

The connection of the stakeholder cooperation intensity and team agility

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Abstract – Today, new software development methods and technologies are being used to create new systems, applications and services in a wide range of industries. Especially agile software development has been gaining ground among the software development professionals. This paper analyses the differences in stakeholder cooperation intensity for different levels of agile development in the teams. Two teams use a stakeholder identification framework to identify stakeholders for the new software systems. The teams are also measured with two agile measurement tests used in the industry.

Keywords – Agile Software Development, stakeholder, measuring agility, agile assessment, stakeholder identification

I. INTRODUCTION

Modern service and product delivery is largely dependent on complicated software systems. There is a wide variety of software development methodologies used to handle the system complexity, the frequent changes of requirements and the ever changing business and technology environment [1], [2]. Despite the lack of empirical evidence from academic research [3], especially the agile software development has been adopted to answer the challenges of developing software. In agile software development the interaction between developers, sponsors and users is found to be very important [2], [4]. The review of previous studies on the impact of stakeholder involvement in new product and service development has reported mixed results, and no conclusion can yet be drawn [5]. Therefore, it is important to investigate the topic of stakeholder engagement in new software system development.

This paper examines agile development and stakeholder cooperation intensity in two software development projects in the financial industry. The cooperation intensity of relevant stakeholders is measured using a four-level stakeholder identification framework. The level of agile development is measured using two lightweight industry-used tests. The correlations of these measurements are analysed and discussed.

The research question addressed in this study is: *What is the connection between the stakeholder cooperation intensity and the level of agile development?*

The results show that there is a correlation with the level of agile development and overall stakeholder cooperation intensity. However, unlike in agile literature, the results do not support the notion that more agile teams have more intensive cooperation with business people and customers.

The study is structured under six sections. The following section will present current knowledge of agile software development and stakeholders, stakeholder identification and measuring the level of agility. After that, the research methodology is presented in Section III, followed by the results in Section IV. Section V discusses the findings and limitations, and finally Section VI concludes the study.

II. LITERATURE REVIEW

In this section, literature on the role of stakeholders in agile development, stakeholder identification and measuring level of agile development are reviewed.

A. Agile Software Development and Stakeholders

The stakeholders have been researched since the 1960s by management, economics and policy researchers [5]; therefore, multiple definitions for a stakeholder exist, e.g. [6]–[8]. The Freeman’s definition [8] with slight adaptation is used in this study: *Stakeholders* for a new system development are those who have an interest in or are affected by the new system.

Agile software development is a collection of novel and lightweight software development processes, e.g. Scrum, Extreme Programming, Feature-Driven Development [1]. These processes, or agile methods, are collaborative, communication and feedback intensive, team and quality oriented. The popularity of the agile software development has increased since the introduction of the term in 2001 [9], and can be nowadays considered to be the mainstream in software development [10], [11].

The Agile Manifesto [9], which defines the values and principles of agile software development, has also referred to stakeholders. One of the four values in the Agile Manifesto is “Customer collaboration over contract negotiation”, which calls for intensive stakeholder collaboration. Also, one of the 12 principles highlights frequent communication with stakeholders: “Business people and developers must work together daily throughout the project”.

However, in agile software development context the term stakeholder is often limited to customers, end-users or project sponsors. This is also reflected in Agile Manifesto that identifies customer, business people, developers, sponsors and users. Furthermore, the stakeholder groups are often considered as a single stakeholder, e.g. “the customer”, “the development team”. Due to this many papers reporting on the stakeholder cooperation and collaboration are actually only considering a single part of the whole related stakeholder landscape. [12]

B. Stakeholder identification

The issue with previous stakeholder identification theories and techniques is that they are at the strategic level of companies. In practice, a guideline on stakeholder identification would be useful at the operational level, where new product development and software development happens. Examples of proposed theories include: 1) Identifying stakeholders and understanding their sources of influence, e.g. [8], [13]; 2) Incorporating stakeholder interests into enterprise planning, e.g. [6]; 3) Dynamic theory of stakeholder identification and salience [14].

A four-level framework for stakeholder identification was introduced recently for new product-service system development in the healthcare industry [15]. This framework is inspired by the Moore’s literature [16] of business ecosystem, extended enterprise, and core business [17]. As seen in Fig. 1, the four levels are: business environment, offering, product, and service delivery. Table I shows the stakeholder identification framework adapted for financial service industry from the healthcare industry [18].



Fig. 1. Four levels of stakeholders (adapted from [17])

C. Measuring agility

There are multiple ways to measure the agility of a team. The most superficial way is to verify that the practices of given agile method are followed. A more subtle measure can be evaluated by comparing the team to agile manifesto’s values and principles [19]. The downside of such evaluation is that the measurement is rather subjective and qualitative by its nature.

