identified in backward and forward searches (“Backward/forward,” Table 5). Reading them through resulted in 9 additions to the initial 33 articles. Thus, 42 articles constitute the material from which the evaluative results of the literature review are drawn.

4.4.2.3 Results

A concept matrix (Table 6) was compiled while reading the articles, and at the same time, key concepts were formulated and grouped iteratively (see Webster and Watson 2002).

When analyzing the findings, the ISD selection criteria were classified into three main categories: people-, project- and environment-based criteria (see also chapter 2.7.2). Each main category has 6 subcategories (Table 6). Other kinds of classifications could have been used as well, but these three main categories are more or less balanced; they cover the articles’ different perspectives and present a more holistic view into IS development than traditional project criteria approaches (i.e., iron triangle). Based on the concept matrix and the found selection recommendations, the proposed ISDM selection framework was evaluated as shown in publication II. A reference list of the literature review articles is in appendix A.

All in all, a rather small amount of literature concerning ISDM selection was found. In addition, over half the articles were not based on empirical or theoretical grounding but on previous literature and authors’ insights and opinions.

Table 6. Concept matrix

| Criterion | People | end user involvement | end user acquisitions | developer acquisitions | developer involvement | size of the development team | communication | Project | size of the system | complexity | money (resources?) | time | quality | system history | environment | criticality | uncertainty of results | business satisfaction | uncertainty of current situation | control | stakeholder involvement |
|-------------------------------|--------|----------------------|-----------------------|------------------------|-----------------------|------------------------------|---------------|---------|--------------------|------------|--------------------|------|---------|----------------|-------------|-------------|------------------------|-----------------------|----------------------------------|---------|-------------------------|
| Ahimbisibwe et al, 2015 | | x | x | x | x | x | x | | x | x | | x | | | | | x | x | x | x | x |
| Al Ahmar, 2010 | | | | x | | | | | | x | | x | x | | | | x | | | x | |
| Alexander & Davis, 1991 | | | x | x | | | x | | x | x | | | x | x | | | x | x | x | x | |
| Benediktsson et al. 2006 | x | | | | | | | | x | | | | | | x | x | x | x | | | |
| Ben-Zahia & Jaluta, 2014 | | x | | | | | | | | | x | x | | | | x | x | | | | |
| Boehm & Turner, 2003a | | | x | | | x | | | | | | | | | | x | x | | x | | |
| Boehm & Turner, 2003b | | | x | | | x | | | | | | | | | | x | x | | x | | |
| Burns & Dennis, 1985 | | | x | x | | | | | x | x | | | | | | | x | | x | | |
| Clarke & O'Connor, 2012 | | x | x | x | x | x | | | x | x | x | x | x | x | | x | x | x | x | x | x |
| Cockburn, 2000 | | | | | | x | x | | | | x | x | | | | x | | | | x | |
| de Weger; Franken, 1997 | | | | x | x | | x | | | x | | | x | | | | x | | x | | |
| Dyck & Majchrzak, 2012 | | x | x | x | | x | x | | x | x | | | | | | x | x | | | | |
| El Louadi et al, 1991 | | | x | x | | | | | x | x | | | | | | | x | | x | | |
| Episkopou & Wood-Harper, 1986 | | | x | x | | | | | x | | x | x | | | | | x | | x | | |
| Ferrat & Mai, 2010 | | | x | x | | | | | | x | x | | | | | | | | x | | |
| Geambasu et al, 2011 | | | | | | x | x | | | x | x | x | | | | x | x | | | x | |
| Guntamukkala et al, 2006 | | | x | x | | x | | | | | x | x | x | | | x | x | | | | |
| Gupta & Dwivedi, 2015 | | | | x | x | | | | | x | | | x | | | x | x | x | x | x | |
| Hamed & Abushama, 2013 | | | | x | | | | | | x | x | x | | | x | | | x | | x | |
| Hicdurmaz, 2012 | | | | x | | | | | x | x | x | | x | x | | x | x | | | | |
| Howell et al, 2010 | | | | x | x | x | | | | x | | x | | | | x | x | | x | | |
| Kettunen & Laanti 2005 | | | | x | | | x | | x | x | | x | x | | | | x | | x | x | |
| Khan & Beg, 2013 | | x | | | | | x | | x | x | | | | | | x | x | | | | x |
| Khan, Parveen & Sadiq, 2014 | | | | | | x | x | | | x | x | x | | | | | x | | | x | |
| Kumar & Kumar 2013 | | | | x | | x | | | x | x | | x | x | | | x | | | | | |
| MacCormack & Verganti, 2003 | | | | | | | | | | x | | | | | | | x | | | | |
| Mahanti et al, 2012 | | x | | x | | x | | | x | x | x | x | x | x | | x | | | | | x |
| Mahmood 1987 | | x | | x | x | | x | | x | x | x | x | | | | | x | | | | |
| Palvia & Nosek, 1993 | | | | x | | | x | | | x | x | | x | | | | x | | | x | |
| Pries-Heje, 2006 | | | | | | | | | | x | | | | | | | x | | | | |
| Ramasubbu 2009 | | x | | x | | | | | x | | | | | | | | | | | | x |
| Ratbe et al, 2000 | | | | x | | | | | x | x | | | | | | | x | | | x | x |
| Saarienen 1990 | | | | x | | | | | x | x | x | | | | | | x | | x | | |
| Sauer & Lau, 1997 | | x | x | x | x | | x | | | x | | | | | | | x | | x | x | x |
| Sharon et al 2010 | | x | | | | x | x | | x | | x | | | | | x | x | | x | | x |
| Siddique & Hussein, 2014 | | | | | | | x | | x | x | | | x | | | x | x | | | | |
| Tang & Vliet, 2012 | | | | x | | | | | | x | | | | | | | | | | | |
| Vavpotic & Vasilecas, 2011 | | x | x | x | x | x | | | x | x | x | x | x | x | | x | | | x | | x |
| Vavpotić & Vasilecas, 2012 | | x | x | x | x | x | | | x | x | x | x | x | x | | x | x | | x | | x |
| Woo et al 2006 | | | | x | x | | x | | | | x | | x | | | | x | | x | | |
| Yusof, Shukur & Abdullah 2011 | | | x | x | | x | | | x | x | | x | | x | | x | x | | x | | |
| Öztürk, 2013 | | | | x | | | | | x | x | | x | | | | x | x | | | | |

4.4.3 Interviews

The third research method used in this dissertation was expert interviews. We selected the personal face-to-face interview method for data collection.

