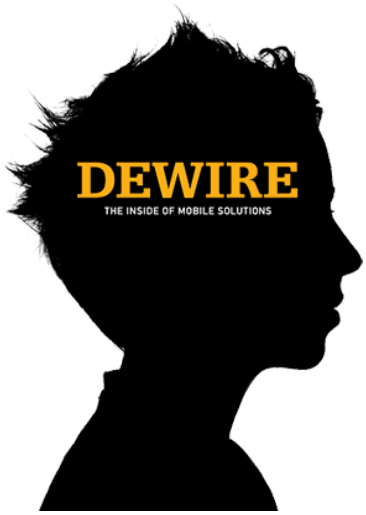

EVALUATING AGILE SYSTEM DEVELOPMENT METHODOLOGIES CONSIDERING STRATEGIC PRIORITIES

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Abstract

The use of agile methods is becoming widespread in the system development industry. Organization's varying needs and environments results in context specific adjustments of agile methods. Still, the evaluation of agile work is often based on how well the organization complies with a commercial method. However, in this study, compliance of practices to strategic priorities is considered. The aim has been to identify how gaps between practice and priority can be measured. A case study has been conducted to measure the perceptual performance of five Scrum practices with consideration to the prioritization of seven agile aspects. The results show that the studied agile aspects are considered essential in the organization and that practices in some cases underperform or overperform. The study is a first attempt to consider strategic consensus in agile system development, and the measurement can be used to indicate an organizations strategic direction and identify practices that are not performing in alignment with strategic priorities.

Keywords: Agile systems development; Agility; Scrum; Strategic consensus; Performance; Priorities.

1. Introduction

In a rapidly changing world, many organizations strive for greater flexibility in their operations. Companies face significant challenges as they are forced to adapt to an increased rate of change with intensified competition (Neely, 2002), technological innovation, and greater demands and expectations from customers (Lin et al., 2006). In the area of Information System Development (ISD), an increasing amount of organizations are adopting Agile System Development (ASD) methods to manage these changes, which are seen as a counter initiative to the traditional plan-based methods. Organizations and individuals' varying needs affect how agile methods are implemented and used in practice (Cao et al., 2004). Still, the evaluation of agile work is often based on how well the organization complies with a commercial method. The fact that agile methods are often tailored to organizations increases the relevance to measure how well agile methods or practices support organizational priorities, which is not considered by using commercial methods as a reference point. As a solution to this problem, this study examines the difference between what aspects of agility practices in Scrum should contribute to according to organizational priorities, and what they

actually contribute to (perceptual performance).

1.1. Background and problem motivation

The increased rate of change has augmented the importance of measurement since it facilitates understanding of changing environments (Neely, 2002), provides a communication path to drive change (Guion, 1983) and indicates the organization's strategic direction, priorities and expectations (Bates, 1999). An increased focus on agile methods has brought more focus on measurement in the field since it among other things indicates the company's ability to adapt to the market and take advantage of opportunities that become available due to changes (Erande & Verma , 2008; Arteta and Giachetti , 2004). The lack of an established definition of agility has caused measurement in ASD to be inconsistent (Abrahamsson, 2009). Instead of adding yet another definition to the research field, this study borrows from the work of Conboy (2009) and his comprehensive definition for agility in ISD:

> The continual readiness of an ISD method to rapidly or inherently create change, proactively or reactively embrace change, and learn from change while contributing to perceived customer value (economy, quality, and simplicity), through its collective components and relationships with its environment.

The measurement methods used today do not consider the relation between what agile methods should contribute to in the specific organization and what they actually contribute to. Thus, there is no clear link between strategic priorities and employees actions, also known as strategic consensus in management research (Robinson & Stern, 1998). In theory, a high degree of strategic consensus contributes positively to organizational performance (Ward et al., 1996).

Previous research has highlighted the importance of evaluating how well agile practices support organizational goals and values to ensure non-conflicting purposes (Conboy, 2009). Furthermore, prior studies has called for more research regarding agile goals and values (Highsmith, 2002), measurement in ASD (Abrahamsson, 2009), management-oriented methods (Dingsøyr et al., 2008), the underlying ideas behind ASD (Dingsøyr et al., 2008) and theory-based approaches in ASD (Dingsøyr et al., 2012). The lack of an established definition of agility in ASD has also been pointed out by previous researchers (Abrahamsson, 2009).

