Exploring the Relationship Between Organizational Adoption Motives and the Tailoring of Agile Methods

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Abstract

Advocates of agile information systems development methods originally called for implementation of the method in full – either perform all of the method's practices, or don't call it "agile". Over time this quest for orthodoxy was replaced by the pragmatic tailoring of agile methods to the organization's environment. However, little empirical research has investigated the forces that impact the manner in which agile methods are tailored. This article describes an exploratory study that investigates the relationships between the motives for adopting agile methods, and the agile practices adopted. Using the source data from the VersionOne State of Agile 2011 survey, we identified a sample of 2304 agile practitioners. Our study finds that three motives for agile adoption – a desire for increased software quality, increased efficiency, or increased effectiveness are each associated with different configurations of project management focused agile practices and agile practices related to the software development approach.

1. Introduction

Agile information systems development methods (ISDMs) have become a well accepted method of software development since their emergence in the 1990s, with more than 65% of companies reporting the use of agile methods for their software development projects [24]. Extreme Programming (XP) [3], Scrum [22], the Dynamic Systems Development Method (DSDM) [24], Crystal [6], Feature Driven Development (FDD) [18], Lean [21] and others have all claimed the designation of "agile". Each of these methods prescribes a set of practices that are designed to allow software development teams to better adapt to changing environmental and technical requirements.

Early agile advocates claimed that, while each practice was useful on its own, working together the various practices provided a value greater than the sum of the parts. However, recent research has shown that less than 20% of XP projects use even three practices simultaneously [7].

It has long been understood that software development practitioners seek to implement development practices that fit the environment [2]. In the software development field tailoring is the process of adapting the method used to meet the circumstances of use [23]. Based upon the fact that agile practitioners have been found to heavily tailor their use of practices, we wish to investigate how organizational motivations for adopting agile methods influence the portfolio of practices implemented.

This motivates our research question for this study:

> *How do the motives driving the adoption of agile information systems development methods impact the set of agile development practices adopted?*

Because there has been relatively little research in the area of the impact of adoption motivation on agile ISDM, we examine the question in an exploratory fashion. Utilizing source data of 2304 respondents from the 2011 State of Agile Survey [25], we discriminate the motives driving agile adoption, and their effect on groupings of practices adopted. We present preliminary findings that indicate that the motivation for the adoption of agile methods impacts the methods adopted.

2. Theoretical Background

2.1. Agile Methods and Practices

Agile methods emerged in the 1990s, but became widely popular in the years following the publication of the agile manifesto [13]. There are a number of

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methods that have are considered "agile". Although these methods each claim the agile label, they prescribe significantly different sets of practices, some of which are even contradictory. The differences between methods is to be expected, as each emerged in a different context, with somewhat diverging goals. For instance, Extreme Programming (XP) [3] is a method that prescribes a number of practices that are geared toward better software engineering (e.g., pair programming). In contrast, Scrum [22] is a method that is focused nearly exclusively on managing the work of the project team (e.g., daily standup). In these cases it is reasonable to assume that the methods' practices would have little overlap.

2.2. Method Tailoring

It has been known for some time that due to the differences in project characteristics, environmental contexts, and developer characteristics that no one particular method will ever be a "silver bullet" [e.g., 2,5].

Even so, early agile adopter statements seemed to indicate that orthodoxy to the method was required, and that not performing particular methods or practices disqualified a team from claiming that they were using agile methods [19]. However, agile methodologists now predominantly view the agile practices as a "toolkit" to be applied as needed in a variety of project environments [27]. Agile method tailoring is widely observed among practicing teams [e.g., 7,12,28].

Even though agile methods prescribe a large number of practices, recent research has shown that, even amongst projects being led by highly recognizable agile practitioners, fewer than 20% of projects use more than two agile practices [7]. In this environment of extreme tailoring of methods, it is important to understand both how practitioners choose the practices to implement, and the impacts of these choices.