TABLE I
STAKEHOLDER IDENTIFICATION FRAMEWORK FOR NEW PSS DEVELOPMENT IN THE FINANCIAL INDUSTRY (EXTRACTED FROM [18])

Stakeholder Level	Stakeholders identified
Environment	Industry interest group
	Government quality and regulatory agencies or department
	Law & legislation
	Quality standard and guidance
	Domain experts or industry level
Offering	Media
	Company: management
	Customer: management
	Company: sales
	Company: marketing
	Company: engineering/technical development
	Company: quality & regulatory
	Company: industry / government relationship awareness
	Supplier
	Partner
	Business network
Product	Competitor
	Resellers/distributors
	Customer: product maintenance
	Company: product maintenance
	Customer: information technology support
	Company: information technology support
	Company: product manufacturing
	Company: service parts logistics
Customer: end users (using product)	
Service delivery	Company: service delivery (using product)
	Company: service delivery (not using product)
	Customer: service delivery (not using product)
	End customers / beneficiaries of the product and/or service
	Family of the end customers / beneficiaries
Service delivery	For-profit organizations supporting end customers / beneficiaries
	Non-profit organizations / network that support end customers / beneficiaries

A common trait in software development is the large number of measurement frameworks aimed for multiple purposes. Several maturity and capability models (e.g. CMMI) have been used in traditional software development. However, the underlying assumptions do not suit for agile software development. As a result, a large number of agile maturity models have been developed (e.g. [20]–[23]), and there exists some meta-analysis of the landscape of agile maturity models [24], [25]. The issue with maturity models is the lack of support from practitioners [26], the lack of theoretical underpinnings and the lack of validation of the models [25]. This has sparked off a new initiative that aims at bringing rigor to software development. This new initiative also addresses the issues around measurements at a later stage [27].

To address the insufficiency of more suitable measurements, and to avoid the potentially huge effort needed in performing these complex measurements, a collection of more lightweight and simple means have been used in the industry. Tools such as Nokia test [28] and many others e.g. [29], [30], are used to check on what level the team currently is and how the team could improve. These tools are arguably very simplistic and fail to capture all useful data, but on the other hand, are practical.

III. METHODOLOGY

The purpose of this study is to examine the relationship between stakeholder cooperation and the team's level of agile development. For this examination, two teams from the same company are selected. The company is a large customer and asset management service provider in Europe with a presence in 11 countries. Both project teams have at least three years of experience in agile software development, and are working in a similar organisational structure.

The stakeholder identification is conducted in workshops facilitated by the researchers. A worksheet of the stakeholder identification framework, with two columns for capturing the relevant stakeholders and stakeholder involvement are provided (Table I). Involvement here refers to activities including: communications between the development team and the stakeholders, instructions or rules given by the stakeholders to the development team, or stakeholders' participation in development activities.

The workshop preparation and execution processes and the context of the company and participating project teams are documented in order to achieve validity in the findings [31]. The workshops are also audio-recorded. The same independent observer is used in both workshops to enhance the quality of the reflection and data analysis.

To compare the differences in stakeholder for software systems of different levels of agile development, qualitative and quantitative data [32] from each workshop is used. Quantitative data about stakeholder cooperation is captured in a similar form than in Table I with two added columns: Stakeholder relevance (Yes/No) and Stakeholder proximity (1-10, where 10 is the highest proximity). The term proximity was explained to the teams as stakeholder collaboration intensity, engagement and frequency, and has been used here as a synonym to cooperation intensity.

Quantitative data about the level of agile software development is captured through two industry-used agile tests: the Nokia test [28] and agile evaluation provided by VersionOne [29]. The industrial tests were selected to keep the measurement lightweight and fast, in order to provide useful feedback for the teams to work on. Furthermore, the teams are already familiar with the Nokia test, which helps to decrease the time commitment needed from the team to support this study. Qualitative data is gathered through workshop observations and the audio-recorded discussions.

The data is analysed by comparing the commonalities and differences between the two development teams in terms of: (1) number and distribution of stakeholders that are identified as relevant to the project; and (2) the level of agile development in the team. Comparative analysis is selected because the number of study subjects is small enough to handle. Qualitative data is used to verify and improve the quality of the findings and to help the analysis.

IV. RESULTS

There were six participants from Team A and five participants from Team B completing the stakeholder identification framework worksheet during the workshops. In both workshops, the participants found that some stakeholders were more obviously relevant to the development projects than others. Some of the stakeholders in the framework were identified to be irrelevant to the development projects, but the participants did not identify any stakeholder missing from the framework. Some stakeholders were identified as parties that the development team must listen to, but had no opportunity to influence, such as "Law & Legislation" for Team B. For Team A, some stakeholders were identified as parties who would be good to have their involvement, such as "End customers", but had not been successful so far. The identified stakeholders with their intensity ratings are shown in Table II. The non-relevant stakeholders have been omitted from the table.