In order to address this expressed need in research, this study examines how gaps between strategic priorities and perceptual performance in agile practices can be identified. Specifically, the use of five Scrum practices is evaluated considering seven agile aspects. The evaluated practices are:

A. Backlog grooming,
B. Sprint planning,
C. Daily scrum,
D. Sprint review
E. Sprint retrospective

According to the originators of Scrum, Schwaber & Sutherland (2013), it is a lightweight framework used by teams to develop and sustain complex products. In Scrum, products are delivered iteratively to optimize predictability and control risk. Practice A is defined as a an act of adding detail, estimates and order to items in the Product Backlog, a list of all desired functionality. Practice B-E are defined as formal events for inspection and adaption of the product and development process.

2. Research approach

A case study in a medium-sized IT-company has been conducted to measure the perceptual performance of five Scrum practices with consideration to the prioritization of seven agile aspects. The seven agile aspects are based on Conboy's (2009) taxonomy of ASD agility:

I. Creation of change
II. Proaction in advance of change
III. Reaction to change
IV. Learning from change
V. Perceived economy
VI. Perceived product quality
VII. Perceived simplicity

These agile aspects have been prioritized in a workshop with three strategically involved people at the company whereas the performance has been measured by sending out survey questions to scrumteam members. During the workshop, the participants were asked to weight the importance of each agile aspect in each practice on a five point Likert scale ranging from very unimportant (1) to very important (5). Then, the participants were asked to motivate their weighting. The same range was used in the survey, but participants were instead asked how well each practice contributes to each agile aspect, from not contributing at all (1) to contributing very much (5). The survey included mandatory fields to obtain scrumteam members motive for each score.

To identify gaps between priorities and performance, the strategic weighting was used as reference against which performance was compared. Two indicators were used for performance; mean and mode of the

scrumteam members scoring. Weights and indicators for performance were then compared to identify potential areas of improvement. Denotations and formulas for calculations are presented in table 1 and formula 1-3 respectively.

Table 1. Denotations for statistical calculations.

Denotation	Explanation
W	Weight of agile aspect in agile practice
x_i	Score *i* for scrumteam member
M	Mean of scrumteam members scoring
T	Mode of scrumteam members scoring.
S_M	Difference between weight and mean
S_T	Difference between weight and mode

$$M(x) = \frac{\sum_1^n x_i}{n} \quad (1)$$

$$S_M = V - M \quad (2)$$

$$S_T = V - T \quad (3)$$

An in depth analysis was conducted in the cases where the difference between the weights (W) and any of the performance indicators (M and T) were greater than one (see figure 1).

Figure 1. Analytical process for identifying gaps for further analysis.

The in depth analysis consisted of a comparison of qualitative and quantitative data from both workshop and survey. Motives for weighting and scoring were compared for each gap. Possible causes for identified gaps were summarized and discussed in a follow up interview with the focus group in order to validate the findings.

3. Results and analysis

3.1. The importance of agile aspects in practices

The weighting of agile aspects in agile practices are used as a reference to assess performance and identify gaps, this is presented in table 2.

Table 2. Weighting of agile aspect I-VII in practice A-E.

	I	II	III	IV	V	VI	VII
A	5	4	4	3	5	4	5
B	2	4	4	2	5	4	2
C	1	3	4	2	5	4	4
D	5	4	4	4	2	4	2
E	5	4	4	4	5	5	3

The quantitative result shows that each agile aspect is important or very important in at least two practices or more, which indicates that the measured aspects are considered essential in the organization. Furthermore, by considering the average weighting of each aspect or practice, the results show that economy (V) is the most important agile aspect while backlog grooming (A) and sprint retrospective (E) are the most important practices.

By combining this result with motives for each weighting identified during the workshop, it is possible to expose the underlying purpose of adopting and using an agile methodology. As an example, it is very important that sprint planning (B) contributes to improved economy (V) since conditions can be created for effective work in the sprint by planning with consideration to timeframe, resources and sprint goal. This practice should therefore increase the possibility of doing steady progress and prevent the occurrence of waste during the sprint that can be caused by unnecessary waiting.

3.2. Gaps between priorities and performance

A summary of statistically indicated gaps are shown in table 3 while descriptive statistics are shown in appendix A. Gaps are either positive (weights are higher than performance) or negative (weights are lower than performance).

