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When Is the Right Time for Method Decisions?

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Abstract

Previous studies have emphasized the importance of selecting a project-specific information system development (ISD) method. In addition, timely decision making in ISD projects is increasingly important: nowadays, most ISD projects are outsourced, and all decisions affecting the outsourcing, such as ISD method (ISDM) selection, should be made before contracts are signed. However, although some ISDM selection models are presented, their practical utilization, especially timing of decisions, is seldom discussed. If a pre-project process is not clearly defined, there is a risk that the right moment for decision-making will pass. Thus, it is important to study what the situation is in practice. The data from a systematic literature review and 31 ISD expert interviews were analyzed, and, based on the findings, recommendations for pre-project process and timing of decision-making are presented. There is only a small time frame for ISDM selection, it is essential for companies to detect it.

Keywords: digitalization, information systems development (ISD), ISD methods (ISDM), ISDM selection, pre-project decisions, timing

Introduction

Making project decisions at the right time is vital for the project. Make-or-buy decisions, as well as outsource-or-insource decisions, are commonly considered before starting an information system implementation project. However, to be successful especially with outsourcing, between these two decisions there should be another decision, which is largely neglected: information system development method (ISDM) selection (Lagstedt and Dahlberg 2018a; Nokkala et al. 2021).

Although several different ISDMs have been developed over time, the success rate of IS development (ISD) projects seems to remain low. Thus, it seems that the key to success is not to develop more and new kinds of ISDMs (Dahlberg and Lagstedt 2018). Instead, it has long been known that one ISDM can't suit all different ISD projects (Ahimbisibwe et al. 2017; Brooks 1986; Cusumano et al. 2009; Gupta and Dwivedi 2015; Howell et al. 2010; MacCormack and Verganti 2003; Vessey and Glass 1998), and it has been concluded that ISDMs should be selected case by case (Lagstedt and Dahlberg 2018b; Vessey and Glass 1998). As IS development projects become more complex, it is increasingly important to have the right ISDM for a project, and having a general, "universal" method used in all projects is not a solution: if the method is general enough to suit all different cases, its ability to solve problems optimally is low (Vessey and Glass 1998).

Normally IS development is a long project with many different phases and steps, and as such, it follows the ideas of process theory (Markus and Robey 1988). This means that the right actions must be taken in the right steps for the project to be successful (Markus and Robey 1988). Selecting an ISDM for a project is one rather important action, which must be done at the right moment to be beneficial for the project. Since ISDM selection is rarely done in practice (Lagstedt and Dahlberg 2018a), it is generally not part of organizations' IS development processes. Finding the correct time for ISDM selection is essential to achieving its benefits. If the selection is done too early, there is not enough information for it, and on the other hand, if the project is already started, ISDM selection is too late. As Ahonen and Savolainen (2010) point out, some projects are already doomed with wrong decisions even before they have started. So, the timing of ISDM selection—that is, embedding ISDM selection into one step of the information development life cycle—is crucial for any ISDM selection model to be useful in practice.

But how should this embedding be done? In the literature, several ISDM selection models have been presented (Lagstedt and Dahlberg 2018b), but timing of the selection is rarely discussed. This has been some kind of blind spot in academic discussion. In some models the assumption seems to be that decisions can be made rather late, even when the project is already started. This might have been possible at the time when development was mainly insourced, but it is not possible (or, is rather costly) if development is outsourced. Because in most ISDM selection models decision-making timing is not discussed explicitly, the intended timing must be inferred from the selection models and criteria presented. Traditionally, ISDM selection is recommended to be done based on ISD project features, such as criticality of results, dynamism of the project requirements, project size, and project personnel and their development culture (see e.g. Boehm and Turner 2004). However, some of the proposed criteria are possible to evaluate only after the project is already started (Lagstedt and Dahlberg 2018b), which is obviously too late for outsourced development. Some ISDM selection models have clear discrepancies here: selection is recommended to be done before the project's start using criteria that are possible to evaluate only after the project is already started. Thus, some arguments are initially vague, and, due to outsourcing and ISDM development, for example, the earlier recommendations in general can be considered outdated (Dahlberg and Lagstedt 2019). In addition, most of the prevailing ISDM selection models are more like theoretical concepts than practical tools, and the scientific evidence for the old selection models is low (Wendorff and Apshvalka 2005). Since the decision-making timing clearly effects on what is possible to select and what is not, there clearly is a need for more careful consideration of ISDM selection timing. This is essential, of course, for practitioners who seeks more successful ISD projects, but also for academia when more comprehensive ISDM selection models and frameworks are developed.

