Selection, Adaption and Use of IS and Business Development Methods in Digitalization Projects

Lagstedt, Altti
Haaga-Helia UAS;
Turku School of Economics
aaelag@utu.fi

Dahlberg, Tomi
Turku School of Economics,
University of Turku
tomi.dahlberg@utu.fi

Kiselev, Caroline
University of St.Gallen
Institute of Information Management
caroline.kiselev@unisg.ch

Kautz, Tobias
University of St.Gallen
Institute of Information Management
tobias.kautz@student.unisg.ch

Abstract

As digitalization has a significant impact on all industries, it is important to examine how digitalization methods are selected and applied. For that, we conducted two-step research: first, a survey examining how the connection of IT and digital business management affects business development management, followed by digitalization project participant interviews. We can conclude that method selection is done rarely, and even if it is done, project participants are not always aware of it. In addition, although business development objectives were largely emphasized, business development methods were scarce. Instead of deploying systematic business development, it was easily left as a vague part of IS development. Quite often, projects (willingly or accidentally) utilized some kind of hybrid method, but its elements were not combined systematically. As one result, we propose a new kind of hybrid method evaluation tool to be used in the method selection phase.

1. Introduction

As digitalization is considered an important tool for enterprises to cope with the constantly changing world and increase the efficiency of processes, its success is essential for all industries [8]. At the moment, COVID-19 seems even to have accelerated the already rapid pace of digitalization [3]. In digitalization it is not enough just to automate existing practices and digitize information; rather, digitalization often means significant changes in business models, processes and work practices. Human factors have to be taken into account, and new kinds of competencies are needed in companies [32]. Thus, to succeed in digitalization it is necessary to contemplate both what is digitalized and how to digitalize.

Our research addresses digitalization projects that develop both business and information systems (IS), that is, IS-enabled business development projects. The selection and use of business, IS and other development methods, the focus of our research, is one of the decisions that in each project and its sub-projects has to make [28]. Prior research has revealed that failures in selections have adverse outcomes. A digitalization project may not deliver the desired and agreed-upon results or may have quality, time-schedule and/or cost problems [16]. Users could be unwilling to use the delivered functionalities [15]. Moreover, inconsistent methods might cause organizational tensions [22].

In this article, we report the first empirical findings of our research in progress currently conducted in two European countries, Finland and Switzerland, on factors that impact the selection and use of development methods. The objectives of our research are: to better understand issues and factors that have influenced the selection and use of alternative business and IS development methods; to detect how such issues, factors with selected and used methods are related to the success of digitalization projects; and finally to craft and empirically validate tools with related guidelines for the selection and use of business and IS development methods for digital transformations. Here, we report interview findings on the ideal properties of methods and method selection in projects recently executed.

As a whole, backed by prior research [9, 15, 17], we propose that there is no single business or IS development method that suits all development project contexts. At extremes, both business development and IS development methods (ISDMs) can be classified into two main categories: plan-driven and change-driven methods [30]. Our research idea is that the selection and use of business and IS development methods delivers optimal results when the methods are consistent and also match the characteristics of the addressed digitalization context. We continue from the proposed ISDM selection framework by Lagstedt and Dahlberg [29], which follows a similar approach.

The selection and use of development methods is only one set of factors that impacts the success of digitalization projects. For example, the mentioned ISDM selection framework builds on two sets of factors that describe business development contexts: the

URI: https://hdl.handle.net/10125/80240
978-0-9981331-5-7

uncertainties of the developed business (business process maturity, business process stability and ability to model cause-effect relations) and the uncertainties of business development outcomes (business process metrics maturity, ability to define relevant business outcome metrics) [29]. We concluded that it is necessary to better understand the relationship between IT and digital business management and IS project success. We investigated this issue by analyzing the responses of survey data in the "Annual IT and Digitalization Barometer Survey 2020". The survey had 272 valid responses.

We then conducted interviews motivated by the backdrop described above. We interviewed 17 business or IS development experts, 10 in Finland and 7 in Switzerland, with an open semi-structured interview instrument. We asked the same set of interview questions about the characteristics, selection and use of business and IS development method at three levels. General level was described as the representation of ideal characteristics. Enterprise level was described as the representation of policies, guidelines and practices of the interviewee's company. Specific IS-enabled business development projects represents practical level.

In addition to plan-driven ("waterfall") and change-driven ("agile") approaches and methods, so-called hybrid approaches and methods are also used [26, 41, 42]. As the term indicates, they combine plan-driven and change-driven approaches and methods. According to prior research the application of hybrids varies a lot, and there are no established guidelines or models on how to organize hybrid methods [26, 35, 41].

Large enterprises, where we did our interviews, typically execute several digitalization projects at the same time. Some might use plan-driven, others change-driven, and a third group hybrid methods. The use of multiple methods could cause organizational tensions between the users and advocates of various methods, which then could hamper their optimal use [22]. As a summary, we feel that there is a need for tools with related guidelines to support the selection and use of various IS and business development methods within digitalization projects. (Large) enterprises execute several digitalization projects simultaneously and appear to either rely on or be highly interested in the hybrid approach and hybrid methods [25, 41] in these projects. We see these issues as a research gap.