The interview method is well suited to situations in which opinions of complex issues are collected because it allows for synchronous communication, asking additional supplementary questions, registering body language and other social clues, which all help an interviewer and an interviewee better understand each other (Opdenakker 2006). The semi-structured interview was seen as a good choice for data collection because, with it, the interview has a clear structure, but it is still possible to discuss interviewees' viewpoints more openly than in a standardized interview or questionnaire (Flick 2010, p. 150). On the other hand, the more open the data gathering, the more variation there is as well. It has to be understood that all targets are not possible to achieve in all interviews and situations. Not everything can be planned in advance. So it is possible to have a clear structure for an interview, but the interviewer also has to be ready to make quick decisions during the interview (Flick 2010, p. 154). For that reason, especially in expert interviews, it is good for the interviewer to have a high level of expertise in the subject matter (Flick 2010, p. 168).

Expert interview situations also differ, and in different cases, different interview strategies should be applied. Bogner and Menz (2009) have found six different expert interview strategies based on the position of the interviewer in relation to the interviewee: the interviewer as 1) a co-expert, 2) an expert from a different knowledge culture, 3) a layperson, 4) an authority, 5) a potential critic and 6) an accomplice. In this case, the interviewer did not have any kind of authority over the interviewees, but he was familiar with different ISD methods and had been developing information systems for several years, so he was seen as a co-expert. When the interviewer is a co-expert, interaction in the communication situation is symmetric, and more counter questions are asked by the interviewee (Bogner and Menz 2009).

The challenges of an interview are to listen and understand the responses of the interviewee while at the same time ensuring that all questions are answered within the given time frame (Opdenakker 2006). To tackle these challenges and increase the reliability of the responses, we followed the interview method protocol developed by Dahlberg et al. (2016). During an interview, the questions were presented one by one on a screen to the interviewee, and the interviewer typed the responses right away before moving to the next question. Typing the responses did not disrupt the conversational nature of the interview; rather, it gave interviewees more time to ponder their answers. Also, the ISDM selection recommendation questions were discussed and the comments were typed, even though the

interviewees were asked to also provide a Likert scale value to each recommendation.

Flick (2010, p. 150–153) presents four general criteria for semi-structured interviews: The first is non-direction, meaning that the interviewer should avoid early evaluations as much as possible and keep a non-directive style in conversation. This was especially important with the new interview method, in which answers were compiled into notes and presented to the interviewee continuously. The risk of written answers being too conclusive and starting to affect the course of the interview was fairly high, especially when the interviewer had a co-expert role. To minimize this risk, different types of research questions were formed and ordered according to Flick (2010, p. 150). Flick's second criterion is specificity: the interviewee must have the possibility of bringing out his specific perspectives of the topic. As such, interview questions should not restrict the interviewee too much. Also, to increase specificity, Flick (2010, p. 151) suggests that the interviewee be encouraged through retrospective inspection, for example, by presenting them with extra material. We claim that the new interview method used here has this retrospective element built in: by showing the typed answers to the interviewee immediately after they answer, they can add more specifically to their answers. The third criterion is range, meaning that all the relevant topics are discussed during the interview. This is achieved by following the interview questions but also accounting for new points of view introduced by the interviewee. We find this important especially with this new interview method, where there is a risk of cutting off the conversation about that topic after the answer is typed. Therefore, the answers were typed only after the interviewee ended their answer, and when the answer was typed, the interviewee was asked whether they had anything to add or other points of view regarding the topic. Finally, the fourth criterion is depth and personal context, meaning that the interviewee should be guided deeply enough into their personal context of the study topic. We claim that good practice with interview questions and having a co-expert interviewer helped interviewees delve deep enough. Also, the constantly written documentation (which could be revisited during an interview if needed) of this new interview method allows the interviewee to check if something is missing.

Bogner and Menz (2009) distinguish expert interviews between exploratory, systematizing and theory-generating expert interviews. In exploratory expert interviews, a researcher is looking for an initial new orientation to the research to develop a clearer idea of the problem or to develop a final interview guide. The purpose of a systematizing expert interview is to obtain systematic and complete information, and an expert is seen as a guide who possesses the knowledge. It is not the experts themselves that are the object of the research but the knowledge they have; most of the emphasis is put on their capacities as experts of a certain knowledge area (Bogner and Menz 2009; Flick 2010, p. 164). In theory-generating

expert interviews, the goal is “the communicative opening up and analytic reconstruction of the subjective dimension of expert knowledge” (Bogner and Menz 2009, p. 48). We see this new interview method, where only part of the discussion is transcribed, as very suitable for systematizing expert interviews because transcription now concentrates more on the opinions presented by the interviewee rather than, for example, the discourses or the interviewee’s personal characteristics. Here, this new interview method is also in line with Flick’s (2010) suggestions that only part of the expert interviews should be transcribed, and only as precisely as actually needed to get the required answers (Flick 2010, p. 147–148).

There are some known problems with expert interviews relating to the role of the expert in the interview situation. There are risks of an interviewee telling more about their person than about their expert knowledge, wanting to give a lecture instead of answering the questions, talking about problems in their work and trying to involve the interviewer in ongoing conflicts, or the interviewee may not be an expert of the topic at all (Flick 2010, p.167). No matter how well the interview is planned and prepared, it is not possible to totally prevent all these risks. However, when questions and answers are visible all the time for the interviewee, it is easier for the interviewer to stay on track using this new interview method than more traditional interview methods where the interviewer has to rely only on discussion.

We wrote and maintained an interview protocol as advised by Yin (2009) to guide interview planning and execution as well as data collection and analysis. We also kept a diary about the experiences of each interview. Prior to the interviews, we crafted several versions of the interview questions to reflect the findings of the systematic literature study (Lagstedt and Dahlberg 2018a). The aim of crafting the interview questions was to have simple, direct and neutral questions with enough variation to get rich data (Kaplan and Maxwell 2005). We also followed the recommendations of Myers and Newman (2007) and planned a clear interview drama. We conducted two rehearsal interviews and fine-tuned the interview questions; for example, we added a Likert scale to the nine ISDM selection recommendation questions. The fine-tuned questions were sent to four academics and two senior consultants with academic backgrounds. Another fine-tuning round was carried out to include their comments, although most interview questions remained unchanged.