2.3. Method/Environment Fit

The concept of fit, specifically person-environment fit has been a subject of interest within the psychology and organizational behavior fields for over 40 years [e.g., 1,4,11,14,20].

More recently we have seen fit theories emerge in the IS literature. Just perusing *MIS Quarterly* and *Information Systems Research*, one can find over 30 articles referencing fit with several conceptualizations and applications of the concept of fit (e.g., task-technology [16], cognitive [26], organization-enterprise system [15], business strategy - IS capability [17]). Looking across these conceptualizations we see an overarching theme such that at the broadest level fit can be thought of as the compatibility between two phenomena.

In addition, literature has proposed that a high level of fit is a good thing. Further, literature has also found that achieving fit is an evolutionary process. Organizations attempt to fit their processes to the perceived environment, then modify their structure and/or practices when the fit is less than satisficing [10].

The fit between the environment and the software development method is recognized as a key contingency for software project success [2]. When there is a fit between the environment in which the software development team operates, and the development method used to manage environmental risks, better outcomes are predicted. For example, if the environment includes organizational characteristics that require very strong project management controls, it would be assumed that a method that focuses on project management controls more than other factors would potentially perform better than one that focused primarily on code engineering practices.

We use fit in this research as a lens to explore the relationship between agile motives and practices. We define fit in this context as the alignment between individual's perceptions of the organization's motivation to use agile methods and the agile practices enacted in the organization. In this research we propose that, as fit is an evolutionary process, and moves to achieve fit are motivated by a perceived structure that is less than satisficing, that the motives for adopting agile methods will impact the practices adopted. Thus, our research question is "*How do the motives driving the adoption of agile information systems development methods impact the set of agile development practices used?"*

3. Research Approach

Although we utilize a quantitative data set, our research approach is exploratory and somewhat qualitative. We approached the dataset with our broad research question in mind, but we did not motivate particular hypotheses. Instead, we wished to explore the data to determine what patterns and relationships emerged from the data, in order to motivate testable propositions for future research.

3.1 Selection of Data

To explore the research question noted above, we utilized the source data from the 2011 State of Agile

Survey. This survey is administered annually by VersionOne, a maker of agile team coordination and management software. VersionOne provided the data directly to the authors after scrubbing any personally identifying information from the data. The initial data set provided included 6,060 responses, of which numerous were incomplete. We dropped incomplete responses, leaving 5353 remaining. Further, we screened responses to only include respondents who indicated that their organizations had utilized agile methods (i.e., at least one agile practice) on at least one project and for at least six months. Next we removed respondents who indicated that they possessed "very little knowledge" about agile methods, and respondents who indicated that they had personally used agile methods for less than six months. These filters resulted in the final sample of 2304 respondents that were knowledgeable in agile development. Therefore, our sample was more representative of adopters of agile development and not all developers. The applicable questions from the survey instrument utilized for the study are included in Appendix A. The data were entered into SPSS v.20 and all analyses were conducted using that software package.

The VersionOne survey's unit of analysis is at the organizational level. Respondents are asked general questions about the organization's motivations for choosing to use agile methods, challenges facing the organization, and VersionOne includes a question about which of 25 agile practices were used in the respondent's organization.

3.2 Characteristics of the Sample

The individuals in the sample had an average level of agile experience of 2.97 years, and their organization's average level of agile experience was 3.75 years. The number of teams using agile methods in their organization on average was 86.2, and the number of projects using agile methods in their organization on average was 31.8. As shown in Tables 1 and 2, the sample represented a wide range of individuals with regard to their department and job title/team role.