ISDM selection timing is not an IS developers' issue, nor does it apply only to the IT industry. The prevailing wave of digitalization is significantly changing the importance of information systems in companies. Organizations that do not operate in IT-intensive fields and have traditionally been thought of as non-IT businesses will also benefit from digitalization and new information systems (Bharadwaj et al. 2013; Borg et al. 2020). In practice, this means that there are a large number of companies who do not have development traditions, nor development capacity, and all of their IS development must be fully outsourced. If the client company does not have knowledge, guidelines or a process for the selection of the project ISDM, the ISDM used may not be optimal for the client company, even if it is optimal for the supplier (Lagstedt and Dahlberg 2018a). Because of this, expectations and realizations may differ significantly. Adding in teleworking and remote project management due to COVID-19, it becomes even more difficult to find a common view between the client organization and the developers and to address useless or harmful practices if there are no common models or tools helping decision making and communication. Therefore, it is increasingly important to develop pre-project models and processes that can be utilized to reduce pre-project phase risks.

Based on the above, it was seen as important to study what exactly the ISDM decision-making situation is and when ISDM selection should be done. Although a project-specific ISDM selection is rarely done

(Lagstedt and Dahlberg 2018a), the ISDM selection timing is not much discussed in earlier studies, which is a clear research gap. It seems that this gap is one of the reasons ISDM selections are not done in practice: there is no exact place for it. To fill this gap, the following research questions are formulated:

RQ1: How is ISDM selection timed in prior ISDM selection literature?

RQ2: What kinds of recommendations or opinions about ISDM selection timing do ISD experts have?

RQ3: What kinds of recommendations about ISDM selection timing is it possible to form from findings in literature and opinions of ISD experts?

To achieve the answers to the research questions, we have analyzed the findings of a systematic literature review of ISDM selection criteria and collected together the implicit and explicit assumptions about ISDM method selection timing. In addition, we have analyzed the answers from interviews with 31 ISD experts and combined their opinions about ISDM selection timing with the findings from the systematic literature review.

The article is organized as follows: in the theoretical background, the main phases of IS development starting are discussed, as well as what is known of ISDM selection and its timing. In the methodology section the main methods of the study, systematic literature review and 31 expert interviews are presented, which after the results are presented. The discussion and conclusion address and summarize the main findings and recommendations based on them.

Theoretical Background

When ISDM selection timing is discussed, it is important to understand that, even though they are not visible for all developers, there are many important phases before actual coding is started, and coding is only a minor proportion of the whole development (Bocij et al. 2019 p. 420). In the bigger picture, coding is only one part of the systems development life cycle (SDLC). Some kind of SDLC, in one form or another, is possible to detect in all ISD projects, no matter what ISDM is selected for a project (Bocij et al. 2019 p. 250). It is important to discuss the stages before the actual coding is started, especially the selection of ISDM and the stages preceding it.

When the development phases formulate the context where the ISDM selection should be embedded, it is important to study the existing ISDM selection models as well. As already stated, no ISDM suits all cases (Ahimbisibwe et al. 2017; Dahlberg and Lagstedt 2018; MacCormack and Verganti 2003), and there is clear need to develop new kind of ISDM selection models (Dahlberg and Lagstedt 2019). So, it is important to understand what have been studied so far, and how the results of previous studies can be applied.