The objective written into the case protocol was to conduct at least 20 interviews. However, we continued interviews until nothing new emerged, that is, until data saturation was achieved. Cumulatively, 31 interviews (including the two rehearsal interviews) were conducted during spring 2016.

ISDM consultants and professionals working on the borderline between IS suppliers and IS user organizations were recruited as interviewees. To have a “variety of voices” (Myers and Newman 2007), interviewees were selected in

cooperation with the Association for Information Systems Developers and the Finnish Software Measurement Association. We also used “snowball sampling” by asking every interviewee to recommend a person who should be interviewed next. The interviewees had a long history in ISD projects, averaging 20 years’ experience. They had cumulatively participated in more than 1000 ISD projects, they knew plan-driven and change-driven ISDMs, and, with one exception, they had personal experience with ISD projects with both types of ISDMs.

The interviews were semi-structured and standardized to better enable the analysis of collected data. An interview began with open-ended questions about the interviewees’ experiences (Kaplan and Maxwell 2005). Closed, more specific questions were placed at the end of the interview (Myers and Newman 2007). Quantitative questions about the usefulness of the ISDM selection recommendation were used as the last set of questions in the interview.

Two hours were reserved for each interview since typing the responses took slightly more time than just recording them, but interviews were also recorded. Recordings were used to verify and complement responses. The verified and completed interview texts were sent to the interviewees for acceptance. Out of 31 interviewees, 14 responded by returning slightly modified responses, and the other 17 accepted the written interview narrative without changes.

In our opinion, the interview method proved its usefulness in our study. We interviewed experienced ISDM experts, who often tell “war stories.” They have a lot of experience with various ISD projects, different user and IS supplier organizations, and with several ISDMs. However, these facts do not guarantee that they would be impartial observers. In real-life projects, our interviewees follow the rules and practices of their employers. Those rules and practices could be biased toward the use of particular ISDM(s). Although we asked the interviewees to express their personal opinions and describe their own experiences, we are unable to evaluate whether they actually behaved in this way. No documents or other sources of data were available for data triangulation. On the other hand, we were able to document why an interviewee responded the way (s)he did. The method allowed us to easily continue interviews until data saturation since we were able to assess the saturation after each interview.

5 SUMMARY OF PUBLICATIONS

5.1 Publication I

Dahlberg, T. and Lagstedt, A. (2018). “There Is Still No ‘Fit for All’ IS Development Method: Business Development Context and IS Development Characteristics Need to Match,” in *Proceedings of the 51st Hawaii International Conference on System Sciences 2018*, pp 4803–4812.

5.1.1 Abstract

Information systems development has returned to strategic management due to the increase of software-enabled businesses. We investigated two failed IS development projects using the exploratory case study method. One of the projects was executed with the plan-driven approach methods and the other with the change-driven (agile) approach methods. Data analysis showed that both projects followed the principles of the selected methods. That, however, was not enough. The plan-driven project achieved project objectives but did not deliver business value and the IS was never taken into use. The change-driven project delivered desired business value but failed to release a robust IS. Our main contribution to research is our proposition to match the characteristics of IS development methods with the characteristics of business development contexts. We also disclose some novel reasons for IS project failures.

5.1.2 Author’s Contribution

The author of this dissertation collected the data from the first case with another researcher and the data of the second case by himself. The author of this dissertation analyzed the collected data with Dahlberg. Dahlberg also defined the overall structure of the publication and how the results should be presented. The publication was written in cooperation with the author of this dissertation and Dahlberg.

5.2 Publication II

Lagstedt, A. and Dahlberg, T. (2018a). “A Contingency Theory Motivated Framework to Select Information System Development Methods,” in *Pacific Asia Conference on Information Systems*, pp. 1–14.

5.2.1 Abstract

Several change-driven (agile) information systems development (ISD) methods have been launched during the recent years. In addition to agile ISD methods it is still possible to succeed also with plan-driven ISD methods. To facilitate ISD method selections that maximize the probability of ISD project success we crafted and evaluated an ISD method selection framework based on the idea of matching the properties of ISD methods and the characteristics of the business contexts where ISD methods are used. We conducted a systematic literature search to evaluate whether the proposed framework is also able to capture the findings of prior ISD method selection research and to guide future empirical research. From over 1000 potential articles we identified 42 articles that address ISD method selection. We discovered that the proposed framework was able to explain the findings of prior research.

5.2.2 Author’s Contribution

The author of this dissertation formulated the contingency theory–motivated ISDM selection framework together with Dahlberg. The author of this dissertation conducted the systematic literature review (SLR) to evaluate the framework and find out what is said about ISDM selection in prior literature. The SLR was conducted with Dahlberg’s guidance. The author and Dahlberg defined and wrote the publication together.

5.3 Publication III

Dahlberg, T. and Lagstedt, A. (2019). “The Usefulness of the Recommendations Regarding the Information System Development Method Selection during the Era of Digitalization,” in *Proceedings of the 52nd Hawaii International Conference on System Sciences 2019*, pp. 6960–6969.

5.3.1 *Abstract*

The business criticality of information systems (IS) and their development (ISD) appear to have increased recently. Backsourcing, cosourcing and multisourcing of ISD are some of the consequences. They, in turn, extend the need for understanding how to select information systems development methods (ISDM). In this research, we first condensed the knowledge base of ISDM selection research into nine recommendations. We then interviewed 28 ISDM experts and asked them to evaluate how useful the extant ISDM selection recommendations of prior research are to IS user organizations. We discovered that most recommendations were perceived outdated and only limitedly useful. We finally contemplated that paying more attention to how ISDMs are used in business development contexts is a means to increase the usefulness of ISDM selection recommendations.

5.3.2 *Author's Contribution*

The idea of publication III was developed in cooperation with the author of this dissertation and Dahlberg. The author of this dissertation defined the expert interview research protocol and research questions with the help of Dahlberg, after which the author of this dissertation conducted data collection (interviews) and analyzed the collected data with Dahlberg's guidance. The author and Dahlberg defined and wrote the publication together, and Dahlberg finalized the final version.

5.4 *Publication IV*

Dahlberg, T. and Lagstedt, A. "A Business-IS Development Aligned Framework for the Selection of IS Development Methods". Submitted to Information and Management 17.10.2019.