From the described background we formulated the following research questions for this article:

RQ1. *What is the relationship between IT and digital business management and the success of digitalization and IS projects?*

RQ2. *How are methods selected for digitalization projects?*

RQ3. *How are the selected methods adapted and combined?*

The next section reviews related research, followed by the methodology section. We then present the results of the research and end the article with a discussion and conclusions section. The main contributions of our article are in describing the relationship between IT and digital business management and project success, and in revealing factors that need to be considered in the selection of alternative IS and business development methods from general- to project-level. As a contribution, we also propose initial guidelines to be used in the crafting of a hybrid method evaluation tool, which our research in progress will fine-tune, complete and validate.

2. Related research

The success of digitalization is strongly reflected in the business and IS development methods used in it [17]. It is well known that no ISDM is suitable for all possible situations [9, 15, 29]. Instead of creating more new methods for developing IS, it is more important to consider how to choose a method that is appropriate for each development situation [32]. Recent studies have shown that the choice of method should be influenced not only by the object of development (the objectives of the new IS) but also by the business environment of the development project [24, 29].

To include the management practice aspect with the contextual impact factor of business management in digitalization projects, we reviewed related research on how success in the management of IT/IS and digitalization as part of business management is related to the success of digitalization and IS/IT projects. We augmented this knowledge with our survey study. Within this digitalization management context, the key issue of the present article is how development methods are selected, adapted and combined for digitalization projects.

2.1. Management of IT in business, business-IT alignment and IT management impacts

The findings of related earlier empirical research are consistent on how the management of IT as a part of business management, business-IT alignment, and the impacts of IT management influence IT/IS project outcomes. Dahlberg and Kivijärvi [14] and especially Kivijärvi [24] offer detailed reviews and summaries about literature and findings on the relations between these factors and their item-level variables. All three factors – the management of IT as a part of business management, business-IT alignment, and IT

management – have been detected to positively influence positively both IT/IS project performance and the business significance of IT/IS projects, that is, the business benefits of IT/IS projects. Our research builds on two propositions. We regard the IS development (sub-)projects of digitalization projects as IS-enabling business development projects. Secondly, business and IS development methods selected and used should match each other and the characteristics of the business development context. Our conclusion is that these propositions are based on related earlier research, and hence our empirical findings augment existing scientific knowledge.

Kivijärvi [24] used the same open source survey data as we do. His data were from the year 2015, whereas our data are from the year 2020. Over the years some of the survey items have changed. Kivijärvi used variance-based structural equations modeling (SEM) type confirmatory factor analysis (CFA) to test his hypotheses and the research model, whereas we use Student's two-tailed t-test. Hence the findings of his and our studies can be compared meaningfully only on item/variable level.

2.2. Information system development methods

From the control perspective, ISDMs are classified into two main categories: plan-driven and change-driven methods [30]. We summarized the differences of these two approaches in prior research to Table 1. The use of plan-driven ISDMs was the prevailing approach till the end of the last millennium; during the last two decades there has been a clear paradigm shift from plan-driven ISDMs to change-driven ISDMs [42].

Table 1. Characteristics of change-driven and plan-driven ISDMs

Character-istics	Plan-driven ISDMs (one end of scale)	Change-driven ISDMs (other end of scale)
presumption	objectives can be defined beforehand [37, 39, 40]	objectives can't be defined beforehand [7, 10]
objectives and prioritization	defined before development [37, 40]	adaptive, specified during development [1]
costs	"fixed" before development[40]	open, "acceptable losses" [4]
time	"fixed" before development [40]	open [38]
progress	sequential phases [37]	iterative and incremental [1]
approval points	stage-gate model applied [11]	review at the end of development cycle [38]
validation (QA)	end of development [37]	end of each development cycle [38]
management	project management (time, objectives and money) [40]	method and objectives management [38]
measure	targets (iron triangle) [40]	velocity of development [38]
risk taker	developers[27, 36]	customer[27]
use of resources	different experience in different phases, also part-time [40]	experience inside team, full-time commitment [38]
role of customer	part-time commitment, not so competent [37, 40]	committed to cooperate continually, competent [7]
system development responsible	systems analyst [6, 40]	product owner [38]
known challenges	costly and late changes [40, 44]	vague, changing objectives, technical debt [5, 18, 19, 30]
business process change management	someone else's problem (behind project manager)	someone else's problem (behind product owner)

The plan-driven and change-driven ISDMs presented in Table 1 represent only the extremes, which are seldom used purely in practice [25, 26, 41, 42]. Currently, most ISs are developed with hybrid methods, which combine the plan-driven and change-driven approaches. Hybrid methods can be organized in different ways [35]. In some cases there are parallel plan-driven and change-driven elements, and in some cases they are organized sequentially; in different projects the elements may have different emphases, and there are no established guidelines or models on how to organize hybrid methods [26, 35, 41].

However, the characteristics presented in Table 1 can be used as an evaluation or planning tool when a hybrid method is selected and planned for a project. The characteristics of hybrid methods fall between the presented ends, which helps to evaluate the suitability of a specific hybrid method for a specific case.