Table 3. Statistically indicated gaps between priorities and performance.

	I	II	III	IV	V	VI	VII
A	+	OK	+	+	OK	OK	+
B	-	+	OK	OK	+	OK	-
C	-	OK	+	OK	+	+	OK
D	+	+	OK	OK	OK	OK	OK
E	OK	OK	OK	OK	+	+	OK

An overall analysis shows that *creation of change* (I) has most indicated gaps out of all seven aspects while *learning from change* (IV) has fewest. Concerning practices, horizontal comparison shows that backlog grooming (A), sprint planning (B) and Daily scrum (C) has four indicated gaps each while sprint review (D) and sprint retrospective has two gaps each.

Since there are both positive and negative gaps under creation of change (I), the results indicate that improper practices contribute to the aspect. This might not only affect other practices regarding this aspect, but also affect other aspects in the specific practice. For instance, if too much change is created during sprint planning, this might have a negative effect on proaction (II) and economy (V) since focus is shifted from these higher prioritized aspects.

By comparing qualitative and quantitative data from both workshop and survey results, it is possible to identify potential causes of gaps. As an example, it is considered important that sprint planning (B) contributes to proaction in advance of change (II) since preventive actions can be planned based on experience. Simultaneously, some motives for scores from scrumteam members indicated that there is limited room to plan for potential events and that analysis and assessment of probable changes is done continuously by the solution manager.

The follow up interview with the focus group revealed that scrumteam members have limited preconditions to be proactive since the Scrum methodology is iterative and handles the risk of change through continuously delivering usable product increments. Thus, change is mostly handled reactively through feedback from the customer. Despite this, proaction in advance of change has been weighted as high as reaction to change in all practices except one. This implicates that scrumteam members in this case need to complement the method with other activities in order to be proactive and support organizational priorities. For instance, activities can be planned into the sprint to analyze the work for upcoming sprints, and thereby reduce the risk of choosing a solution that might not be well-suited with future direction of the project.

4. Discussion

The study focused on evaluating the application of agile methods in a novel way by using a theory-based approach to examine how well applied practices within a management-oriented approach (Scrum) contributes to priorities within an organization. This is something that has been requested in previous research (Conboy (2009), Highsmith (2002), Abrahamsson (2009), Dingsøyr et al. (2008, 2012)). This was done by addressing gaps between what agile practices should contribute to according to strategically involved persons and what practices contribute to according to scrumteam members.

Based on the literature study, this attempt to consider strategic consensus in the evaluation of ASD methods is considered a new perspective in the field as well as a development and new application of Conboy's (2009) taxonomy of agility in ISD.

It is important to consider the possible tension between strategic consensus and agility. A high degree of strategic consensus means that prioritized aspects at a strategic level are also catered for in practice. This can affect the organization's ability to quickly adapt to change since employees at the operational level must adapt to new strategic directions rather than directly to changes. Since many companies apply agile methods to cope with changing environments, it is challenging to achieve high strategic consensus in these companies. Strategic consensus can also be considered to be more important in a flat organization than in a hierarchical because important decisions often are made at the operational level. As Scrum teams in theory are self-organized and make strategically significant decisions on a daily basis, it is important that the team members know what is prioritized at the strategic level for practices to be used as intended. Also, this can prevent the emergence of practices with contradicting goals. Therefore, awareness regarding strategic priorities is seen as prerequisites for practices to perform as desired.

4.1. Methodology

The specific research design has enabled an analysis of gaps that would not have been possible using only quantitative or qualitative methods. By combining focus group interviews with a questionnaire, questions such as "what is important and why?" and "how and why do practices contribute to agile aspects?" have been addressed.

5. Conclusions

Based on the results and discussion above, the key findings are:

- The agile aspects are important in the organization, which implicates that concepts that are central to the organization have been measured
- There are areas where practices either underperform or overperform in relation to strategic weighting of agile aspects
- Quantitative data is useful to indicate potential areas of improvement, while it can be complemented with qualitative data to examine underlying causes for gaps
- By summarizing the results in a matrix format, it is possible to visualize potential dependencies between agile practices and dependencies between agile aspects.