5.4.1 *Abstract*

Information systems development methods (ISDM) are constantly launched. Still 70% of IS-projects fail or are troubled. Over the last 15 years, there has been little debate about the selection of ISDMs, even less about how ISDMs relate to business development. We crafted an ISDM selection framework that matches the characteristics of ISDM and business development. We probed the framework

with a systematic literature review of articles published since the 1950s and face-to-face interviews with 31 ISDM experts. Results support the usefulness of the framework that was also able to cover the ISDM selection criteria of prior research and the interviews.

5.4.2 Author's Contribution

The author of this dissertation formulated the contingency theory–motivated ISDM selection framework together with Dahlberg. The author of this dissertation defined the expert interview research protocol and research questions with help of Dahlberg, after which the author of this dissertation conducted data collection (interviews) and analyzed the collected data with Dahlberg's guidance. The author and Dahlberg defined and wrote the publication together.

5.5 Publication V

Lagstedt, A. and Dahlberg, T. (2018). "Understanding the Rarity of ISD Method Selection – Bounded Rationality and Functional Stupidity," in *Pacific Asia Conference on Information Systems*, pp. 1–14.

5.5.1 Abstract

No single information systems development method (ISDM) suits to all information systems development (ISD) projects. Despite of this, ISDM selection has received limited attention in earlier research. This raises the question are ISDM selection decisions rare in practice as well, and if so, what are the reasons. We used the bounded rationality and functional stupidity theories to investigate ISDM selection decision-making behavior, and interviewed 31 IS professionals working in the borderline between IS clients and suppliers. We examined their experiences about ISDM selection within both types of organizations. We discovered that the ISDM selection decisions of ISD projects are seldom discussed, that the ISDM selection behavior of client and supplier organizations differ, and that the bounded rationality and functional stupidity theories are descriptively useful. In addition to these research contributions, our study shows that there are theoretical and practical reasons to develop better ISDM selection guidelines for ISD projects.

5.5.2 *Author's Contribution*

The author of this dissertation composed a suitable theoretical background to explain different decision-making points of view in ISDM selection situations. The author of this dissertation defined expert interview research protocol and research questions with the help of Dahlberg, after which the author of this dissertation conducted data collection (interviews) and analyzed the collected data with Dahlberg's guidance. The author of this dissertation defined the structure of the publication and wrote the publication together with Dahlberg.

6 FINDINGS

The main findings and answers to the specific research questions are discussed more in detail in publications I –V. In this chapter the answers to the research questions (Table 1) are collected together, and based on them an answer to the overall research problem (RP1) is formulated.

6.1 Answers to the research questions

6.1.1 Research Question 1

The first research question of this study was RQ1: *What can be said about the matching ISDMs and the characteristics of business contexts where they are used based on the analyses of two ISD projects (ex post)?*

We investigated one failed IS development project executed with the plan-driven approach method (Waterfall, stage-gate, PMBOK) and another failed IS development project executed with the change-driven approach method (scrum). In both cases, we discovered IS project failure reasons reported in prior studies that are typical to respective IS development methods.

It was discovered that in the plan-driven ISD project, the selected method matched poorly with the characteristics of the business development context. There were a lot of uncertainties related to the existing business context (business processes), and afterward, it could be questioned whether the chosen IS solution was the best possible one for the case. Based on Thompson (2003), an inspirational approach should be preferred. However, when the current business situation was not known to be important, uncertainties related to the current business context were not thoroughly evaluated beforehand, and the need for another kind of approach was not seen. A business context evaluation without any model or framework is hard to make.

In the change-driven project, there were clear uncertainties related to the current business context situation (business processes), and it is unclear what the best possible IS outcome could be. So, the selected method was more suitable for the characteristics of the business context (cf. Thompson 2003). However, during the project, the uncertainties were not reduced much. With new project directions, new kinds of IS features were wanted, which caused a rise in new kinds of uncertainties

relating to the technical platform. Finally, the project drifted into deadlock, where the selected technical platform was not able to provide the features needed. In this project, uncertainties increased too much to change-driven IS development method to cope with (cf. disorder in the Cynefin framework [Snowden and Boone 2007]). One way to proceed in situations like this is by “problem structuring” (Howell et al. 2010), where the main purpose is to understand the project’s objectives and environment, and with that understanding, delimit the uncertainties of the project.

By analysing two (failed) ISD projects, we can conclude that the business environment has a remarkable effect on IS development, and the characteristics of the business environment should be taken into account in a project’s starting phase when the used ISD method is selected.

6.1.2 Research Question 2

The second research question of this study was RQ2: *What kinds of ISDM selection models and criteria are possible to find in the literature, and how well do they account for the characteristics of business contexts?*

Our systematic literature review revealed that ISDM selection has not been studied much. Although we tried to review as widely as possible (8 different kinds of scientific databases and 4 different search strings), we found only 42 articles with some kind of ISDM selection criteria. In addition, the number of publications with proper ISDM selection models was clearly lower, only 16 publications. Moreover, only half of these 16 publications had original models; the rest were more or less copies and modifications of earlier models. The selection models from prior literature are discussed in more detail in chapter 2.7.3. We did not find any articles where proposed ISDM selection criteria or models were empirically tested.

It was found that ISDM selection models in prior literature concentrate mainly on project characteristics. Business context characteristics are mostly neglected, being considered as if they are static or given factors with no impact on ISD work. One exception is in the model proposed by Ahimbisibwe et al. (2015), whose 28-factor polar-chart model includes organizational culture as one of the factors. According to them, if mechanistic and bureaucratic structures characterize an organization, then plan-driven ISD methods are preferable. Change-driven ISD methods are preferable for organic and flexible structure organizations.

From the papers, it is difficult to estimate why the business context situation aroused so little interest. Maybe business context has not been seen as an important part of IS development, or maybe it is assumed to have been taken care of during an ISD project. There can be some historical reasons as well: most ISDM selection models are done in the era of in-house development, where all ISD projects were done with the same in-house project groups. At that time, the most important

question was what the development team was able to do, and ISDM selection had to be made according to that.

It was also found out that the ISDM selection framework proposed in this dissertation directly or indirectly covers almost all ISDM selection criteria found in the prior literature. The criteria not covered by the proposed ISDM selection framework were communication, size of the system, resources (money) and resources (time). We see communication as important, no matter which ISD method is selected. Communication practices, however, differ among ISD methods, and communication can be seen as more an ISDM property than a selection criterion. The latter three, size, money and time, are typical success criteria of plan-driven ISD projects (the so-called iron triangle) that do not suit situations where ISD method selection is done between plan-driven and change-driven ISD methods. This is an answer to sub-question RQ2.1.