2.3. Development method selection

As pointed out in earlier papers, no single ISDM approach or method fits all IS development problems and situations [9, 15, 17, 41]. Thus, it is meaningful to select the method project specifically [2, 29, 41]. Furthermore, the context factors, that is, aspects beyond project management, such as terrain, dynamics, complexity, commitment and ability to act, affect the success of the project [2, 23, 43]. When an ISDM is selected, the context factors could be considered as factors coming from uncertainties of business development context (contingency factors, maturity, beliefs about cause-effect relations). The other group of factors to be taken into account are the factors coming from uncertainties of the project outcomes [29]. Based

on these factor groups, Lagstedt and Dahlberg [29] proposed a two-dimensional IS development method selection framework (Figure 1), where the uncertainties related to the development context and uncertainties related to project outcomes are used as dimensions, with a scale of high certainty/low certainty.

High business execution certainty	Leans on plan-driven / Leans on change-driven	Plan-driven ISDM
Low business execution certainty	Change-driven ISDM	Leans on plan-driven / Leans on change-driven
	Low business development outcomes certainty	High business development outcomes certainty

Figure 1. ISDM selection framework [29]

Although dichotomous scales are used in the Lagstedt and Dahlberg [29] model, in method selection practice the situation is not so straightforward. Two important aspects have to be taken into account: firstly, a big portion of IS development projects are done with some kind of combination of change-driven and plan-driven IS development method [42]. These kinds of combinations are called hybrid methods, and they can vary a lot [35]. Secondly, large organizations especially have several digitalization projects going on at the same time; also several different plan-driven, change-driven or hybrid methods are used at the same time. This causes tensions inside organizations, which in turn hamper the use of the methods [22].

2.4. Development context

Recent studies have pointed out the importance of development context as a determinant for IS development success [2, 17, 23]. Winter at al. [43] identified several factors outside of project management influence that explained project failures and should be taken into account in IS development method selection and/or customization. Based on this, Kiselev et al. [23] created an assessment instrument to analyze the project context with the contextual factors presented in Table 2.

Table 2. Contextual factors, adaptation from Kiselev et al. [23]

Contextual Factor	Subfactors
Terrain, the technological and conceptual territory an organization enters through a project.	a) Experience with similar project or solution b) Existence of standard solutions c) Sufficiency of existing infrastructure d) Experience with similar organizational changes
Dynamics	a) Technological environment b) Organizational environment c) Political environment d) Legal environment e) User demands
Complexity, both systemic and organizational	a) Amount of relevant peripheral technical systems and interfaces b) Complexity of system architecture c) Stakeholder heterogeneity d) Complexity of organizational structures and processes
Commitment, the general standing and respect of project	a) Management commitment b) Employee commitment
Ability to act, the autonomy of a project	a) Decision-making autonomy b) Budgeting cycles

3. Research method

In this paper, we present the first results of our ongoing research. Since the research questions form a multi-stage interrelated entity, and reality is viewed from different complementary perspectives, a mixed method approach is a good one here [12, 20, 45]. Applying the classification of Petter and Gallivan [34], our purpose of using different methods in same study is complementarity and our approach is sequential: we first conducted a survey about business digitalization and ICT management experiences, after which we conducted interviews where we collected data from different digitalization projects. This approach follows Creswell and Plano Clark's [12] explanatory sequential design, where quantitative data collection and analysis are done first, and, after that, qualitative data is collected to follow the results of the quantitative phase.

This is the first result of our research. In the next phase of the research, we will have more interviews based on the results of this phase, as well as at least one workshop of experts coming from different companies.

3.1. Survey

To analyze the relationship between IT and digital business management and the success of digitalization and IS projects, we used a relatively large existing survey data set called the IT and Digitalization Barometer 2020. It contains data collected by the Finnish Information Processing Association in October 2020. The survey was addressed to business and IT executives and experts, from both companies and public sector organizations with a focus on organizations with over 500 employees. In this study, we used only the part of the available data that concentrated on the investigated issue. An invitation to participate in the survey along with one reminder was sent to approximately 5000 respondents. The response rate was 5,5 % with 277 responses, which we regard as normal for surveys sent to executives and experts with

voluntariness to respond. Of the respondents, 42% (n=122) were business executives and experts, and 58 % (n=169) were IT and digitalization executives and experts. The proportion of executives and managers was 66 % (n=179, 93 in business; 86 in IT and digitalization) and experts 34 % (n=92). Six respondents did not answer these questions.

The survey items data were collected as responses to statements shown on a seven-item Likert survey scale. By choosing value 1 (-3) respondents indicated that they fully disagreed with the statement of a survey item, and by choosing value 7 (+3) they indicated full agreement with the statement. The other values represented strongly agree (=6), somewhat agree (=5) and so on. From potential survey items/variables, we selected for our analysis the statement: "My organization has succeeded well in the management of IT and digital business as a part of business management." We divided the respondents into two groups on the basis of how they responded to this statement and compared the means of all other statements (variables) between these groups. Of the respondents, 98 either strongly or fully agreed with the above statement and 169 responded with options from fully disagree (=1) to somewhat agree (=5). Ten respondents did not answer these questions. We compared the means of the following IT/IS project success items (variables). In my organization:

1. We define clear measurable objectives to IT/IS projects prior their start.
2. IT/IS projects are completed within agreed timetables.
3. IT/IS projects are completed within agreed financial budgets.
4. IT/IS projects deliver agreed outputs and/or functionalities.
5. IT/IS projects deliver well business benefits expected from them.
6. The results of IT/IS projects represent well what we planned.

