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An Agile Information Systems Development Method in Use

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Abstract

Recently, agile information systems development methods, agile methods in short, have got considerable attention from practitioners. One of the reasons seems that agile methods, to some degree, can be adaptable to different project situations. However, little empirical research has been conducted on this subject. The major goal of this research is to identify which aspects of agile methods are perceived as most critical and difficult to realize and how such aspects are adapted in practice. To reach this goal we studied the working practices concerning the adaptation of an agile method in the IT department of one of the leading financial institutes in Europe. We found that especially some principles and techniques of the method needed more care and often required their adaptation. The ways to adapt these aspects in projects provide an empirical ground to discuss the existing theoretical accounts in literature. Such a discussion leads to a number of research questions for future research and provide valuable insights for practitioners.

Key Words: *Agile information systems development methods, method engineering, method adaptation.*

1. Introduction

As indicated in [1], the effective use of Information Systems Development Methods (ISDMs) remains an issue on both academics' and practitioners' agendas. An ISDM has been interpreted as an organized collection of concepts, beliefs, values, and normative principles supported by material resources [2]. In the last decades, the rationales behind structured, brand-named ISDMs, the so-called conventional methods, were being questioned as being IT-oriented, complex, rigid, and inappropriate for postmodern forms of

organizations whose distinctive character was to be adaptable to continual change [3]. Recently, agile – denoting "having a quick resourceful and adaptable character" [4] – ISDMs, agile methods in short, have appeared as a solution to the long-standing problems related to conventional methods.

Our goal in this paper is to identify which aspects of agile methods are perceived as most critical and how such aspects are adapted in practice. To do this we studied the working practices concerning agile method adaptation that took place in a large-scale IT department. Similar to the research approach adopted by [5], this paper inductively draws lessons from agile method adaptation in practice - rather than tests hypotheses defined in advanced.

The structure of the paper is as follows. The following section provides some information on the background of the research related to its theoretical and methodical dimensions. Thereafter we present the case organization and major findings. The last section includes the reflections on our findings and discusses future research directions.

2. Background

2.1. Theoretical background and the scope of the present research

Different terms and theoretical accounts have been used to study the notion of method adaptation (for example, 'scenario use' in [6], 'method tailoring' in [7], 'situational or situated method engineering' in [8-9], and 'context-specific method engineering' in [10]). The proposed models appear to be limited to theoretical arguments and need empirical findings to support their arguments. As [7] state, 'little research has been conducted to date on method tailoring specifically.' This observation is particularly true for agile methods.

The term adaptation simply implies 'a modification according to changing circumstances' [4]. For the purpose of this paper, we further define 'method adaptation' as 'a process or capability in which human agents through responsive changes in, and dynamic interplays between, contexts, intentions, and method fragments determine a system development approach for a specific project situation'.

The term context refers to a collection of relevant conditions and surrounding influences that make a project situation unique and comprehensible [11]. A method fragment is a description of an ISDM, or any coherent part thereof. It is usually prescribed, and structured in terms of fragment properties [12]. Fragments can be principles, fundamental concepts, products to be delivered, activities needing to be performed, job aids - techniques, tools, hints, tips - to be used, etc. The intention as an indication of what drives the agents while carrying out method adaptation.

As noted in [13], the existing studies related to method adaptation follow one of two key perspectives: the engineering perspective representing the positivist views of natural science, and the socio-organizational perspective representing interpretative views of social science. The former is of interest to the school of method engineering, emphasizes the structural aspects of the method, and usually employs contingency-based models for method adaptation. The latter appears to be concerned with better understanding how a method and its components are invented on-the-fly and are actually used in an emerging work setting, and is reflected in the body of knowledge contained in the socio-organizational literature.