TABLE II
RESULTS OF THE STAKEHOLDER COOPERATION INTENSITY WORKSHOP

<i>Level</i>	<i>Stakeholder group</i>	<i>Team A Intensity</i>	<i>Team B Intensity</i>
Environment	Law & Legislation	3	3
	Quality standard & Guidance	7	
	Media		1
Offering	Customer's management	5	7
	Company's management	3	2
	Company's sales	4	9
	Company's marketing	2	1
	Company's engineering/technical development	10	10
	Company's quality & regulatory	6	2
	Company's industry/government relationship awareness		1
	Supplier	8	9
	Partner (external & internal partners)	9	7
	Business networks	2	
	Competitors	1	2
Product	Customer's product maintenance	2	7
	Company's product maintenance	9	10
	Customer's IT support	2	8
	Company's IT support	7	5
	Company's product manufacturing	10	
	Company's service parts logistics	2	
	Customer's end users (using this product)	4	4
	Company's service delivery (delivering service by using this product)	2	10
Service delivery	Customer's service delivery (not using this product)	3	
	End customers / beneficiaries of the product and/or service		3

A total of 24 stakeholders (75%) were identified to be relevant to at least one of the development projects. Within the common stakeholders, 16 were identified to be relevant for both Team A and Team B, five were only relevant for Team A, and three were only relevant for Team B (Table III).

At the Environment level, half of the proposed stakeholders are identified to be relevant for the development team. At the Offering level, apart from “Resellers / Distributors”, all 12 of the stakeholders in the framework were relevant. At the Product level, Team A had identified all eight (100%) of the stakeholders in the framework as relevant, while the Team B identified six (75%) of the stakeholders at this level as relevant. At the Service Delivery level, only one-third of the proposed stakeholders were indicated as relevant to the development projects.

The most intensive stakeholder groups (intensity at least 9) for Team A were “Company’s engineering-technical development”, “Partner (external & internal partners)”, “Company’s product maintenance” and “Company’s product manufacturing”. For Team B the corresponding stakeholder groups were “Company’s sales”, “Supplier”, “Company’s engineering/technical development”, “Company’s product maintenance” and “Company’s service delivery (delivering service by using this product)”.

TABLE III
STAKEHOLDER IDENTIFICATION BY LEVEL

		Team A	Team B
Environment	Sum	10	4
	Average	5	2
Offering	Sum	50	50
	Average	5	5
Product	Sum	38	44
	Average	4.75	7.33
Service delivery	Sum	3	3
	Average	3	3

The total sum of intensity and the average intensity in Table IV suggests that even though the total intensity of the stakeholder communication is equal, Team B has on the average more intense stakeholder collaboration. The phenomenon is further illustrated in Fig. 2, which shows that Team B has more intensive cooperation with its stakeholders.

TABLE IV
TOTAL COUNTS OF STAKEHOLDER ANALYSIS

	Team A	Team B
Total sum of intensity	101	101
Total count of stakeholders	21	19
Average	4.8	5.3
Median	4	5

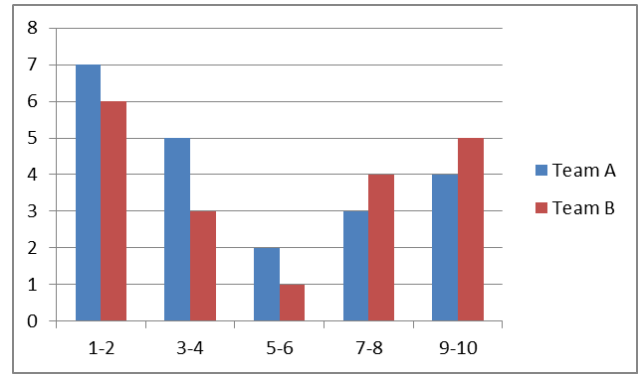


Fig. 2. Histogram of communication intensity in frequency classes

As can be seen from Table V, both assessments show that Team B seems to be more agile, with a higher score in both VersionOne assessment (25% higher) and Nokia test (2.4 % higher). The standard deviations in both tests and both teams are large. This suggests that there are multiple opinions within the teams.

TABLE V
RESULTS FROM AGILE ASSESSMENTS

		Team A	Team B
VersionOne	Average score	3.6	4.53
	Lowest area	Ability to Change	User Accessibility
	Highest area	Team	Team Location, Team Structure, Delivery, Testing
	SD	0.95	0.846
Nokia test	Average score	2.76	2.83
	Highest score	35	33
	Lowest score	23	23
	SD	1.52	2.03

V. DISCUSSION

This section discusses the results in order to elaborate on the main research question. Finally, the limitations of the study are discussed and further useful study topics are identified.