Development Phases

Systems development stages are studied a lot, and there are several models created as well. A basis for different plan-driven development models has been Royce's (1970) waterfall model, which has four steps (system requirements, software requirements, analysis and program design) before actual coding is started. Although in change-driven development coding is started much earlier, at minimum a feasibility study and system requirements collection at some level should be done before the development is started (Bocij et al. 2019; Sommerville 2011).

The main objective of a feasibility study is to evaluate if new IS is feasible and really needed. Bocij et al. (2019) divide feasibility into four parts: organizational, economic, technical and operational feasibility. As an output, a feasibility study should have recommendations for proceeding, such as different alternatives for acquiring the solution (Bocij et al. 2019).

Although in plan-driven development requirements collection prior to development is heavily emphasized, some level of requirements collection must also be done in change-driven development

before the coding can be started. So, no matter which ISDM is used, these two stages are able be done, at least on some level, before the ISDM must be selected.

On the other hand, phases can be considered not only from the IS development point of view, but also from the client organization point of view. Normally, IS is either supporting the changed processes or enabling new kinds of processes (Henderson and Venkatraman 1999). In addition, ISs are not developed in a vacuum; there should be continuous interaction and communication between developers and business processes, as well as development context of the project. From the client point of view, the diffusion of new IS, and stages related to it, are at least as interesting as the SDLC stages.

Cooper and Zmud (1990) point out that the diffusion of new IT does not happen all at once. According to them, the diffusion of new IT is a gradual process consisting of six stages: initiation, adoption, adaptation, acceptance, routinization and infusion (Cooper and Zmud 1990). The actual coding of new IS is done in the adaptation stage, so the initiation and adoption stages are interesting from an ISDM selection timing perspective. The initiation stage quite resembles the feasibility study proposed in SDLCs. In the initiation stage the main problems/opportunities, as well as existing IT solutions, are scanned. The organizational needs and technological innovations are also evaluated. Adoption stage, in turn, is more organization-oriented; the rational and political negotiations during this stage ensure organizational backing for the new solution (Cooper and Zmud 1990). This more organizational or business process-oriented approach is utilized in later works as well. For example, Lagstedt et al. (2020) proposed an EXOD model to help digitalization of expert work processes. In their model they have four steps: initiation, process re-engineering emphasis, IS development emphasis, and stabilization. Process development and IS development are intertwined, and ISDM selection is done and IS development started only after the first ideas of new processes are agreed upon (Lagstedt et al. 2020).

ISDM Selection and Timing

MacCormack and Verganti (2003) emphasize the importance of early enough ISDM selection by stating: “The first stage of any project should not, in fact, be concerned with the product design, but rather should focus on the design of the development process itself.” Nevertheless, they do not have any more specific guidelines for ISDM selection process or timing, and that seems to be the situation with other prior studies as well.

It is generally agreed that one ISDM can’t suit all different ISD projects (Ahimbisibwe et al. 2017; Brooks 1986; Cusumano et al. 2009; Gupta and Dwivedi 2015; Howell et al. 2010; MacCormack and Verganti 2003; Vessey and Glass 1998), and one solution is to select an ISDM project specifically, case by case (Lagstedt and Dahlberg 2018b; Sommerville 2011; Vessey and Glass 1998). Still, there is no general agreement how the ISDM selection should be made. In the literature several ISDM selection models have been presented (Lagstedt and Dahlberg 2018b). Because in most ISDM selection models the decision-making timing is not discussed explicitly, the intended timing must be inferred from the selection models and criteria presented.