These two perspectives adopt different levels of abstraction for method adaptation [14]. The engineering perspective stays at a conceptual level where the main focus is on models of the "real or empirical world" rather than the "real world" itself [12]. In comparison, the socio-organizational perspective prefers to look into the empirical world and tries to understand method adaptation in practice, examining real, concrete

development processes. It is clear that we need empirical studies and draw some lessons on what goes into practice and draw some lessons on the working practices.

One of the reasons for lacking this kind of studies might be that practitioners usually do not use any formal or semi-formal procedure, instruments or alike while adapting methods. So, it is difficult to find some case organizations where practices related to method adaptation take place in some forms. In fact, given the uniqueness of project context and model-based nature of methods for any project the adaptation is necessary and takes place implicitly or explicitly. Since the organization we investigated established a team for method adaptation we had an excellent opportunity to find out how and which aspects of an agile method were often adapted.

Characterizing an ISDM in terms of several aspects is not new to academic circles (see, for example, [1]). In this study we have considered three aspects of the agile method: its underlying philosophy (captured in nine principles), its framework (stages, activities, products), and its essential techniques. Since the working practices in the department did not cover adaptation of modeling techniques, we did not include modeling techniques, tools in this study.

2.2. Research design

The research approach adopted in this study is that of an interpretive field study. Many researchers, including [3,5], have also used this research approach for the study of method use in practice. It has been suggested as an appropriate research method for explorative and descriptive types of research. According to [15], interpretive research does not predefine dependent and independent variables, but focuses on the complexity of human sense making as the situation emerges; it attempts to understand phenomena through the meanings that people assign to them.

The field research was conducted in the form of a project in the organization and carried out by a research team consisting of people from both the university and the case organization. The field research consisted of three stages: the preliminary study stage, the actual research stage, and the posterior study stage. During the actual research stage, one of the researchers worked with a group of method engineers on tooling activities concerned with method adaptation. Another of the researchers had been already involved in the organization-wide deployment of an agile method for more than two years. The other researchers were subject matter experts from the academic side. Further, a sponsor and a method engineer from the company participated in this research.

The sources of knowledge were, in this empirical setting, informants, direct observations, and documents. Since the information needed was partially available in the organization, the team concluded that several rounds of formal and informal interviews, direct observations in the form of attending meetings, and in-depth documentary analysis were the most appropriate ways to collect data. Essentially, three rounds of interviews were conducted, each at a different level of detail in different forms, with different informants (i.e. embedding different levels and roles). In some interviews, a list of questions was used to ensure that all the important subjects were covered but, at the same time, room was left for emerging issues (see Appendix).

In this interpretive research approach, we preferred “engaged” data gathering methods to “distant” ones as they allowed us to gain rich insights into method adaptation. However, some limitations of this approach have been identified. One of the problems, as frequently cited in the IS literature (e.g., [15]), was the difficulty in controlling the interactions between the researchers and the subjects, especially in a large IT development department. Another problem was the level of abstraction needed and the degree of generalization achieved. To assess these problems, the research team members organized three ‘checkpoint’

meetings in which up-to-date research findings were discussed and the scope of the future stages of the research determined. In these meetings, the 'depth' and 'breadth' of the research scope was elaborated and found to be satisfactory for all the parties involved in this research. Another type of feedback mechanism, used to check the validity of the analysis, was to present and discuss the research findings with other interested parties in the case organization. This involved twelve method engineers, six project managers, one change manager, one chief domain architect, and two quality assurance leaders. The feedback from such a broad audience was useful to justify our findings.

2.3. About the case organization and the agile method used

The organisation we investigated is one of the leading financial institutions in Europe and operates in a dynamic business environment. One of the global strategic business units, Consumer & Commercial Clients (C& CC), focuses exclusively on services to individual clients and small- to medium-sized businesses. The Netherlands Business Unit (BU) is one of the five BUs under C& CC. IT Development is one of the departments within the Netherlands BU and employs 2000 people involved in systems development projects. Such a large IT department was chosen because it enabled us to investigate method adaptation in various project contexts. It is worth noting that the organisation has considerable experience of information systems development (ISD) method use. The organisation's identity goes back ten years to the merger of two organisations, both of which were used to using conventional methods. One of them had been using a method developed in-house, and the other a brand-named method. Until the introduction of an agile method, just two years ago, there had been a lot of effort put into achieving a standard method influenced heavily by previous development procedures, processes, and templates.