When the IS experts working on the borderline between clients and customers were asked to evaluate the recommendations composed from prior ISDM selection literature, it became quite clear that those recommendations are outdated. World and ISD methods have been changed so that prior ISDM selection models are no longer valuable. This is an answer to sub-question RQ2.2.

We were unable to find thorough empirical evaluations of the usefulness of ISDM selection criteria and/or models, or about the user experience and popularity of alternative ISDM selection models. The popularity of ISD outsourcing could be one reason for this: when IS clients outsourced IS development, they lost their interest in ISD and ISDMs. In consequence, it was not possible to use any of the ISDM selection models as a “baseline” for empirical evaluation in this study.

6.1.3 Research Question 3

The third research question of this study was RQ3: *Do the interviewed ISDM professionals consider the proposed ISDM selection framework useful for ISDM selections at an ISD project level?*

We interviewed 31 ISDM experts working on the borderline between clients and customers. All interviewees had a long history working on different kinds of projects. We discovered that 23 of the 31 interviewees saw the proposed ISDM selection framework as a useful model for ISDM selection. Six interviewees did not agree with that. All interviewees accepted the selection and the use of change-driven (agile) ISDMs. The criticism toward our model reflected attitudes according to which plan-driven ISDM methods should be limited or not used at all. Two interviewees did not comment on the model at all.

We asked interviewees to explain what ISDM selection criteria they have seen in use and which criteria they consider useful. As a result, we got a list of 23

different criteria. However, the 31 interviewees mentioned only four ISDM selection criteria that were new to us. In our opinion, three of them—size of the user organization, size of the IS supplier organization and type of industry—describe contingent factors of the ISDM method selection, which may or may not affect the current business context situation. We see the fourth new criteria, trends and plausibility of a method, as one sign of uncertainty of a current business situation: relying heavily on trends, the organization shows its inability to cope with the situation as it is. This is an answer to sub-question 3.1.

6.1.4 Research Question 4

The fourth research question of this study was RQ4: *How common is it for the client and supplier organizations dealing with projects related to information system development to conduct systematic, project-specific ISDM selections?*

This question was related to the existing ISDM selection practices. It is important to know not only what kinds of ISDM selection models there are or could be, but also how the existing models and recommendations are applied, if at all. Also, the data collected from the 31 ISDM experts working on the borderline between clients and customers were applied.

It was found out that systematic project-specific ISDM selections are really rare. According to the interview responses, 77% of supplier organizations and 87% of ISD project client organizations did not discuss the ISDM selection for an ISD project at all. Universal or tailored ISDM utilization approaches were used by 73% of organizations.

The research sub-question 4.1 was: *What are the main reasons for client and supplier organizations dealing with projects related to information system development to conduct or not conduct systematic, project-specific ISDM selections?* In the data analysis, we discovered three supplier-related and eight client-related reasons for not making project-specific ISDM selection decisions. Both suppliers and clients have personal but different reasons for not making project-specific ISDM selection decisions. Suppliers' reasons seemed to be related to the use of their ISD resources. Clients' reasons were related to their organizational traditions and culture, both the governance and management of business and IT and also the (lack of) competencies and understanding. ISDM trends and plausibility was the only reason that was similar between the two types of organizations. When an ISDM is trendy and/or plausible, both suppliers and clients prefer it. However, client and supplier organizations had different reasons for this behaviour.

The research sub-question 4.2 was: *In the ISDM selection decision-making, is it possible to describe the behavior of the ISD projects' client and supplier*

organizations with bounded rationality and functional stupidity theories? We discovered that these theories were highly useful in understanding the detected reasons to not make ISDM selection decisions. These theories proved even more useful in understanding the differences between the suppliers' and the clients' reasons than in just describing different decision-making behaviors in general. The suppliers' reasons were predominantly (bounded) rational as they attempted to optimize the use of their ISD resources. On the other hand, functional stupidity was characteristic of the clients' reasons. This result emerged from detected client reasons, which clearly indicated that clients seldom ponder ISDM selections, usually lack clear reasons for the selection and utilization of ISDMs, rely (blindly) on ISD suppliers and are seldom able to connect the selection and utilization of ISDMs to their business development.

6.2 Answers to the research problem

The overall research problem (RP1) of this study is the following: *How should an ISDM be selected for an ISD project?*

This research problem could be seen from two sides: the kinds of ISDM selection guidelines (framework) that could help the ISDM selection and how people and organizations should act (use the framework) in the ISDM selection situation.

Based on the findings of this dissertation, I claim that the proposed ISDM selection framework (Figure 9) could be a useful tool to help ISDM selection. However, the proposed framework is only tested by asking opinions of ISDM professionals, and more practical tests are needed to thoroughly evaluate it.

For the second part of the research problem, I claim that ISDM selection should be project-specific. Using the same ISDM that is always used is not an optimal decision; projects and their business contexts and objectives change case by case. A discussion of a suitable ISDM should be done early since changing the ISDM when the project has already been started is difficult and expensive. In addition, since supplier and client organizations have different business models and business objectives for ISD projects, clients should not trust suppliers' opinions only, so they should have enough ISDM knowledge of their own. This is especially important nowadays when, due to digitalization, the strategic importance of IS for clients' businesses is rising, and due to co-sourcing, client organizations are forced to take more and more responsibility for development.

7 DISCUSSION AND CONCLUSIONS

In this chapter, the main results of this study are discussed. As this study of ISDM selection frameworks is seen only as a start to ISDM selection research, the emphasis is on the implications for future research. Also, the practical point of view, (i.e., how ISDM selection is done, what problems there may be and how practices should be changed) is seen as important, and implications for practice are emphasized as well. As this study is still rather small and the research project has also been the author's learning project, it goes without saying that this study is not free of limitations, and those are also discussed in this chapter.