This is considered a first attempt to take strategic consensus into account in ASD research. While this study aimed to evaluate Scrum practices, future studies might focus on examining how other agile methodologies (eg. XP or LSD) are performing in relation to organizational priorities. The measurement can be used to indicate strategic direction, provide organizations with a communication path to drive change and facilitate identification of practices that are not performing in alignment with strategic priorities. If you have any

questions about the study, feel free to contacts us at www.dewire.com

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APPENDIX A – QUANTITATIVE RESULTS

Descriptive statistics for each practice is shown in table 3-8, with indicated gaps in red.

Table 4. Descriptive statistics for backlog grooming.

	Creation	Proaction	Reaction	Learning	Economy	Product quality	Simplicity
Weighting (*V*)	5	4	4	3	5	4	5
Mode (*T*)	5	4	[1, 2, 3, 5]	1	4	5	4
Mean (*M*)	3,88	3,63	2,75	2,25	4,00	3,13	3,00
Standard deviation	1,36	1,41	1,58	1,28	0,76	1,73	1,20
Interval	[2, 5]	[1, 5]	[1, 5]	[1, 4]	[3, 5]	[1, 5]	[1, 4]
Difference (S_T)	0	0	[3, 2, 1, -1]	2	1	-1	1
Difference (S_M)	1,13	0,38	1,25	0,75	1,00	0,88	2,00

Table 5. Descriptive statistics for sprint planning.

	Creation	Proaction	Reaction	Learning	Economy	Product quality	Simplicity
Weighting (*V*)	2	4	4	2	5	4	2
Mode (*T*)	[3, 4]	[2, 3, 4]	3	1	3	4	5
Mean (*M*)	3,21	3,29	3,21	2,57	3,57	3,64	4,57
Standard deviation	1,05	1,07	1,25	1,45	0,85	0,93	0,51
Interval	[1, 5]	[2, 5]	[1, 5]	[1, 5]	[2, 5]	[2, 5]	[4, 5]
Difference (S_T)	[-1, -2]	[2, 1, 0]	1	1	2	0	-3
Difference (S_M)	-1,21	0,71	0,79	-0,57	1,43	0,36	-2,57

Table 6. Descriptive statistics for daily scrum.

	Creation	Proaction	Reaction	Learning	Economy	Product quality	Simplicity
Weighting (*V*)	1	3	4	2	5	4	4
Mode (*T*)	2	4	3	1	4	3	5
Mean (*M*)	2,81	3,25	2,94	1,81	3,44	2,94	4,13
Standard deviation	1,17	1,44	1,29	0,91	1,31	0,85	1,02
Interval	[1, 5]	[1, 5]	[1, 5]	[1, 3]	[1, 5]	[1, 4]	[2, 5]
Difference (S_T)	-1	-1	1	1	1	1	-1
Difference (S_M)	-1,81	-0,25	1,06	0,19	1,56	1,06	-0,13

Table 7. Descriptive statistics for sprint review.

	Creation	Proaction	Reaction	Learning	Economy	Product quality	Simplicity
Weighting (*V*)	5	4	4	4	2	4	2
Mode (*T*)	5	[1, 2]	[4, 5]	3	2	5	1
Mean (*M*)	3,89	2,44	3,67	3,22	2,67	3,67	1,89
Standard deviation	1,17	1,59	1,41	1,48	1,58	1,22	1,05
Interval	[2, 5]	[1, 5]	[1, 5]	[1, 5]	[1, 5]	[2, 5]	[1, 4]
Difference (S_T)	0	[3, 2]	[0, -1]	1	0	-1	1
Difference (S_M)	1,11	1,56	0,33	0,78	-0,67	0,33	0,11

Table 8. Descriptive statistics for sprint retrospective.

	Creation	Proaction	Reaction	Learning	Economy	Product quality	Simplicity
Weighting (*V*)	5	4	4	4	5	5	3
Mode (*T*)	5	5	5	5	3	4	3
Mean (*M*)	4,63	3,44	3,81	4,31	3,50	3,25	2,81
Standard deviation	0,62	1,41	1,22	1,25	1,21	1,18	1,22
Interval	[3, 5]	[1, 5]	[1, 5]	[1, 5]	[1, 5]	[1, 5]	[1, 5]
Difference (S_T)	0	-1	-1	-1	2	1	0
Difference (S_M)	0,38	0,56	0,19	-0,31	1,50	1,75	0,19