Traditionally, the ISDM selection is recommended to be done based on the ISD project features, such as criticality of results, dynamism of the project requirements, project size, and project personnel and their development culture (see e.g. Ahimbisibwe et al. 2015; Boehm and Turner 2004). However, some of the proposed criteria, such as dynamism of the project requirements or project personnel and their development culture, are possible to evaluate only after the project team is selected and the project is already started—that is, only after the outsourcing development contracts are signed (Lagstedt and Dahlberg 2018b). It can be concluded that some ISDM selection models have clear discrepancies here: selection is recommended to be done before the project’s start using criteria that are possible to evaluate only after the project is already started. This kind of ISDM selection is obviously too late for outsourced development. This conclusion is in line with Ahonen and Savolainen (2010), who pointed out that in

three out of five cancelled IS development projects they studied, the critical mistakes were already made, before signing the contracts.

Thus, some ISDM selection arguments are initially vague, and, due for example to outsourcing and ISDM development, most of the earlier ISDM selection recommendations can be considered outdated (Dahlberg and Lagstedt 2019). In addition, most of the prevailing ISDM selection models are more like theoretical concepts than practical tools, and the scientific evidence for the old selection models is low (Wendorff and Apshvalka 2005). There clearly is a need for more careful consideration of the ISDM selection timing.

Instead of relying on ISD project features only, making the selection of an ISDM based on the objectives and business development context of the project is more fruitful (Ahimbisibwe et al. 2015; Bannerman 2008; Lagstedt and Dahlberg 2018b; Nokkala et al. 2021). Lagstedt and Dahlberg (2018) presented one approach to ISD project-specific ISDM selection where the business development context of the project is also taken into account. According to them, when the IS development method is selected, two sets of factors should be taken into account: factors coming from uncertainties of the business development context (context factors, maturity, beliefs about cause-effect relations) and factors coming from uncertainties of the project outcomes (Lagstedt and Dahlberg 2018b). Based on this, Lagstedt and Dahlberg (2018b) proposed a two-dimensional IS development method selection framework, where these sets of factors are used as dimensions, with a scale of high certainty/low certainty. Nokkala et al. (2021) have discussed utilization of the framework, and they emphasise the timing of ISDM decision making. For a solution, they propose that the method selection decision be divided into three steps: firstly, the ISD project's business context is evaluated by the ISD client organization; secondly, the main principles of ISDM are selected (with consultants); and finally, the utilization and management of ISDM is agreed upon with developers. They stress the criticality of right decision-making timing and claim that it is not possible to decide on every aspect at once. Dividing decision making into three parts makes it possible to make right decisions just when they are needed (Nokkala et al. 2021).

Methodology

The aim of the study was to combine the previous knowledge from literature and practical knowledge of experts. For that, two already-collected research datasets are utilized. At first, we used data collected in a systematic literature review (Lagstedt and Dahlberg 2018b). The objectives of the systematic literature review were to summarize existing knowledge on ISD method selection. After that, we conducted 31 ISD expert interviews in which we tested the ideas found in the literature and asked what really happens in practice (Lagstedt and Dahlberg 2018a). By analyzing the findings from both literature and practice, we summed up the main findings and composed the recommendations.

Systematic Literature Review

In our systematic literature review we followed the advice of Kithchenham (2004) and formulated a written research protocol to guide the literature review. During conceptualization, we read selected seminal textbooks (Avison and Fitzgerald 2006; Boehm and Turner 2004) and scanned top information systems science (ISS) and computer science (CS) journals. Next, we conducted a preliminary search in ProQuest and Google Scholar databases to estimate publication volumes and the types of publications and to design useful search term strings and limitations. ISS and CS are interdisciplinary, and thus research findings on ISD method selection are found in various academic disciplines. We decided to search literature from all disciplines including conference proceedings and so-called "grey literature" (Kitchenham 2004; Webster and Watson 2002) instead of limiting the search to the top journals only. We used three types of databases: 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 indicated that only a handful of articles address ISD method selection. We also discovered several poorly designed, conducted and documented studies. For these two reasons we decided to include in the final search all peer-reviewed articles, regardless of their quality or the scientific impact of a conference or a journal.