Recently, an agile method (Dynamic Systems Development Method - DSDM) has become the method of choice for all information system development projects in the department. The main motivation for this decision was to ensure 'time-to-market' systems development, in order to achieve substantial product and process improvements, and to use one terminology in all projects.

Dynamic Systems Development (DSDM) can be considered as an agile method [16]. In the UK and in Benelux countries, DSDM, which is supported by a consortium of over 600 organizations, has become the de-facto market standard. The method strongly emphasizes the concepts of suitability and adaptability – DSDM will be, to a certain extent, suitable for a project or an organization, and is adaptable if not completely suitable.

Modeling techniques are not included in DSDM since they are often a part of modeling tool sets which are not themselves part of the method. In this way, DSDM is highly adaptable – it is possible to use fully-fledged DSDM, but individual techniques or just the terminology are still valuable on their own. To this end, an instrument called a 'suitability filter' is available in the manual [17]. The filter considers the critical success factors for DSDM, and the characteristics of projects that will make DSDM especially effective. Each potential project should be judged individually using the filter. If the project provides a good match with the filter, then DSDM can be considered as a suitable method. If the criteria results are not satisfied then the method can be modified. For more details of DSDM one should refer to the DSDM consortium document [17].

3. Major Findings

3.1. About the existing working practices concerning method adaptation in the department

The DSDM implementation in the department focused on coaching project managers in adapting the method in the organization and at project levels with the help of experts. The experts, known as coaches, had extensive project experience and were subject matter experts in DSDM use. They coached project managers on how to make better decisions on the *suitability* of DSDM and on *the degree of adaptation* DSDM would require for each project. Basically, there were two essential, important roles in DSDM adaptation: the project coaching role and the project management role. The DSDM coaches assisted project managers in adapting DSDM to their project context, whereas project managers were fully responsible for the project execution. They were the final decision makers in terms of the use of DSDM aspects. The coaches first tried to reveal the characteristics of the project at hand and then found out how best to use the aspects accordingly. For characterizing a project projects they were using an instrument, the so-called Extended Suitability/Risk List (ESRL). During the early stages of DSDM use in the department, the coaches had used the questions in the original DSDM suitability filter [17]. Later, as they gained experience with them, some questions were extended and clarified, and furthermore, for each question, working instructions, measures, useful hints, and tips were added (see [18-19] for further information on the use of the instrument).

3.2. Most critical aspects of the agile method used in the organization

We asked the interviewees' opinions on each aspect (principles, framework, techniques) of the method. We especially asked them to relate their comments with the following variables: "Very critical", "Moderate", "Not very critical" "No particular experience with the aspect". We noted that even though the interviewees addressed some issues related to the framework aspect, they were especially concerned with difficulties of realizing the philosophy and essential techniques of the method. Namely, the principles constituting the philosophy and essential techniques were appeared to be most critical aspects. The term, criticalness, was measured in terms of impacts on project execution, dominance over other aspects, and relevance to practitioners' actual needs.

Among nine principles, it was interesting to see that they took the principle, entitled *empowered team*, out of the discussion and commented that this principle was almost impossible to be realized due to the existence of the organization culture and structure concerning controlling mechanism at hand. But, they did their best to find some ways to realize this principle. For the rest of principles they commented three principles - *active user involvement*, *incremental and iterative development strategy*, *fitness for business purpose* - were always problematic and difficult to manage. The active user involvement principle refers that a user-centered approach needs to be adopted in the projects. Incremental development means that a solution can be split into components that are based on prioritized requirements. More formally, an increment is a part of the system that is delivered to, and used by, a user before the total system is operational [20]. However, having iterations means that some stages and corresponding activities need to be repeated through incorporating continuous feedback from the user. The principle, fitness for business purpose, underscores the necessity of revealing a concrete business value behind the system to be delivered. The rest of the principles were found to be manageable even some problems were encountered to realize them.