We also compared the means of the following digitalization – that is, digital transformation – success items (variables). In my organization:

1. We have succeeded well in the investments and purchases of digital business.
2. We have succeeded well in electronic business.
3. We have succeeded well in data-driven business.
4. We have succeeded well in software-based business.

3.2 Interviews

We selected the personal face-to-face interview method for data collection. The interview method enables interactive synchronous communication and asking of additional questions, which help an interviewer and an interviewee to better understand each other [33]. The aim of crafting the interview questions was to have simple, direct and neutral questions with enough variation to get rich data [21]. We also followed the recommendations of Myers and Newman [31] and planned a clear interview drama. Due COVID-19, all interviews sessions were virtual. Virtual conference tools (Zoom and Teams) were used for communication and sharing the screen.

The objective was to conduct at least 24 interviews in 6-8 organizations with 3-4 interviews per project. Due to the COVID-19 situation, some interviewees are postponed to autumn 2021. Here we report the findings of 17 interviews completed so far, 7 in Switzerland and 10 in Finland. Our aim was to interview key parties of each business digitalization project: business representatives (for example process or product owner), developers (for example project manager or architect), end users and executives (e.g. project portfolio managers or project steering committee members).

The interviews were semi-structured and standardized to better enable data analysis of collected data. 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 [33]. To tackle these challenges and to increase the reliability of the responses, we followed the interview method protocol developed by [13]. During an interview, the questions were presented to the interviewee one by one on a shared screen, and the interviewer typed the responses right away before moving to the next question. Notes were stored in a shared document (Google Drive), and interviewee had access to the document as well. In addition, in interview sessions there were two interviewers present, one making notes while the other asked questions.

One and a half 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. Immediate feedback from the interviewees was one of the strengths of the interview method used. As interviewees saw what was written down the whole time, they were able to make corrections immediately. Both the interviewee and the interviewer saw and shared the same response text.

In data analysis, we developed preliminary data coding categories based on literature, as recommended by Kaplan and Maxwell [21]. We then added new codes that were developed inductively during data analysis.

4. Results

4.1. Survey

Figures 2 and 3 illustrate the results of the survey data analysis. These two figures show that there is a strong relationship between the success of managing IT and digital business as a part of business management and the success of IT/IS projects and digitalization. For example, in Figures 2, when respondents agree strongly or fully with the statement that their organization has succeeded well in the management of IT and digital business as a part of business management, then the average (=mean) of their responses to the statement "*IT/IS projects deliver well business benefits expected from them*" is 5.67 on the Likert scale. The mean of other respondents is 4.74 and statistical probability of the difference in the means is over 99.99%. All comparisons between the averages of the dependent variables in Figures 2 and 3 are similar.

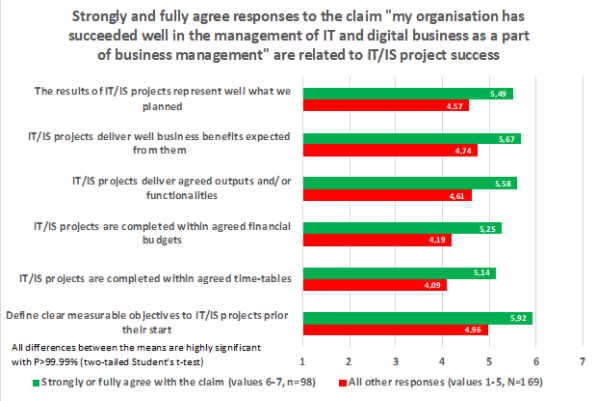

Figure 2. Differences of IT/IS project success variables

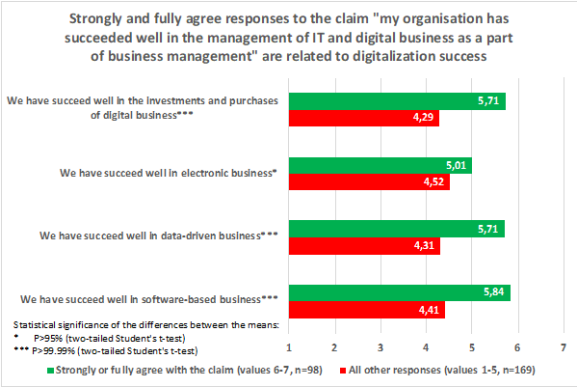

Figure 3. Differences of digitalization success variables

We also analyzed the data by dividing the respondents into those who agreed with the statement of the independent variable (values 5-7) and to those who disagreed (1-3). The differences of the means were even wider, but the responses of those who did not agree or disagree were excluded. We repeated the analysis with other independent variables, such as understanding the significance of IT and digital business management and defining objectives to IT and digital business management. Analyses produced comparable results.