Although there are known limitations in this study, I think the results are very useful for science and practice. A new kind of ISDM contingency theory-based selection model is presented (Lagstedt and Dahlberg 2018a). The framework enlarges the previous model's perspective by also taking the business context of the ISD project into account. The framework has rigid theoretical backgrounds, and it is tested against the ISDM selection criteria found in the literature and in the interviews with ISDM experts (Dahlberg and Lagstedt 2019, n.d.; Lagstedt and Dahlberg 2018a). The framework covers the main characteristics of different ISD methods, and when taking the ISD business context into account, it answers the challenges of different sourcing models. It also enlarges the use of contingency theory in information systems development.

From the prior literature, it was discovered that astonishingly few ISD method selection models have empirically validated the criteria and/or guidelines of ISD method selection (Lagstedt and Dahlberg 2018a). There are clearly more articles that give unsubstantiated subjective recommendations for ISD method selection without any theory-backed and/or empirical evidence, i.e., the effects and soundness of the proposed criteria are difficult to evaluate. The lack of attention paid to the business use contexts of ISD methods is also striking. I regard future theoretical and empirical research on these topics as important.

7.1 Implications for future research

As stated, this study is only a start, and there is a clear need for future studies relating to ISDM selection models and practices.

First, in this study, the framework was tested against the existing literature and by asking opinions of ISDM professionals (Dahlberg and Lagstedt n.d.). So, it is

important that future studies also test and validate the proposed framework with other types of empirical studies. Such studies could result in clearer empirically reasoned guidelines for the selection of change-driven and plan-driven ISD methods. During the study, it was found that there are some factors that are not thoroughly studied here and that they may affect ISDM selection (Lagstedt and Dahlberg 2018a). Based on these findings, two potential venues for future research could be proposed:

1. What are the influences of client organizations' work, ISD and business development culture on the ISD method selection? For example, how much do existing control practices or the legacy of ISD methods' usage affect the ISD method selection? As vom Brocke and Sinnl (2011) pointed out, culture is important part of PBM (and IS development relating to it). Is it advisable and/or possible to try to change and/or ignore these kinds of organizational culture factors?

2. How does IS legacy influence ISD method selection and business development? For example, do legacy ISs influence which ISD methods can be used in various business development situations?

In addition, in the ISDM selection framework studied here, only the two extremes of ISDMs are presented: plan-driven and change-driven ISDMs. However, the world is not black and white, and I agree that using pure extremes is rare. In practice, ISDMs fall somewhere in between. Although it seems that the framework gives good advice in the ISDM selection phase, it is important to study the wide area of different kind of ISDMs between these two extremes, and so-called hybrid models (see e.g. Theocharis et al. 2015) should also be taken into account in future studies. Moreover, also the possibilities of other than project based development should be studied more. One interesting approach is continuous software engineering (Fitzgerald and Stol 2017), which is applied, for example, in the SAFE (Scaled Agile Framework) method. In addition, there a balance between plan-driven and change-driven approach should be achieved, by, for example, combining meaningful application of continuous planning (Fitzgerald and Stol 2017) with some kind of continuous ISDM selection model.

Not only the ISDM selection framework but also the ISDM selection practices (or organizational practices affecting whether ISDM selection is done or not) should be studied more. It was discovered that the bounded rationality and functional stupidity theories offer a solid and empirically thoroughly tested basis to understand and describe ISDM selection and ISDM utilization decision-making (Lagstedt and Dahlberg 2018c). It was also discovered that the behavior of client and supplier organizations differed in making ISDM selection decisions (Lagstedt and Dahlberg 2018c). Thus, my advice to researchers is to consider the use of these theories and compare the behavior of various IS development stakeholder groups in order to get a rich understanding of this phenomenon. Organization knowledge

creation (see, e.g., Nonaka 1994) offers one interesting point of view to study how the existing ISDM selection practices, or their absence, could be changed. Finally, I advise researchers to investigate IS development as an element of business development.

7.2 Implications for practice

The importance of ISDM discussion and selection, especially for client organizations, is the main contribution in practice. This is not so obvious, and it was found that most client (and supplier) organizations do not have ISDM-related discussions at all (Lagstedt and Dahlberg 2018c). Based on the findings of the study, it is concluded that organizations need up-to-date ISDM selection models and real ISDM discussion and selection culture. At the moment, there is a lack of both.

The first advice to practitioners is to pay attention to the match between selected ISD methods and the characteristics of the business development contexts in which the selected ISD methods are to be used. It is good to understand that no single ISDM suits all ISD cases (Brooks 1986; Cusumano et al. 2009; Hall and Rapanotti 2015; Lagstedt and Dahlberg 2018a). It is also important to discuss a project-specific ISDM method selection early enough (Ahonen and Savolainen 2010) and to understand the limitations imposed by existing organizational culture and practices (Lagstedt and Dahlberg 2018c). If IS clients want to execute ISD projects that better suit their business objectives, they need to change their functionally stupid ISDM selection behavior (Lagstedt and Dahlberg 2018c). This is my key recommendation for practitioners. I propose our ISDM selection framework to be a practical tool in the business context and to be suitable for ISDM selection discussion.

The second advice for practitioners relates to the outsourcing/insourcing/co-sourcing discussion. In recent decades, most IS client companies have not considered IS development as their core business, and IS development has largely been outsourced to ISD suppliers for that reason. Outsourced IS development has been seen as the most cost-effective means of sourcing skilled professionals to develop particular ISs for an organization. The rapid increase in digital business appears to change the business significance of IS development (Fuggetta and Di Nitto 2014). Already in 2012 Gartner Inc. estimated that over 80 % of information technology (IT) investments fell outside the traditional IT. In a situation like this IS development competencies may become strategically important to traditional IS client organizations, such as in the manufacturing industry and commerce. Whatever the situation is, based on the findings here, it is essential that an IS client organization has at least a “good enough” methodological knowledge and clear

practices about how ISDM selection decisions for ISD projects should be made in different outsourcing/insourcing/co-sourcing situations (Lagstedt and Dahlberg 2018c).

The third advice for client organizations is to understand that IS suppliers have different business objectives for ISD projects than client organizations. A client are waiting to get business profit from the use of the new IS, while the ISD project itself is a business opportunity for a supplier (Savolainen et al. 2015; Taylor 2007). Because of this, suppliers have different expectations and criteria for the selection and utilization of ISDMs than IS clients. So, clients should not rely only on suppliers' ISDM knowledge, the optimal ISDM for a supplier is not automatically optimal for the IS client. Clients have to have enough ISDM knowledge of their own to make independent evaluations of ISD situations.