Regarding the essential techniques, we found that *MoSCoW* and *timeboxing* were perceived as critical and difficult to apply in the projects. MoSCoW is a technique used for prioritizing requirements. The letters

of the term stand for *Must have* for requirements that are fundamental to systems, Should have, Want to have but Won't have this time.

For the triangulation purpose we did documentary analysis and especially looked into advice reports written by the coaches. The result was in line with the opinions as noted in the interviews. Namely, we found that the principles and the essential techniques were again referred as the most critical aspects. The next step was to find out how the aspects mentioned above were managed in the projects. In other words how these aspects are adapted to different projects.

3.3. The way to adapt most critical aspects of the agile method

During our investigation in the organisation it became clear that it was not feasible to cover all the aforementioned aspects. So, to continue our investigation we focused on the incremental-iterative development strategy. Our purpose is at this stage to identify possible variants of this development strategy and to find out how the choice is made for an appropriate variant in a particular project situation. To analyze adaptation of this principle two dimensions of a systems development process were considered: the increment strategy and iteration strategy [20]. We should note that while analyzing the DSDM lifecycle variants for the sake of simplicity we did not take into account the realization strategy, which is another dimension of systems development process.

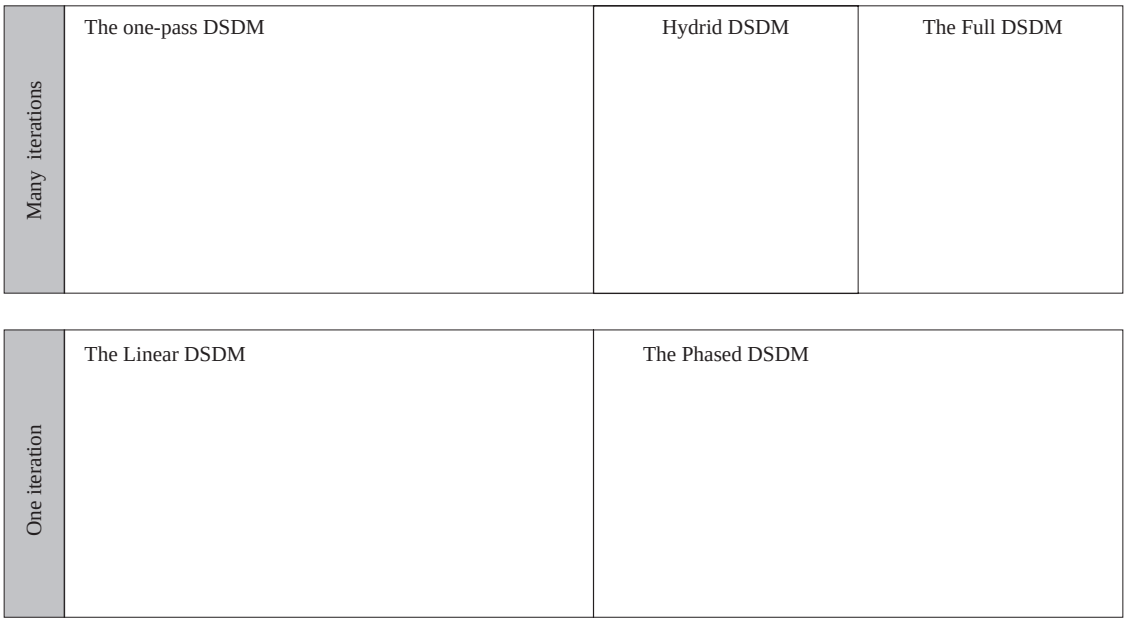

Figure 1. Demonstration of DSDM life cycle variants.