The results show that Team B that had larger score from both agile assessments had also larger average stakeholder cooperation intensity. So either being more agile indeed makes stakeholder cooperation more intense, and thus follows the values and principles from Agile Manifesto. The values of collaboration and frequent communication seem to be followed.

Other way to interpret the result is to state that cooperating more intensively with the stakeholders drives agile behaviour. It might be that the only way to satisfy stakeholder needs in current complex business environment is to adopt the agile development methods. Inherent characteristics of intensive, and most likely continuous, communication is that the amount of changes grows, but the changes over time are more aligned with the needs.

Even though the teams are in the same organization and have a similar culture, the deliverables differ a bit as shown in Table III. Team A is delivering a more complete product, and Team B is working on a product to support service delivery. This naturally impacts the relevant stakeholders, but it also might impact the cooperation intensity. In more product oriented team, there might be clear responsibilities and less need to discuss with stakeholder groups. In service related development, the owners of the service process, sales and service operations are involved more heavily.

Judging from the Agile Manifesto, the hypotheses would be that more agile team would communicate more intensively with the stakeholders in Offering and Service delivery level. However, according to these measurements this is not true. In fact, the measurements show that the team with larger score in agile measurements actually had the same cooperation intensity with Offering and Service delivery levels than the other team. This hints that the cooperation intensity with Offering and Service delivery are more organizational characteristics than dependant on the level of development team's agility.

However, it can be stated that both of the teams are actively communicating and collaborating with most of the stakeholders mentioned in the Agile Manifesto. Surprising exception is the end user, which only Team B sees relevant, and the intensity of that cooperation is low. The Team A stated that they have not been able to involve end users even though they see the value in that. This is most likely an industry specific characteristic.

One interesting finding from agile assessment viewpoint is that the differences between Team A and Team B in agile assessments are larger in VersionOne's test than in the Nokia test. A possible explanation for this is that the Nokia test has a background in Scrum projects. Team A is working using Scrum, but Team B has evolved into more Kanban-like process. This might lower the score from Nokia test for Team B, which then in more general VersionOne assessment gets higher score.

Naturally, this study has some limitations. First, it should be noted that the stakeholder intensity evaluation is done by the teams themselves. Therefore, values from a team that has high communication intensity are not directly comparable to a team with low communication intensity. However, to the authors' knowledge, there are no major differences between the two case study teams.

Second, the data is gathered from only two teams and from one company. There might be firm specific features that hinder the generalisation of the results. Therefore, further works from the different companies in the different domains of the industry are needed to validate and further elaborate the results.

Third, there is no agile measurement with a sound theoretical background and validation. Current measurements are done using lightweight measurements in order to be able to scale the measurements effectively.

Nevertheless, this study opens new avenues for further studies. First, this study has shown a method to assess stakeholders in an agile software development context.

Future studies can use this method to collect a larger set of data to address the development's method effects on the stakeholder participation, and to verify the above presented results.

Furthermore, a longitudinal study with multiple cases is needed to investigate whether higher intensity of communication leads to better quality products.

VI. CONCLUSION

This paper focused on analysing the connections between agile software development methods and the stakeholder cooperation intensity in software business. We studied in-depth two agile software development teams in a large multinational corporation and the stakeholder cooperation of these teams. In this study, we utilised the stakeholder identification framework [17], [18] and two industry-based frameworks to assess the agility of the development teams.

The results support the hypotheses that there is a connection between the level of agile development and overall stakeholder cooperation intensity. The intensity gains are in cooperation with more technical stakeholders, but not with the stakeholders like customer, business people and end users as hinted by the agile manifesto.

This implies for the software development research that the communication and collaboration of agile software development are not yet understood. Simplistic views of agile software development leading more intensive cooperation with stakeholders seem to be incomplete.

As a managerial implication, this study proposes a tool for companies to analyse stakeholder involvement in software development. At the same time we were able to test two lightweight agile measurement tools and found that they produce rather similar results with certain emphasis. These tools are coherent enough to be used in continuous improvement efforts to measure the baseline for teams.

As the number of case studies is low and both cases are from the same company, the result of this study is not to be generalised. This was an intentional decision as the focus was to minimise the impact of organisational culture; furthermore, the small number of cases allowed in-depth study. Further work is needed to replicate and confirm the results with a wider range of industries and development teams.

ACKNOWLEDGMENT

Tomi Juhola thanks Jenny & Antti Wihuri foundation and Nokia Foundation for financially supporting his dissertation work on innovations in agile software development context.

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