Based on the above, I recommend that IS clients' organizations establish a step-by-step ISDM selection process based on the proposed ISDM selection framework.

7.3 Limitations

As always, also this study has limitations. The time and resources available limited what was possible to do and what was not. In addition, long study like this is often an abductive project; the researcher learns more and more during the project and when the project ends, the researcher would be more prepared to do the first steps of the study than in the beginning.

The first limitation relates to the scope of the study. Here only ISD development done in ISD projects is discussed. There are other kind of ISD development relating, for example, to continuous development and organizational learning, which is left out of this study. Also only business process development related ISD is discussed. IS development invisible for business, such as platform and interface updates and other technological improvements is left out of this study. So, this study covers only one part of ISD work. However, limiting the examination to ISD projects only is considered to be meaningful since, as pointed out in Chapter 1.1, the generally identified problem of IS development specifically concerns the success of ISD projects.

Another limitation is that in this study only two extremes of ISDMs, i.e. pure plan-driven and change-driven ISDMs are considered. In practice, there are plethora of different kind of ISDMs between these two extremes which are left out of this study. Also different kind of scaled agile methods and so called hybrid methods, where for example plan-driven methods are used for higher level and change-driven methods in a lower level of an ISD project are out left out of this study. However, I see ISDM discussion important in also selecting and using above

mentioned method, and the proposed ISDM selection framework a good tool for that kind of discussion.

This study has a geographical limitation, as well. Even though publications in systematic literature review were sought without any geographical restrictions, the case studies and ISDM expert interviews were done in one country only. However, it has to be noted that one of the case study organizations is a multinational organization, and some of the interviewed experts had been working in multinational organization or abroad, so the informants' experiences are not limited to one country only. Nevertheless, this geographical limitation should be taken into account in future studies.

Another methodological limitation is that the existing practices haven't been studied in IS client or supplier organizations, but only experiences and opinions of ISDM experts are collected. Especially when IS clients and suppliers ISDM selection practices was studied, ISDM experts, even though being involved in the starting situations of ISD projects, can give only second hand data about the motives of different parties. However, ISDM experts were considered to be more reliable data sources than representatives of IS clients and suppliers, as ISDM experts did not have visible vested interest to explain the situations in a better light than it was. Still, in future studies it is important to get more firsthand data from IS clients and suppliers.

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APPENDIX A, LITERATURE REVIEW ARTICLES

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APPENDIX B, INTERVIEW QUESTIONNAIRE

Research

The aim of the research is to study information system development method (ISDM) selection factors and practices. This study concentrates on the choices done prior information system development (ISD) project is started.

The target group of this interview is the ISD experts working in the borderline between IS supplier and IS client organizations. These experts were selected as a target group because they have a good visibility to both main groups of IS development: IS suppliers and IS clients who are acquiring the developed IS.

In this interview there are open questions helping to constitute a whole picture about the phenomenon, and in the end there are propositions to helping to clarify the effect of different factors for ISDM selection.

Systematic literature review done during autumn 2015 and spring 2016 is used as a background for this interview.

Background information

Name: _____

Project experience, years: _____

How many projects you have been involved in:

| A few: 1-7 | Some: 8-15, | Moderately: 16-30, | Rather many 30-60, | Many: > 60 |
|------------|-------------|-----------------------|-----------------------|------------|
| | | | | |

How many IS suppliers have you been working with: _____

How many IS client organization have you been working with: _____

How many different business areas have the IS clients been represented: _____

What is the proportion (%) of the projects that have been:

- Very small, less than 5 000 hours of productive labor: _____
- Small, less than 10 000 hours of productive labor: _____
- Moderate, 10 000 to 30 000 hours of productive labor: _____
- Medium, 30 000 to 60 000 hours of productive labor: _____
- Large, 60 000 to 100 000 hours of productive labor: _____
- Grand, more than 100 000 hours of productive labor: _____

What is the proportion (%) of the projects where the size of IS supplier developer team has been under 10? _____

Have you been involved in projects using different ISDMs? Y / N

I Assess the procedures of IS client organizations based on your own experience

1. In what situations does an IS client organization end up with a new information system? Examples?

1.1 i.e. what are the triggers, what is the point where an old system is no longer enough / working?

1.2 How often there is a significant change in the business process behind the decision?

1.3 Are there differences in projects if the need for a new system development comes from the company management or if the need is detected in the day-to-day operation (top-down / bottom-up)? How about if the need comes from the customer? What are the differences?

2. How much, according to your experience, in the IS client's side of the project and the ISDM used therein are evaluated in advance, and what criteria are used in the evaluation?

2.1. Does the assessment made affect the choice of an ISDM?

2.2. Does the assessment made affect the choice of a supplier?

2.3. How well are different IS development methods known in IS client organizations?

2.3.1. Is there the willingness to use different methods?

2.4. Do they have discussion about pros and cons of different ISD methods?

2.4.1. Which sources is the discussion based on (own experiences / literature / consultants / IS suppliers / rumours)?

2.5. How much the IM affects ISDM selection?

2.5.1 How about outsourcing, does it have an effect?

3. Which factors, according to your experience, affect the way the project is implemented?

3.1 What kind of effect the complexity of the ISD project has to ISD project implementation (pre-project phase, planning, and development)?

3.1.1 How well it is possible to perceive project complexity before the project starts?

3.2. How does the known end result uncertainty affect the implementation of the ISD project? Does it affect the chosen ISD method?

3.3. How does the criticality and quality of the application being developed affect the implementation of the ISD project? Does it affect the chosen ISD method?

3.4 How about people and co-operation?

- The known commitment of end-users and stakeholders? Communication opportunities?

- IS client organization's level of competence?

3.5 How about available resources? (money and time)

3.6 How often an IS client organization has an ISDM of their own (%)

II Assess the procedures of IS supplier organizations based on your own experience

1. At which stage the IS supplier is normally taken into ISD project design?

1.1. What are the IS supplier's first tasks with regard to the ISD project?

2. How much, according to your experience, is the ISD method evaluated in advance (before the official start of the ISD project)? What criteria is used in evaluation?

2.1. Does the evaluation affect the proposed ISD development method?

2.2. How much, according to your experience, different software IS suppliers are ready to use different ISD methods?

2.3. Do they have discussion about different ISDMs?

2.4. Is there any project specific discussion?

2.5. Which sources is the discussion based on (own experiences / literature / consultants / IS Clients' requirements / rumours)?