For the increment strategy, there were basically two options: the one-increment strategy (no any subsystem, i.e. only one system to be developed) or the many-increments strategy. Similarly, for the iteration strategy, we identified two options: the no-iteration strategy or the many-iterations strategy. A combination of these options generated five variants of the DSDM life cycle (figure 1). In figure 1, circles represent DSDM phases: functional model iteration (FMI), design build iteration (DBI), implementation (I). A number of circles (loops) represent a number of iterations, whereas boxes represent increments. For instance, for the representation of the hybrid DSDM, you see two boxes labelled as A and B. This means the

system will be divided into two increments: the increment box-A and the increment box-B will be developed by using the typical DSDM and the linear DSDM respectively.

These variants, which appear to be similar to DSDM paths presented in DSDM manual, are as follows [17].

- The linear DSDM (one increment without iteration).
- The one-pass DSDM (one increment with several iterations).
- The hybrid DSDM (many increments, some of them with several iterations, others without iteration- a mixture of linear and full DSDM).
- The full DSDM (many increments with many increments).
- The Phased DSDM (many increments without iterations).

3.4. Determining the most appropriate variant of a principle

Once we captured the variants of the chosen principle (the iterative-incremental development strategy) we wanted to figure out how the choice for the appropriate variant was made. We noted that for such a decision project managers were using the advice report written for their projects. To give a flavor of such advice we have provided Table 1.

As indicated in table 1, the hybrid development process recommended in the sample advice shows how the principle of iterative and incremental development can be adapted to the project context at hand (see the first column, "About the project context"). It suggests that some increments could be realized in an iterative manner, and others could be realized without iterations (i.e. by applying a linear or "waterfall" systems development strategy). The term hybrid underscores the mixture of typical DSDM development strategy (iterative and incremental systems development) and a linear development strategy in such a project context.

The point here is that the choice of an appropriate variant and its execution depends on many contextual factors. The advice includes some suggestions concerning how to mitigate some issues in the event that some iterations are to be needed and the end-user involvement could be difficult to realize. In this case two possible reactions can be expected from a project manager: change the context at hand or make another choice for the development strategy. The former means that project managers would be active in changing the project context to make the context suitable for the execution of iterations.

Before deciding on the appropriate variant the coaches and project managers had discussed the implications of each alternative in terms of conformance to method *time* and *budget* (i.e. the degree to which the desired functionality could be realized within an agreed time or budget), *customer satisfaction* (the degree to which the project outcomes would fulfill the expectations of the sponsor and users) and *method adherence* (the degree to which the realized method would be in line with the aspects of the method).

In fact, we have identified many episodes in which the practitioners faced many compromises and trade offs between the aspects to be used and the project context at hand. However, given the space limitation in this paper, we have simply presented how a particular aspect was adapted to illuminate the adaptation rationale used in a real project setting, and we will discuss its implications in the next section.

Table 1. The extraction from sample advice.

About the project context	**About the appropriate DSDM lifecycle variant**
' ... If we know that the requirements are almost clear, stable, and that it is hardly possible to prioritize them, that there is no clear user interface, that there is high computational complexity, that the timeline is not clear, and that the resource availability (in terms of developers, end user) is not known, yet the total resources can be fixed, then we would like to know which development strategy is most appropriate and what kind of consequences we may anticipate in the later phases of the project.'	' ... It *seems* that a hybrid development strategy is more appropriate than the other options. The reason is the following: even though all requirements are 'must haves', we can still partly prioritize them and for those requirements that are stable we may plan one increment for the DSDM phases covered in a more linear way (i.e. no iteration for this increment). For the rest of the requirements we may plan other increments for which many iterations will be needed. For the realization of iterations per increment it is essential to ensure the end-user involvement. Here are some suggestions you may find them useful for this issue: - Tell the users in advance that they have the authority to make decisions within the specified boundaries and that they must indeed make these decisions. - If the decision-making authority is not delegated to users, management must also participate in the team. Make agreements with management regarding availability, For other tips and hints contact the coaches.'
About some issues related to two techniques of DSDM and related risks	
' ... as the case indicates, the MoSCoW (a DSDM technique) appears not to be very suitable for this situation due to the difficulty of prioritizing requirements. The same holds for timeboxing, for which there must be a fixed date for the project, or for an increment, or for an iteration. For both anticipated issues there may be some opportunities to use these two techniques in different ways. Indeed, DSDM coaches have had some experience with such ways and they successfully use the philosophies behind MoSCoW and Timeboxing in real projects situations'.	