Table 1: Sample department breakdown

Department	Frequency	%
Software Development	1379	59.9
IT/Support	606	26.3
Services	95	4.1
Sales/Marketing	48	2.1
Other/Missing	176	7.6

Table 2: Sample job title / team role

Job Title / Team Role	Frequency	%
President/CEO/COO	46	2.0
CIO/CTO	67	2.9
VP/Director of Development	222	9.6
Team Lead	213	9.2
Project Manager	464	20.1
Product Manager	127	5.5
Development Manager	302	13.1
Architect	119	5.2
Developer	93	4.0
QA/Tester	78	3.4
Consultant/Trainer	186	8.1
IT Staff	29	1.3
Senior Developer	156	6.8
Other / Missing	202	8.7

3.3 Data Analysis & Findings

Because our research question focuses on the motives for adoption of agile methods, we first performed an exploratory factor analysis of the responses to the question "How important were the following in your company's decision to initially adopt agile development methods in your organization?", using principal component factor analysis and varimax rotation with kaiser normalization (scale 1-Not Important At All; 4-Highest Importance).

Three factors of motivation emerged from the analysis which we labeled– motivation to improve software quality (F1), motivation to improve efficiency (F2), and motivation to improve effectiveness (F3). The Improve Software Quality (F1) factor contained the adoption motives of Enhancing Software Quality,

Improve Engineering Discipline, and Enhance Software Maintainability. The Improve Efficiency (F2) factor contained the adoption motives of Increase Productivity, Accelerate Time to Market, and Reduce Costs. The Improve Effectiveness factor (F3) contained the adoption motives of Enhance Ability to Manage Changing Priorities and Improve Alignment between IT and Business Objectives. See Table 3 for the adoption motives, factor loadings and corresponding factors.

Table 3. Factor structure

Adoption Motive	F1	F2	F3
Enhance Software Quality	**.683**		
Improved/Increased Engineering Discipline	**.733**		
Enhance Software Maintainability / Extensibility	**.730**		
Increase Productivity		**.645**	
Accelerate Time-to-Market		**.800**	
Reduce Cost		**.618**	
Enhance Ability to Manage Changing Priorities			**.751**
Improve Alignment Between IT and Business Objectives			**.684**

Factor 1 = Software Quality; Factor 2 = Efficiency; Factor 3 = Effectiveness

Once we determined that there were three specific motivation factors that emerged from the data, we turned to the agile practices. We determined the rank order of agile practices (i.e., practices that were used the most). While the survey asked about the use of 25 agile practices (scale = yes/no), the usage of the practices fell off significantly after the 12th practice. For this reason, we limited our analysis to the 12 most commonly used agile practices.

We performed a two-round categorization exercise for the 12 practices, in order to determine if there was a structure in the practices. In round one, we asked three expert agile developers to categorize the practices. After the initial categorizations were completed, two of the judges had created two categories, which reflected project management and software development approach. While these two judges used different terms (development practices and PM, versus software development approach and PM), the authors agreed that the intent of the categories was congruent. For these two judges there was 95.9% agreement on the categorization. The third judge created four categories, which included disciplines, management, metrics, and strategy. As project management includes the management of projects, tracking of metrics, and setting a strategy for completion, the authors merged these three categories into the project management category. The judge's disciplines category was congruent with the other two judges' software development approach category. In all, for the three judges and twelve practices, the modified categorization reflected a 97.2% agreement across the judges. From this categorization process the two themes (categories) that emerged were - Project Management (contained practices such as Daily Standup Meetings) and Software Development Approach (contained practices such as Refactoring). In round two we had two additional (although less experienced), agile developers conduct a card sort of the practices into these two categories. The overall level of agreement on this round of categorization was over 80%. This process resulted in the categorization scheme presented in Table 4.

Table 4: Categorization of agile practices included in the analysis

Rank	Practice	Category
1	Daily Standup	PM
2	Iteration Planning	PM
3	Unit Testing	SDA
4	Retrospectives	PM
5	Burndown	PM
6	Release Planning	PM
7	Automated Builds	SDA
8	Velocity	PM
9	Continuous Integration	SDA
10	Coding Standards	SDA
11	Refactoring	SDA
12	Test Driven Development	SDA

Significant correlations were found between the three motivation factors and the 12 agile practices. As illustrated in Table 5, the Software Quality factor (F1) was negatively correlated with agile practices in the project management (PM) category and positively correlated with agile practices in the software

development approach (SDA) category. The Improve Efficiency factor (F2) was positively correlated with agile practices in the project management category but not correlated with agile practices in the software development approach category. The Improve Effectiveness factor (F3) was positively correlated with agile practices in the project management category and positively correlated with agile practices in the software development approach category.