2.6. Where do you think the possible case-by-case differences comes from?

3. How are ISDM methods most commonly chosen?

3.1. Which of the following practices is most commonly used:

- method tailoring,
- method engineering,
- method selection,
- universal method or
- ametodological / ad-hoc
- Something else, what/what kind of?

III Other topics for discussion

1. Which criteria do you think are relevant when considering ISD methods for a project?

- 1.1. Project criteria?
- 1.2. Environment criteria?
- 1.3. People criteria?

2. How do you think the ISD method selection should be done?

- 2.1. Process (stages) /professionals /criteria?

3. Should the maturity of the business process developed by the IS client organization affect the choice of the ISD method?

3.1.How?

4. What kind of pros and cons you see in plan-driven development methods (e.g. waterfall method)?

4.1. In what situations / projects would you see such methods as good?

5. What kind of pros and cons you see in change-driven development methods (e.g. XP or Scrum)?

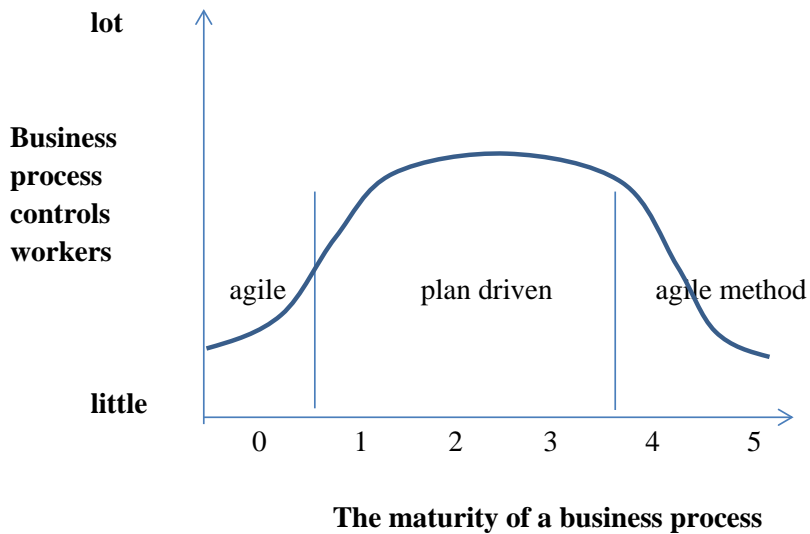
5.1. In what situations / projects would you see such methods as good?

6. Who did the final decision about the ISD methods in projects you have been involved, i.e. whose proposal / requirement the used ISD method was?

- 6.1. IS Supplier, %?
- 6.2. IS Client, %?

IV Claims

Graph 1. The maturity of the business process to be developed / selected ISD method



Comments:

Graph 2. The structuredness of action versus the structuredness of the application development method (and project objectives)

| | | | |
|--|---------------------|---|--|
| Business process (certainty of business execution) | Structured | "moving to an uncertainty zone" - Out of the box - objectives - dynamic implementation with flexible ISDM - Change-driven ISDMs or plan-driven ISDMs could be used, depending on the amount of uncertainties related to current situation and objectives | "further development" - known objectives and risks - a straightforward, effective implementation with clear ISDM - Plan-driven ISDMs should be selected and used |
| | Unstructured | "basic situation clarification" - unknown objectives and risks - ISDM is used to make the sense of current situation - Change-driven ISDMs should be selected and used | "basic activity building" - known objectives - ISDM is used to make order to current situation - Change-driven ISDMs or plan-driven ISDMs could be used, depending on the amount of uncertainties related to current situation and objectives |
| | | Unstructured | Structured |
| ISD properties and approach to the structuredness of business development | | | |

Comments:

| | | | | | | |
|---|------------------|----------------|-----------|-------------------|---------------------|-------------------|
| 3. Less competence - plan-driven method, more competence - agile method | | | | | | |
| Agree Strongly | Agree Moderately | Agree Slightly | Undecided | Disagree Slightly | Disagree Moderately | Disagree Strongly |
| | | | | | | |
| 4. small team – agile method - large team – plan-driven method | | | | | | |
| Agree Strongly | Agree Moderately | Agree Slightly | Undecided | Disagree Slightly | Disagree Moderately | Disagree Strongly |
| | | | | | | |
| 5. A relatively small increase in methodology size adds a relatively large amount to the project cost. | | | | | | |
| Agree Strongly | Agree Moderately | Agree Slightly | Undecided | Disagree Slightly | Disagree Moderately | Disagree Strongly |
| | | | | | | |
| 6. A critical project – plan-driven method | | | | | | |
| Agree Strongly | Agree Moderately | Agree Slightly | Undecided | Disagree Slightly | Disagree Moderately | Disagree Strongly |
| | | | | | | |
| 7. If continuous communication with the IS client cannot be guaranteed – plan driven method | | | | | | |
| Agree Strongly | Agree Moderately | Agree Slightly | Undecided | Disagree Slightly | Disagree Moderately | Disagree Strongly |
| | | | | | | |
| 8. Large project – plan-driven method | | | | | | |
| Agree Strongly | Agree Moderately | Agree Slightly | Undecided | Disagree Slightly | Disagree Moderately | Disagree Strongly |
| | | | | | | |
| 9. If the maintainability of IS is important – plan-driven method | | | | | | |
| Agree Strongly | Agree Moderately | Agree Slightly | Undecided | Disagree Slightly | Disagree Moderately | Disagree Strongly |
| | | | | | | |
| 10. If there are high uncertainties relating to ISD project outcome – agile method | | | | | | |
| Agree Strongly | Agree Moderately | Agree Slightly | Undecided | Disagree Slightly | Disagree Moderately | Disagree Strongly |
| | | | | | | |
| 11. If high security is important – plan-driven method | | | | | | |
| Agree Strongly | Agree Moderately | Agree Slightly | Undecided | Disagree Slightly | Disagree Moderately | Disagree Strongly |
| | | | | | | |

| 12. The large size of an IS user organization – plan-driven method | | | | | | |
|--|---------------------|-------------------|-----------|----------------------|------------------------|----------------------|
| Agree Strongly | Agree Moderately | Agree Slightly | Undecided | Disagree Slightly | Disagree Moderately | Disagree Strongly |
| | | | | | | |

Comments:



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