4. Analysis and Discussion

When we have presented the major findings in the previous section we hardly referred to a theoretical ground. We now prefer to discuss the findings by revisiting relevant research as mentioned in section one.

Basically, for the identification of most critical aspects we distinguished the philosophy, the framework, and the essential techniques. We have seen that some principles and essential techniques of the method have gotten more attention than the framework. In fact, the principles and essential techniques perceived as most critical aspects are interrelated. It can be easily seen that *active user involvement* is a precondition for *iterative-incremental development* since the feedback from the end-user is necessary for its realization. And, both principles equally contribute to achievement of *fitness for business purpose.*

The principles mentioned here are often cited as typical features of other agile methods [21]. The point here is that these principles reflect the way of thinking as an underlying rationale of the method. It is clear that if agents (the project managers and the coaches in this study) cannot accommodate the way of thinking in a given project context, then they will encounter the mismatches between the method rationale and the context. Such mismatches eventually result in issues, breakdowns, in systems development. So, it is wise to focus on the principles as a starting point for method adaptation.

As noted before, both the engineering and the socio-organizational perspectives use the notion of fragment to refer to principles and other aspects of the method. It is interesting to see that the existing studies concerning method adaptation in the field of method engineering usually focus on structured fragments that are related to the framework aspect. Baskerville indeed already emphasized this limitation and pointed out the need for studying notation and criteria as the underlying rationale of the method [22]. But the problem with studying the principles is that they are usually defined implicitly in the method description. In this

present study the principles were explicitly given in the manual and this prompted practitioners to discuss their adaptation in an explicit way. This means that the explicitness of the principles of a method is essential to achievement of a transparent method adaptation process. So, it is our contention that the principles of a method should be made explicit so that one can illuminate a method adaptation process easily.

The way to adapt the aspects can be discussed in terms of the existing models describing the selection of fragments. In fact from the engineering perspective adaptation of method aspects means selecting, modifying, assembling fragments to reach a situated method [12,20]. Recently, Rolland and her colleagues have attempted to provide a generic model for Situational Method Engineering (SME), which is referred as a theoretical ground for method adaptation [24]. But, their selection procedure seems to use a kind of contingency-based model. In the IS literature several contingency-based models are proposed to study the notion of fitness between project context and method fragments [6]. According these models, the selection of fragments is based on a number of contextual factors. But the relations between the contextual factors and the fragments is one directional. In other words, the factors and the fragments are considered as independent and dependent variables respectively. But, our findings indicate that method adaptation requires bilateral interactions between the factors and the fragments. Namely, the practitioners in the department did not only adapt fragments to a specific context, but they also adapted the context to fragments. Another limitation of the proposed models is the static use of factors. Namely, the existing models lack dynamic interactions among the factors and ignore emergent organizational situations in a project.