4.2 Interviews

The evaluated projects in both countries were considered rather complex, the main sources of complexity being heterogeneity of stakeholders, business processes, system architecture and a large number of integrations. For Finnish projects, the evaluation context for the selected projects was considered quite familiar, a similar business change, project type or collaboration model was used in previous projects. In Switzerland, on the other hand, the majority of the project teams did not have experience with the respective evaluation context, but if they had, they had experience with multiple of the aforementioned features of the evaluation context. Regarding dynamics in the development context, in Finland, it was pointed out that other concurrent projects in the context lead to changing environment or conditions for certain projects. Swiss interviewees however did experience dynamics because of changes in the legal environment.

Based on the answers, it seems that management, and developers were highly committed to all projects, even in the troubled projects (a project that ran into difficulties and had to be started again, and a project where the supplier was changed during development phase). This also applies for the end-users, with the exception of one (plan-driven) project that failed to capture the needs of the end-users prior to the roll-out of the solution. However, it emerged that employees outside of the project do not understand why the members of the development team are not available to other work and tasks of a company.

We also asked the reasons behind the digitalization project in the organization. The Finish interviewees raised mostly business process-based reasons for the project (automation, efficiency, cycle time), even in cases where the primary reason for the project was changing legislation. In addition, the renewal of a system was mentioned several times. The Swiss interviewees mentioned mainly market-based (e.g., customer demand), technical (e.g., renewal of system), capability-related and organizational (e.g., supporting an enterprise-wide strategy) reasons. Noteworthy, the most often mentioned capability-related reason (in both countries) was the execution of agile pilot projects to get to know agile methodologies. Although business process development was emphasized, systematic

methods for developing business processes were rarely used in either country. And, if used, the methods followed a plan-driven approach, although IS development might have been done with change-driven methods.

Most of the Finnish interviewees could not answer how the compatibility of the business development methods and the IS development methods was ensured. A dedicated tool and person were mentioned in one answer, while another interviewee pointed out that business development was done inside IS development; the need for separate business development wasn't seen, and that caused problems. As one person stated: " *The IS project knows what the pursued situation is, other organization only knows the old (existing) situation, no-one takes care of the gap*." With Swiss interviewees it was rather the other way around. The IS development, often change-driven, was done within the business development, often plan-driven. The compatibility was mostly ensured through temporary or spatial decoupling of the two methods responsible teams.

In Finland, method selection, if it existed at all, was not visible for all. Members of the same project could have a different view on whether there has been method selection or not and who made the decision. Most of interviewees did not mention any selection criteria. In few projects method selection was really done before the start of the project, in other projects, the method either the supplier or the end-user organization promoted was used, or the project somehow "drifted" to a particular method. Since selection was done rarely, not many selection criteria were mentioned either. The biggest selection criteria group that came out was popularity related criteria (trends/hype, plausibility of a method, recommendations outside of the organization and supplier preferences). In the Swiss projects, method selection was done more explicitly and mostly ex-ante by top management and / or the project team. Besides the trends / hype aspect, the maturity of the organization, the competences of the project team members and the compatibility with other methods in the organization were the predominant selection criteria in Switzerland.

Methods are applied based on the project needs, but in neither countries, there were no systematic way to adapt methods for a case. The most often named IS development methods were Scrum and Kanban for both countries. A self-configured waterfall was used widely in Finland as well, but no exact description of how the configuration was done was explained in interviews.

Hybrid methods were often applied, and in Finland named positively as "semi-agile" and negatively as "wanna-be-agile", depending on how well the combination had succeeding from the interviewee's point of view. At least two types of hybrid methods were used: waterfall in project management and agile at operational level, and parallel development. In the latter project, waterfall was the bigger development stream providing predictability and agile the smaller, providing flexibility and continuous feedback from end-users (ca. 20% of the content). Both hybrid approaches were praised and criticized, and there is room for further studies here.

We also asked interviewees to characterize different methods. Table 3 summarizes the interview findings in relation to the issues described in earlier studies (Table 1). The cells of the table not mentioned in any interview are indicated with gray background.

Table 3.Characteristics of change-driven and plan-driven ISDMs detected in the interviews

Character-istics	**Plan-driven ISDMs (one end of scale)**	**Change-driven ISDMs (other end of scale)**
presumption	objectives can be defined beforehand	objectives can't be defined beforehand
objectives and prioritization	defined before development	adaptive, specified during development
costs	"fixed" before development	open, 'acceptable losses'
time	"fixed" before development	open
progress	sequential phases	iterative and incremental
approval points	stage-gate model applied	review at the end of development cycle
validation (QA)	end of development	end of each development cycle
management	project management (time, objectives and money)	method and objectives management
measure	targets (iron triangle)	velocity (burn-rate) of development
risk taker	developers	customer
use of resources	different experience in different phases, also part-time	experience inside team, full-time commitment
role of customer	part time commitment, not so competent	committed to cooperate continually, competent
system development responsible	systems analyst	product owner
known challenges	costly and late changes	vague, changing objectives, technical debt
business process change management	someone else's problem (behind project manager)	someone else's problem (behind product owner)

Individual answers varied considerably. Some interviewees mentioned a few characteristics only. In general, interviewees had a better grasp about (and more experience on) plan-driven methods although change-driven methods were valued at least equally high as plan-driven methods, sometimes even higher.