The literature search 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. We conducted 32 (4 search strings in 8 databases) individual searches. Google Scholar does not support searches from abstracts only, truncations are not allowed and the search field is too short for long search strings. For these reasons those searches were limited to titles, and shorter search strings were used. We deemed the resulting wider search acceptable, since Google Scholar was used as a complementary database. We did not set any time limitations since the history of ISD methods goes back 60+ years (Larman and Basili 2003). We followed the recommendation Webster and Watson (2002) to use backward and forward searches to supplement search results.

The literature search produced 1419 initial results and approximately 1000 unique articles after duplicate removal. During the filtering, a positive drop policy was applied. In each filtering phase, only those articles were dropped that were clearly out of scope. Unsure cases were moved to the next phase. We used the following inclusion criteria: 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) the full text is available and 5) it is in the English language. Correspondingly, the exclusion criteria were: 1) the article is out of scope (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, compares various plan-driven methods only); 3) it shows unsubstantiated subjectivism (for example, the superiority of a particular method is presumed without evidence). After filtration, we found 42 articles that constitute the material from which the evaluative results of the literature review are drawn.

ISD Expert Interviews

The second dataset is based on the ISD expert interviews and was collected as a part of a larger study where a personal face-to-face interview method was used for data collection (Lagstedt and Dahlberg 2018a). We wrote and maintained an interview protocol, as advised by Yin (Yin 2014), to guide interview planning and execution as well as data collection and analysis. We also kept a diary about the experiences of each interview. 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, adding 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. We, however, 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 local 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 with an average of 20 years' experience. They had cumulatively participated in over 1000 ISD projects, knew plan-driven and change-driven ISDMs, and, with one exception, had personal experience of ISD projects with both types of ISDMs.

The interviews were semi-structured and standardized to better enable data 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). Questions about the usefulness of the ISDM selection recommendation was the last set of questions in the interview.

The challenges of an interview are to listen and understand the responses of the interviewee and, at the same time, ensure that all questions are answered within the time frame reserved for the interview (Opdenakker 2006). To tackle these challenges and to increase the reliability of the responses, we followed the interview method protocol developed by Dahlberg, Hokkanen and Newman (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 interviewing; instead, 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 for each recommendation. Two hours were reserved for each interview since typing down the responses took slightly more time than just recording responses. Interviews were also recorded. Recordings were used to verify and complement responses. The thus 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 interviewees accepted the written interview narrative without changes.

Immediate feedback from the interviewees was one of the strengths in the interview method used. As an interviewee saw what was written down at the time, (s)he was able to make corrections immediately. Both the interviewee and the interviewer saw and shared the same response text (but could still understand the meaning differently (Kaplan and Maxwell 2005)). The method also ensured that all the interviewees verified and accepted the responses.

We interviewed experienced ISD experts with a lot of experience of various ISD projects, different user and IS supplier organizations, and several ISDMs. These facts do not, however, 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 to the use of particular ISDM(s). Even though we asked the interviewees to express their personal opinions and to describe their own experiences, we are unable to evaluate whether or not they behaved in this way. No documents or other sources of data were available for data triangulation.

Findings

Systematic Literature Review

In prior ISDM selection literature, the exact timing of ISDM selection is rarely discussed. Most of the 42 ISDM selection papers found in the literature review (Lagstedt and Dahlberg 2018b) list criteria that ought to be taken into account when ISDM selection is done. They provide tools for ISDM selection discussion rather than taking into account the ISDM selecting process. Those papers do not share clear guidelines on how ISDMs should be selected based on the criteria. Only 16 papers have a selection model of some kind, and half of them were more or less copies or modifications of previous models.