Table 5: Correlation Analysis Detail

Practice	F1	F2	F3
PM Category			
Release Planning	.003	**.119****	**.097****
Iteration Planning	-.029	**.059****	**.064****
Velocity	**-.056****	**.061****	**.091****
Daily Standup	**-.072****	**.058****	.023
Retrospectives	**-.065****	**.086****	**.061****
Burndown	**-.067****	**.093****	.019
SDA Category			
Test Driven Development	**.149****	.001	.034
Refactoring	**.087****	-.037	**.052***
Continuous Integration	**.060****	-.016	**.047***
Unit Testing	.036	.033	.011
Coding Standards	**.121****	-.015	**.049***
Automated Builds	**.059****	-.014	.009
** Sig at 0.01 level (2-tailed). * Sig at 0.05 level (2-tailed)			

While the correlation levels presented in Table 5 are low, this is likely to range restriction in the survey items, due to the dichotomous nature of the agile practice adoption variables (see Appendix A). However, the findings are interesting when we look at the pattern of results. In addition, to further test the categories, we summed the practices by category, and performed an additional correlation analysis. The correlations of the summed categories maintain the same significance and direction, as shown in Table 6.

4. Discussion and Next Steps

We have identified and described several relationships between the motivations for adoption of agile methods and the agile practices implemented. While purported motivations for agile method adoption have been expounded upon anecdotally for some time [8,9], the identified motivation factors in this research emerged empirically from the VersionOne State of Agile 2011 data. The motivation factors of enhanced software quality, greater efficiency and greater effectiveness are each associated with different patterns of agile practice adoption.

Table 6: Correlation of factor with number of practices adopted

Factor Label / Focus	Total Number of PM Practices Adopted	Total Number of SDA Practices Adopted
F1: SW Quality	**-.074****	**.134****
F2: Efficiency	**.127****	-.014
F3: Effectiveness	**.096****	**.053****
** Sig at 0.01 level (2-tailed).		

One of the next steps in this research project is to look more deeply into the relationships between the motivations for adopting agile methods and the agile practices used by the organization. If we further analyze the number and type of agile practices used by the organization we hope to see patterns emerge. For example, would a fit (i.e., alignment) between the factor and the agile practices used positively influence organizational outcome variables such as development speed, and/or success? We propose that a gap (misfit) between perceived motives for adopting agile methods and the agile practices utilized may affect key outcomes of interest such as overall project success. Specifically, consistent with fit theory, we propose that the organizational outcomes should be higher/better when a fit between the factor and practices are present as opposed to out of alignment. For example, if an organization's motivation for using agile methods is to improve Software Quality, and they use a high number of Software Development Approach practices (or perhaps a specific combination of practices), then their outcomes should be higher than an organization with a Software Quality Improvement motivation that uses a low number of Software Development Approach practices (or perhaps the "wrong" practices). From our findings, and motivated by the discussion above, we propose the following six testable propositions, as direction for future research:

P1: For organizations that adopt agile methods, performance will be associated with the alignment between their motivation for adoption and use of agile practices.

P2: For organizations that adopt agile methods with a motive to improve software quality, performance will be positively influenced by the use of SDA focused agile practices.

P3: For organizations that adopt agile methods with a motive to improve software quality, performance will be negatively influenced by the use of PM focused agile practices.

P4: For organizations that adopt agile methods with a motive to improve efficiency, performance will be positively influenced by the use of PM agile practices.

P5: For organizations that adopt agile methods with a motive to improve efficiency, performance will not be influenced by the use of SDA agile practices.