However, we can see that, although some of the answers were scant here, the answers in general covered the list of characteristics presented in Table 1 rather well (see Table 3), and no new characteristics emerged during interviews. Hence, as one result of the study, we propose the characteristics presented in Table 1 be used when ISDMs are evaluated and also when ISDMs are selected for a project. As noted in Section 2.2., the characteristics presented in Table 1 are only the extremes of the scale between plan-driven and change-driven development. When hybrid methods are evaluated and compared, each characteristic should be evaluated separately and placed on the scale. Table 4 illustrates the idea of the proposed hybrid method evaluation tool (in part) with an imaginary example.

Table 4. The hybrid method evaluation tool

Character-istics	**plan-driven ISDMs (one end of scale)**						**change-driven ISDMs (other end of scale)**
presumption				X			
objectives and prioritization					X		
costs			X				
time				X			
progress						X	
…							

5. Discussion and Conclusions

We investigated how business and information systems development work is conducted in parallel within digital transformation projects and how the selected and used development methods support such co-development. To justify our approach, we analyzed survey data and examined the relationship between the success in the management of IT and digital business as a part of business management and the success of IS projects and digitalization. We discovered statistically highly significant relations between these issues. This is our response to the first research question.

Kivijärvi [24] used the same open data as we but from the year 2015. The variable "*my organization has succeeded well in the management of IT and digital business as a part of business management"* was not included in the data in 2015. In his research, Kivijärvi conducted so-called importance-performance analysis for 24 measures of IT/IS project outcomes. He detected that the survey items (variables) "*it is extremely important to our future success that IT provides value to our business by facilitating the development of new innovations*", "*IT serves our business a partner in the pursuing of strategic objectives*", and "*IT projects are actually business development projects*" were the most important model performance indicators (=explained IT project business impact). Although the wordings of these survey items are different from the wording of the explaining survey item used in our research, they strengthen the significance of the results in both studies.

For an answer to research question two, it was found out that systematic development method selection were rarely done. This was not a big surprise; the finding is in line with previous studies (see e.g. [28]). What, in turn, was interesting is that even in cases where method selection was done systematically, not all parties of the projects did know that, nor of the possible criteria used in the selection. It seems that backgrounds and reasoning for action and practices may remain obscured. In a way, this also came out when we gathered the characteristics used to describe the different methods. Some had comprehensive lists and insights, whereas most mentioned two or three characteristics. The characteristics of methods seem to be seldom pondered.

As pointed out in Section 4, the most often mentioned ISDM selection criteria was the method popularity-related (trends / hype, plausibility of a method, recommendations outside of the organization and supplier preferences). This reflects lack of systematic in-house discussions and negotiations of methods, which notion is line with the findings of [28]. This is also supported by the multiple mentioning of enhancing the agile project execution capability as one reason to conduct the project in Section 4 (Results). Of course, when the reasoning for method selection was obscure for many, it is possible that the named selection criteria fail to describe reality. There might have been systematic discussions about the method in the project start-up phase that even the representatives of the project would not know about it. This issue clearly should be studied more, as well as the impact if project members do not know the reasoning behind their daily activities in the project (i.e. methods).

Although the method selection itself was unclear to some interviewees, it did not hamper the motivation for project. Regarding the project context there were some factors such as complexity, dynamism, and terrain (i.e. existing experience) that seem to have had influence on the method selection. Moreover, some interviewees pointed out that the parent organization do not understand the full-time commitment needed, especially in change-driven development; experts were expected to be available to other tasks as well. In plan-driven development, this is possible to some extent, and this can be one factor even affecting development method selection.

As an answer to our third research question, we can infer that in most cases methods applied in the projects are somewhat based on the project needs and its context,

but there is no systematic way to adapt methods to the case. Thus, intentionally or accidentally, many projects applied some kind of hybrid approach. There was not consensus on hybrid methods. They were praised and criticized even inside the same project. The combination of hybrid methods seems to be based more on accident than planning, which is in line with the findings of [35]. Therefore, one objective for future studies is the emphasis on hybrid methods. They were regularly mentioned in this study and seem to enjoy popularity right now [25, 41], but do seem to suffer from a lack of clear construction instructions [35]. Related to that, we proposed the hybrid method evaluation tool (Table 4) to help hybrid method construction, evaluation and selection in the pre-project phase. We offer the proposed tool as our contribution to future research. In addition, it is important to study how the different factors (e.g. the contextual factors) affects to method selection and especially to combination of different kind of hybrid methods. Our next step is to combine the contextual model of Kiselev et al. [23], ISDM selection model of Lagstedt and Dahlberg [29] and the hybrid method evaluation tool shown here as Table 4. The aim is to help organizations to better understand their development contexts and the available method options of digital transformation projects.