5. Conclusion

Concerning the static use of factor, as indicated in the section three, the relevant factors were altogether taken into account and used a reference point to discuss appropriateness of each fragment variant. We also noted that when the agents discussed the implications of its appropriateness they use a kind of mediating factors to reach a conclusion (conformance to time, budget, customer satisfaction, and method adherence). These mediating factors drive the behaviors of agents. We have seen that the agents were pragmatic and reactive to changes in project setting. They commented that they are open to change the chosen fragments and even invent new fragments if necessary. The example given in table 1 showed that even the timeboxing technique, at first glance, was not suitable for the project context, the agents strove to accommodate this technique in a special project context. At this point we see that the socio-organizational perspective helps to illuminate such invented fragments. In addition, this perspective facilitates in understanding of the emerging context in which the resolutions have to be achieved and the fragments invented.

Some limitations of this study should be mentioned. Firstly, the findings are limited to one case organization and a particular agile method. This can be considered as a problem for generalization of the findings. However, in this study we do not aim to generalize findings or test previously defined hypotheses. Rather we have inductively drawn some lessons on the working practices investigated in the department.

Secondly, for the sake of simplicity we had to exclude the realization dimension while identifying iterative-incremental development strategy. In fact, the use of this dimension would help us to identify different versions of each variant, but the level of detail we got was found to be satisfactory for the understanding of nature of this principle.

Finally, by recalling the definition of method adaptation we would able to mention future research. Method adaptation is defined as a process or capability in which agents through responsive changes in, and *dynamic interplays* between, *contexts*, *intentions*, and *method fragments* determine a system development approach for a specific project situation. A model based on three constructs – context, intention, method

fragment – can accommodate two perspectives and provide a good basis for the theoretical account of method adaptation. Thus, we encourage academics to investigate other agile methods in different organizational settings to further discern the role of the key constructs mentioned. Studying various patterns of dynamic interplays between three constructs can be one of the research topics as well. Each pattern might correspond to the existing models concerning method adaptation in literature.

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Appendix. The Research Method Applied

<table>
<tr><th>Research stages</th><th>The preliminary study stage</th><th colspan="2">The actual study stage</th><th>The posterior study stage</th></tr>
<tr><td>The sources of knowledge and the techniques used to interact with subjects</td><td>Informants:
Six method engineers

First round of interviews in the form of semi-open formal interviews</td><td colspan="2">Documentary analysis: The organization-wide development method; the existing route maps and related fragments; an instrument (the ESRL) used for method adaptation; templates and actual project documents, including advice documents, project proposals, systems development plans.

Direct observations: Attending daily meetings of method engineers</td><td>Informants:
The head of coaching group and some method engineers</td></tr>
<tr><td></td><td></td><td>First round of interviews in the form of open-ended and semi-open (formal and informal) interviews</td><td>Second round of interviews in the form of open-ended and semi-open (formal and informal) interviews</td><td></td></tr>
<tr><td></td><td></td><td>Informants:
Twelve method engineers</td><td>Informants:
Twelve method engineers, six project managers, two portfolio managers, one change manager, two quality assurance leaders, one chief domain architect</td><td></td></tr>
<tr><td>Main research focus</td><td>- Determining relevant context(s) for the ways in which an agile method is adapted
- Gathering perceptions and opinions of method engineers on method adaptation in general</td><td colspan="2">- Identifying most critical aspects of the agile method
- Capturing fragment variants
- Exploring, describing, and analyzing working practices and a means that the department uses for method adaptations</td><td>Being up-to date on the subject matter</td></tr>
</table>

Sample questions	What do you think about adaptability of the method (DSDM) to a project situation? What about previous and current practices on method tailoring? How do you go about tailoring it for a specific project? How do you support project managers on this matter? What kind of information you exchange with project managers?	What do you look for and take into account when tailoring the method for a specific project situation? In your opinion which aspects of the method are most critical and difficult to realize? Regarding these aspects, what kind of issues do you encounter in practice? How do you mitigate them? What are the possible variations of iterative-incremental development strategy? How do you decide the appropriateness of each fragment? How do you write down your advice on how best to use the method for the project? How do you use the advice in your project? When you discuss implications of each fragment variant what do you take into account?	What have been changed in method adaptation practice so far? Any change regarding coaching support, other working practices, the means, etc?

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