P6: For organizations that adopt agile methods with a motive to improve effectiveness, performance will be positively influenced by the use of both SDA and PM agile practices.

In addition to furthering our knowledge of the fit between motives and practices, future research could also explore how the motives driving the adoption of agile development methods impacts the set of tools (e.g., unit test tool, taskboard) adopted. Specifically, could the fit between the motives (software quality, efficiency, effectiveness) and the tool used to support the agile development method positively influence organizational outcomes (e.g., project success).

From a practice perspective, the findings also provide some initial evidence that may be utilized in the field. An awareness of the concept of fit with regard to agile information systems development motives and practices may provide practitioners an additional mechanism to fine tune their method tailoring process. Understanding the organization's overall goal in terms of agile method adoption (e.g., increase efficiency) and which types of agile practices better align with that goal (e.g., release planning) may increase the success of the method tailoring process.

So what do the results of this study mean for research and practice? From a research perspective, the findings provide initial evidence for the relationship between organizational motives for the adoption of agile development methods and the agile practices employed. This is worthy of further exploration. According to Conboy and Fitzgerald [7:3]

> *… many organizations had invested considerable resources in agile method adoption and training, but post-implementation use of the respective methods became so sporadic and disjointed that the transition to agile was abandoned. These companies were eager to get information as to how agile method experts are tailoring these methods and to obtain a set of best practices to assist in tailoring efforts.*

This article contributes to the general software development literature and specifically method tailoring research by introducing fit theory and the idea of agile fit (i.e., the alignment of agile adoption motives and agile practices in use). The findings of this study lay the groundwork for further exploration of the implications of fit (and misfit).

5. Limitations

As with all studies, there are a few limitations of this study. The first limitation is with regard to the generalizability of our findings. The sample drawn for this study consisted of IS professionals working in various organizations and industries throughout the United States and, as such, should be fairly generalizable. But through the data cleansing process participants with limited agile development experience were eliminated from the sample. As the sample was more representative of adopters of agile development and not all developers, the findings cannot be generalized beyond the population under study.

Another limitation related to the respondents of the study is regarding the unit of analysis (organization). Respondents were asked questions about the organization's motivations for choosing to use agile methods and which of 25 agile practices were used in the respondent's organization. Furthermore, in the data provided by VersionOne, identifying information such as the individual's organization was not provided. Thus there could be multiple (and differing) responses from the same organization that we are not able to identify.

6. Conclusion

We have described the preliminary findings of an exploratory study on the association between the motives for adoption of agile information systems development methods, and the agile information

systems development practices employed. Using the source data from the VersionOne State of Agile 2011 survey our study finds that three motives for agile adoption – a desire for increased software quality, increased efficiency, or increased effectiveness are each associated with different configurations of project management focused agile practices and agile practices related to the software development approach. We conclude that there are complex, yet interpretable relations still to be discovered among the motives and practices of agile software development that have the potential to make significant impacts on organizational outcomes.

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Appendix A: Survey Instrument Excerpt

How important were the following in your company's decision to initially adopt agile development methods in your organization? If you do not know, please skip this question.

1- Not Important At All; 2-Somewhat Important; 3-Very Important; 4-Highest Importance

Improve Project Visibility
Enhance Ability to Manage Changing Priorities
Increase Productivity
Accelerate Time-to-Market
Enhance Software Quality
Reduce Risk
Reduce Cost
Manage Distributed Teams
Simplify Development Process
Improve Alignment Between IT and Business Objectives
Improved/Increased Engineering Discipline
Enhance Software Maintainability/Extensibility
Improved Team Morale

Which of the following agile techniques do you employ within your organization? (check all that apply)

1 = yes; blank = no or I don't know

Release Planning
Iteration Planning
Test Driven Development (TDD)
Refactoring
Continuous Integration
Unit Testing
Retrospectives
Pair Programming
Velocity
Daily Standup
Coding Standards
Automated Builds
Burndown