Another aspect interesting for future research is the synchronization of the methods applied in the project with the ones used predominantly in the organization. This was only explicitly considered in Switzerland through providing a "modular" organizational basis to configure individual methods in the projects, or the inclusion of (minimum) standards of the respective predominant method.

Although the reasons behind ISDM selection were obscure for many, the reasoning behind the project (the targets) seems to be clear for all interviewees. It was interesting to note that mostly business process-based reasons for project (automation, efficiency, cycle time) were mentioned, although systematic (or any) methods for process development were seldom used. So, the importance of business process development was considered high, but practices supporting it seem to be scarce. Maybe because of the lack of business process development methods, most of the interviewees could not say how the compatibility of the business and IS development was ensured. We see also here a clear need for future studies, but also recommend practitioners consider the business process development methods as a part of business digitalization. Relying only on IS development methods does not guarantee the success of business process improvement and change.

As the study was conducted in two European countries only, with a considerable small number of companies and interviews, and without diverse data sources such as case project documentations and real life observations, the results should be considered as preliminary only.

However, our article describes the relationship between IT and digital business management and project success, and reveals factors that need to be considered in the selection of alternative IS and business development methods from general to project level. We also propose guidelines to be used in the constructing of a hybrid method evaluation tool.

6. References

[1] Abrahamsson, P., O. Salo, J. Ronkainen, and J. Warsta, "Agile software development methods", *VTT Publications VTT Publ.*(478), 2002, pp. 112.

[2] Ahimbisibwe, A., U. Daellenbach, and R.Y. Cavana, "Empirical comparison of traditional plan-based and agile methodologies", *Journal of Enterprise Information Management 30*(3), 2017, pp. 400–453.

[3] Almeida, F., J. Duarte Santos, and J. Augusto Monteiro, "The Challenges and Opportunities in the Digitalization of Companies in a Post-COVID-19 World", *IEEE Engineering Management Review 48*(3), 2020, pp. 97–103.

[4] Alvarez, S.A., and J.B. Barney, "Discovery and creation: Alternative theories of entrepreneurial action", *Strategic entrepreneurship journal 1*(1–2), 2007, pp. 11–26.

[5] Behutiye, W.N., P. Rodríguez, M. Oivo, and A. Tosun, "Analyzing the concept of technical debt in the context of agile software development: A systematic literature review", *Information and Software Technology 82*, 2017, pp. 139–158.

[6] Bocij, P., A. Greasley, and S. Hickie, *Business Information Systems: Technology, development and management for the modern business*, Pearson, 2019.

[7] Boehm, B.W., and R. Turner, *Balancing agility and discipline: A guide for the perplexed*, Addison-Wesley Professional, 2004.

[8] Borg, M., J. Wernberg, T. Olsson, U. Franke, and M. Andersson, "Illuminating a Blind Spot in Digitalization - Software Development in Sweden's Private and Public Sector", *IEEE/ACM 42nd International Conference on Software Engineering Workshops (ICSEW'20)*, (2020).

[9] Brooks, F.P.J., "No Silver Bullet - Essence and Accidents of Software Engineering", *Information Processing 86: Proceedings of the IFIP 10th World Computer Congress*, (1986).

[10] Cockburn, A., *Agile Software Development*, Pearson, Crawfordsville, Indiana, 2007.

[11] Cooper, R.G., "Stage-Gate Systems : A New Tool for Managing New Products", *Business Horizons*(May-June), 1990.

[12] Cresswell, J.W., and V.L. Plano Clark, *Designing and Conducting Mixed Methods Research*, Sage Publications, Thousand Oaks, CA, 2011.

[13] Dahlberg, T., P. Hokkanen, and M. Newman, "How Business Strategy and Changes to Business Strategy Impact the Role and the Tasks of CIOs: An Evolutionary Model", *Proceedings of the Annual Hawaii International Conference*