Papers having listed only ISDM selection criteria do not discuss the ISDM selection process, and the timing of ISDM selection is presented on only a general level in them. In most of those papers, the timing of ISDM selection is either not discussed at all, or it is said to be done in the product design or planning stage (Al Ahmar 2010; Ferratt and Mai 2010) or more generally "at the beginning of every

project" (Benediktsson et al. 2006). So it seems that papers without an exact ISDM selection model do not have exact selection timing defined either. This is understandable since the aim of those papers is to discuss ISDM selection criteria, not the process.

Surprisingly, the situation in papers having an ISDM selection model in them is not much better. Even though the purpose of these papers is to more or less give the guidelines for ISDM selection, the selection stages and timing are seldom discussed, and, if discussed, rather general level statements and recommendations are given.

However, in some papers the ISDM selection timing has been discussed in more detail. A clear ISDM selection process model was found from only one paper. Episkopou and Wood-Harper (1986) have developed the Approach Choosing and Matching System (ACMS) model for "an appropriate approach" (ISDM) selection, and in their model, they have discussed the main phases of the ISDM selection process as well. According to them, ISDM selection should be done when the problem owner, problem content system (developed IS and its environment), problem solver (developers) and different problem-solving approaches (ISDMs) are assessed.

Although they do not have a process model, De Weger and Franken (1997) have one of the most exact determinations of timing. They direct the ISDM selection to be done in the project risk analysis phase, that is, after a feasibility study and before the ISD project design phase. MacCormack and Veganti (MacCormack and Verganti 2003) also emphasized the importance of pre-project ISDM selection but do not offer any suggestions about detailed ISD pre-process or ISDM selection phases. Some papers simply suggest that ISDM selection should be done "at the right moment" (Tang and van Vliet 2012) or "in the early phases of a project (even before project start)" (Öztürk 2013), and there were also papers with no suggestions at all (Boehm and Turner 2003a, 2003b; Ratbe et al. 2000; Yusof et al. 2011).

However, other approaches exist as well. Howell et al. (2010) as well as Pries-Heje (2006) point out that an ISD project could be started with one ISDM, and during the project the situation can be re-evaluated and moved to another ISDM. However, changing an ISDM during an ISD project is risky and time- and resource-consuming, and, if the development is outsourced, there might be difficulties with contracts as well. It can be argued that this kind of "project tuning" indicates the ISDM selection model failing to consider all necessary factors in the first place.

Although exact ISDM selection phases and practices, as well as their relationship to project phases, are mainly ignored in the articles, a general assumption seems to be that the ISDM selection should be done prior the start of an ISD project. Nonetheless, some models have discrepancies relating to the timing of ISDM selection. For example, the proposed criterion "size of the 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) as well as the criterion "developer acquirements (skills, understanding)" (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) includes an assumption that ISDM should be selected only after the project group and development team are formulated. Some criteria even require the project already being started, such as the criterion "dynamism" (how many requirement changes there are per month; Ahimbisibwe et al. 2015; Boehm and Turner 2004). At that stage, ISDM selection is too late: the project is already planned (or even started), the developers are selected and contracts signed. It is not possible to suit the best possible ISDM to the development situation anymore; the project plan and contracts dictate the ISDM used and all changes are costly.

It was also studied who should make the ISDM selection. According to the prior literature, the project manager (Benediktsson et al. 2006), management (Boehm and Turner 2003a, 2003b; El Luadi et al. 1991; MacCormack and Verganti 2003; Ratbe et al. 2000), IS department (Burns and Dennis 1985) designers (Tang and van Vliet 2012), systems analyst (Episkopou and Wood-Harper 1986), and developers (Clarke and O'Connor 2012; Öztürk 2013; Yusof et al. 2011) are said to be responsible for

ISDM selection. However, if the responsibility is on developers, there is a similar discrepancy as mentioned above: when developers are selected in outsourced development, contracts are already signed and the ISDM to be used is fixed. In addition, although Ahimbisibwe et al. (2017) call for developers to forget their allegiance to a particular ISDM community, it seems that, in practice, developers have strong opinions, and their acquirements are the main reason to select a certain ISDM, no matter what the development case is (Lagstedt and Dahlberg 2018a).