on System Sciences, (2016), 4910–4919.
[14] Dahlberg, T., and H. Kivijarvi, "Towards an Integrative, Multilevel Theory for Managing the Direct and Indirect Impacts of IT Project Success Factors", *Proceedings of the Annual Hawaii International Conference on System Sciences*, IEEE Computer Society (2016), 4971–4980.
[15] Dahlberg, T., and A. Lagstedt, "There Is Still No 'Fit for All' IS Development Method : Business Development Context and IS Development Characteristics Need to Match", *Proceedings of the 51st Hawaii International Conference on System Sciences*, (2018).
[16] Dahlberg, T., and A. Lagstedt, "On Solving the Business Requirements Engineering Problems of Information Systems Development Projects – Lessons from Three Projects", *Proceedings of the 53rd Hawaii International Conference on System Sciences*, (2020).
[17] Dahlberg, T., and A. Lagstedt, "Fit to Context Matters – Selecting and Using Information Systems Development Methods to Develop Business in Digitalization Contexts", *Proceedings of the 54th Hawaii International Conference on System Sciences 2021*, (2021), 6902–6911.
[18] Holvitie, J., S.A. Licorish, R.O. Spínola, et al., "Technical debt and agile software development practices and processes: An industry practitioner survey", *Information and Software Technology 96*(Nov. 2017), 2018, pp. 141–160.
[19] Itkonen, J., K. Rautiainen, and C. Lassenius, "Towards Understanding Quality Assurance in Agile Software Development", *International Conference on Agility ICAM, 2005*, (2005).
[20] Kaplan, B., and D. Duchon, "Combining qualitative and quantitative methods in information systems research: A case study", *MIS quarterly 12*(4), 1988, pp. 571–586.
[21] Kaplan, B., and J.A. Maxwell, "Qualitative research methods for evaluating computer information systems", In *Evaluating the organizational impact of healthcare information systems*. Springer, New York, 2005, 30–56.
[22] Kiselev, C., and R. Winter, "Governance of Mixed Agile/Traditional Digital Transformation Programs", *AMCIS 2020 Proceedings*, (2020), 0–10.
[23] Kiselev, C., R. Winter, and P. Rohner, "Project Success Requires Context-Aware Governance", *MIS Quarterly Executive 19*(3), 2020, pp. 199–211.
[24] Kivijärvi, H., "Theorizing IT project success: Direct and indirect effects in a hierarchical framework", *International Journal of Information Technology Project Management*, 2020.
[25] Kuhrmann, M., P. Diebold, J. Munch, et al., "Hybrid Software Development Approaches in Practice: A European Perspective", *IEEE Software 36*(4), 2018, pp. 20–31.
[26] Kuhrmann, M., P. Diebold, J. Münch, et al., "Hybrid software and system development in practice: Waterfall, scrum, and beyond", *Proceedings of the 2017 International Conference on Software and System Process*, (2017), 30–39.
[27] Lagstedt, A., "Selecting the Right Method for the Right Project", 2019.
[28] Lagstedt, A., and T. Dahlberg, "Understanding the Rarity of ISD Method Selection – Bounded Rationality and Functional Stupidity", *Pacific Asia Conference on Information Systems*, (2018), 1–14.
[29] Lagstedt, A., and T. Dahlberg, "A Contingency Theory Motivated Framework to Select Information System Development Methods", *Pacific Asia Conference on Information Systems*, (2018), 1–14.
[30] Moe, N.B., A. Aurum, and T. Dybå, "Challenges of shared decision-making: A multiple case study of agile software development", *Information and Software Technology 54*(8), 2012, pp. 853–865.
[31] Myers, M.D., and M. Newman, "The qualitative interview in IS research: Examining the craft", *Information and Organization 17*(1), 2007, pp. 2–26.
[32] Nokkala, T., A. Lagstedt, and R. Winter, "Context-Aware Digitalization – Adapting solution development to the organizational context of SMEs", *Proceedings of the 54th Hawaii International Conference on System Sciences 2021*, (2021), 6432–6441.
[33] Opdenakker, R., "Advantages and Disadvantages of Four Interview Techniques in Qualitative Research", *Forum Qualitative Sozialforschung/Forum: Qualitative Social Research 7*, 2006. http://nbn-resolving.de/urn:nbn:de:0114-fqs0604118
[34] Petter, S.C., and M.J. Gallivan, "Toward a framework for classifying and guiding mixed method research in information systems", *Proceedings of the 37th Annual Hawaii International Conference on System Sciences.*, 2004.
[35] Prenner, N., C. Unger-Windeler, and K. Schneider, "How are hybrid development approaches organized? - A systematic literature review", *Proceedings - 2020 IEEE/ACM International Conference on Software and System Processes, ICSSP 2020*, (2020), 145–154.
[36] Ross, J.W., P. Weill, and D.C. Robertson, *Enterprise Architecture as Strategy*, Harvard Business School Press, Boston, Massachusetts, 2006.
[37] Royce, D.W.W., "Managing the Development of large Software Systems", *IEEE Wescon*(August), 1970, pp. 1–9.
[38] Schwaber, K., and J. Sutherland, *The Scrum Guide*, 2017.
[39] Sommerville, I., "Software Process Models", *ACM Computing Surveys 28*(1), 1996, pp. 269–271.
[40] Sommerville, I., *Software Engineering*, Addison-Wesley, Boston, Massachusetts, 2011.
[41] Tell, P., J. Klünder, K. Steffen, et al., "What are Hybrid Development Methods Made Of? An Evidence-based Characterization", *2019 IEEE/ACM International Conference on Software and System Processes (ICSSP)*, (2019), 105–114.
[42] Theocharis, G., M. Kuhrmann, J. Münch, and P. Diebold, "Is water-scrum-fall reality? On the use of agile and traditional development practices", *International Conference on Product-Focused Software Process Improvement*, Springer (2015), 149–166.
[43] Winter, R., P. Rohner, and C. Kiselev, "Mission Impossible? Exploring the Limits of Managing Large IT Projects and Ways to Cross the Line", *Proceedings of the 52nd Hawaii International Conference on System Sciences*, Hawaii International Conference on System Sciences (2019), 6388–6397.
[44] Yassien, E., "Software Projects Success by Objectives", *Journal of Management Research 10*(1), 2017, pp. 46–57.
[45] Yin, R.K., *Case Study Research: Design and Methods*, Sage Publications, 2014.