ISD expert interviews

We asked 31 ISD experts for their opinions of ISDM selection timing and the main tasks to be done before a project is started. When the answers were collected together, we found that ISD experts have congruent views on ISDM selection timing, and the answers complemented more than argued with each other.

One general opinion among interviewees is that ISDM selection should be done right after the feasibility study is done, when at least some kind of product backlog is formed (business/user needs and upper-level architecture), but before comprehensive requirements collection is started.

It was also recommended that the decision should be made together with an ISDM expert, project owner and project manager who have experience from previous projects, along with help from a software architect. In addition, the need for a business representative was strongly emphasized. If there is not enough expertise available, several interviewees recommended hiring a consultant—for example, a professional scope manager. One interviewee recommended that the project steering group should be set up already at the ISDM selection point. It was also mentioned that the client's information management (IM) processes should affect, or be taken into account in, ISDM selection.

One interviewee brought up another point of view, stating that at the beginning, before any kind of project-specific ISDM selection discussion, an ISD client organization should analyze its own capability for IS development, how ready they are for IS development.

A clear selection model was seen as an essential tool, as one interviewee noted that if tools to classify projects are clear enough, the final decision maker about which ISDM to use could even be the sales person (from an IS supplier).

Even though the idea of project-specific ISDM selection was largely supported, some interviewees stated that ISD suppliers make the selection because they know the ISDMs and ISD clients do not have the time or resources (with knowledge). However, most of the interviewees agreed that the ISD client should be responsible for ISDM selection alone, or together with potential suppliers or consultants.

Some interviewees did answer in rather general terms, for example, saying that the selection depends on the case or is up to the organization's culture or experience, without specifying in more detail what they meant.

Interestingly, one interviewee pointed out that "project tuning," as described by Howell et al. (2010), happens from time to time in cases where a project has been started with an unsuitable ISDM, but this project tuning was not considered a good nor desirable practice.

Recommendations for ISDM selection timing

1. Who should make the ISDM selection? Based on the findings from literature and ISD expert interviews, the ISD client organizations, no matter their business area, is recommended to have enough ISDM knowledge. An ISDM-aware systems analyst, who is able to do a feasibility study and evaluate the objectives of the IS and the business environment, can be an essential asset for ISD client organizations. The systems analyst, together with business representatives and the client-side project manager, should select the ISDM before the detailed plan is done and ISD supplier is selected. If the

ISD client organization does not have an ISDM-aware systems analyst, it is strongly recommended for the organizations to hire an impartial consultant for that.

2. When should the ISDM selection be done? Based on a handful of articles on having ISDM selection timing defined, it can be concluded that ISDM selection should be done after a feasibility study in the project risk analysis phase, when the product owner is defined and developed IS and its environment is assessed. According the ISD experts, the ISDM selection should be done right after the feasibility study is done, when business/user needs and upper-level architecture are defined, vision is clear, and main requirements are collected, but comprehensive requirements collection and analysis have not started. In addition, the offering phase should not be started yet; the selected ISDM should be one requirement in offers.

3. How should the ISDM selection be done? To help make decisions with incomplete information, an ISDM selection model should be used as a tool for decision-making. So, it is essential for the ISD client organization to use a simple and effective enough ISDM selection method. Since the ISDM selection models based on only the ISD project criteria were found problematic (selection is possible only after the project is started), and the criteria used were mostly outdated (Dahlberg and Lagstedt 2019), they cannot be recommended to use in ISDM selection. Instead, it can be recommended that an ISDM selection model that also takes the business development context of the ISD project into account is preferred. Such a selection model, having a more comprehensive approach, helps to evaluate the suitability of different methods for a particular development situation.

Discussions and Conclusions

As a conclusion it can be said that ISDM selection is agreed to be an essential part of preparing the ISD project, but there is no consensus when the selection should be made. If selection is made before starting the ISD project, it must be made with more or less incomplete information. When the project is started, there is more information available, but there are other restrictions, such as resource and schedule constraints, outsourcing contracts, and developers' preferences, which hinder the possibility of making ISDM changes. However, if no exact stage for ISDM selection is pointed out, most probably there is no place for ISDM selection at all.

As an answer to research question one (*RQ1): How is ISDM selection timed in prior ISDM selection literature?* it is stated that prior literature treats ISDM selection timing and ISD pre-project process superficially. Most of the articles are concentrating on ISDM selection criteria only, with no interest in how the actual selection should be done. In those articles, the timing of ISDM selection is discussed at a very general level, if at all. Articles referencing some kind of ISDM selection model have slightly better guidance to the selection process as well, although most of these articles do not have specific selection timing defined either. According to a handful of articles with ISDM selection timing defined, it can be concluded that ISDM selection should be done after a feasibility study in the project risk analysis phase, when the product owner is defined and developed IS and its environment are assessed.

In the ISD expert interviews, some answers were also on quite a general level, but most of the respondents had a pragmatic approach to ISDM selection practices. When combined the answers together, it can be concluded that according to the ISD experts, the ISDM selection should be made right after the feasibility study is done, when business/user needs and upper level architecture are defined, but comprehensive requirements collection is not started. This is the answer to research question two (*RQ2): What kinds of recommendations or opinions about ISDM selection timing do ISD experts have?*

As an answer to research question three (*RQ3): What kinds of recommendations about ISDM selection timing is it possible to form from findings in literature and opinions of ISD experts?* the findings from literature and ISD professional interviews were conjoined, and based on them, the three main

recommendations presented in the section above were formulated. The main recommendation is that ISD clients should use a comprehensive ISDM selection model to help make their selections and that a professional ISDM-aware systems analyst (inside the organization or hired) should be making the selection right after a feasibility study is done, the vision is clarified, and the main business requirements are understood.

The situation in which ISDM selection ought to be made is rarely discussed in literature. ISDM selection literature is focused mostly on project-based selection criteria; with a few exceptions, there is a clear lack of development of situation-based ISDM selection models. Too often, ISDM selection seems to be "somebody else's problem," meaning that no selection is made in time, but the project is drifting until the IS supplier or developers finally make the selection that suits them best, but which is not optimal for the specific ISD project (Lagstedt and Dahlberg 2018a). In practice, often unconsciously, irreversible decisions are made (or more precisely, decisions are not made) in the project start-up phase, and a project could be doomed to failure even before it has been started (Ahonen and Savolainen 2010). For this reason, it is important for client organizations to understand the importance of decisions made in the project start-up phase (Savolainen et al. 2015), and suitable ISDM selection models should also be applied in ISD client organizations that do not consider themselves IT-oriented. This is the recommendation for practice.

As a remarkable share of existing ISDM selection models can be considered outdated (Dahlberg and Lagstedt 2019), it is important that more up-to-date and comprehensive ISDM selection models are developed and studied. However, the time-bound nature of decision making in constantly changing environment must be understood. There is a time frame in which ISDM selection decisions are able to be made, and if this is not properly understood, there is no point to create and study new ISDM selection models either. The new ISDM selection models should be thorough enough to cover the development situation holistically, but simple enough to be used for ISD clients lacking strong ISD skills. In the new ISDM models there could be, for example, a set of simple questions; and the ISDM selection should be made only when all of the model's questions can be answered. Thus, the ISDM selection must be planted in the ISD project's starting process (pre-project process) in ISD client organizations, and there must be answers to questions: who, when, and how. In this paper, one set of answers to those questions is presented. The answers are based on the findings from literature and ISD expert interviews, but additional comprehensive studies should be made in practice to test and refine these propositions. These are the recommendations for researchers.

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