On Some Challenges in Assessing the Implementation of Agile Methods in a Multisite Environment

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Abstract—**Organizations utilize agile development methods and multisite environments with the intent to reduce costs and development time. Assessing the results of utilizing and adopting such methods is also frequent. An assessment survey instrument was used to analyze the transformation of a multisite software development organization from waterfall-type development into agile development. The transformation was done in two globally distributed sites in Finland and India around 12 months apart. The assessment survey was conducted in the Finnish site 6 months after it had changed its working methods and again 12 months later in both sites. The site in India had adopted similar methods after the previous assessment survey was conducted. The results of the assessment survey in the Finnish site indicated regression between the two assessment rounds, while the results in India appeared to be better compared to Finland in the second round. Analysis of the results suggests that cultural differences and time elapsed from the organizational transformation may have influence in the assessment results and should be taken into account when assessing the implementation of development methods.**

Keywords-organizational change; global software development; agile methods; Scrum; process assessment.

I. INTRODUCTION

Adopting agile development methods like Scrum [1] and extreme programming (XP) [2] have seen a great deal of interest in the software development community because of their intended benefits of delivering working software and being more responsive to changes, among other reasons [3]. However, scaling agile methods into larger organizations than a single or a few teams has its difficulties and there have been several descriptions of how to do that (e.g., [4][5]).

As development organizations become larger, they are often also spread out globally out of necessity or because of their business environments [6], which causes a whole other array of issues to be considered in managing development work.

This publication describes selected results of a quantitative process assessment conducted at a medium-sized software development organization. The organization adopted a Scrum-based software development process in their multi-site organization. The adoption and the assessment were done in two phases. First, the process was adopted by a smaller unit in Finland with approximately 30 people, who were assessed approximately six months after the adoption. Then, with the experience gathered from the first site, similar processes were adopted in the same organization's site of about 50 people in India and the assessment was repeated in both sites. The adoption was also planned to be further expanded to other sites.

The aim of this publication is to provide evidence of issues in assessing the implementation of organizational changes such as new development processes in a global software development (GSD), or other multisite organization.

The remainder of the publication is organized as follows. Section II contains a description of related work as theory of agile development methods and global software development. Section III presents a description of the assessment process and Section IV a description of the organization in which the assessment was conducted. Section V presents the relevant results of the assessments. Section VI includes discussion based on the results and the paper concludes in Section VII.

II. RELATED WORK

The agile movement gained publicity within the community during the 1990's, and was later epitomized in the agile manifesto, published in 2001 [3]. The manifesto was a collaborative agreement of what practitioners saw as the values and principles of agile software development. In addition to the actual manifesto, the authors also described twelve principles behind it. The twelve principles were agreed as common to the agile practitioners, although agile methods had already been described and were in use in many different settings. 'Agile methods' is an umbrella term for a wide different set of approaches (e.g., Scrum, XP and kanban [7]), that have challenged the traditional waterfall model of software development and introduced a more lightweight process of producing software. Key differences between agile methods and traditional software development include iterative development and promoting empowered teamwork. However, a common misinterpretation of agile software development is that agility is achieved with practices and tools, although the focus should be on being agile, instead of doing it [4].

During the same time that agile methods started to become increasingly prevalent in software development, globalization of high-technology businesses have increased the need for GSD. Software and its use as both products and services has become a competitive weapon which must be utilized efficiently to stay ahead in high-technology competition [6].

The challenges of GSD have been clear from the start and have been described in several sources (e.g., [8][9][10]). Issues range from strategic level issues like how to divide work between different sites, to more tactical level problems like how to arrange effective daily communication channels, to more complex systems like cultural differences and their effect on project and process management [6]. It is clear that many types of issues become apparent when dividing any kind of work globally, and with development work that often realizes inside developers' and designers' heads, the problems can be all the more difficult. Methods have also been proposed to reduce the effects of the challenges involved with GSD. These methods range from the use of maturity models [11] to suggested practices and techniques [10].

As organizations try to improve their processes and products, they often turn to assessments to get further understanding of their processes. Many of these assessments have also been conducted in global development environments (e.g., [12]). Similarly to the identified challenges with GSD, analyzing assessment results from GSD organizations may also contain challenges that are unknown. This is true for assessment results in any multisite organization, not just for GSD organizations.

III. RESEARCH METHOD

One of the challenging things in any organizational transformation towards a new way of working is how to assess the transition process and guide the next steps. This research was conducted using the *Lean and Agile Deployment Survey,* which is an assessment instrument developed by the University of Oulu in collaboration with industrial partners in the Cloud Software Program [13] in Finland. The instrument is specifically designed for enabling an effective transformation to a lean and agile way of working. The survey is based on a generic structure of three organizational levels; portfolio, program and project [5], and focuses on four main dimensions: organizational set-up, practices, outputs and culture/mindset. The survey was part of a larger effort that University of Oulu was performing in identifying the right agile practices to adopt and to determine whether organizations are ready for lean and agile. Additionally, the approach is meant to provide information for deciding what necessary preparations and potential difficulties may be faced during the adoption process.

The conducted survey contained four context information questions for analyzing purposes, and over 70 statements that described the organization's agile development process as it had been planned and taken in use internally. The statements were tailored from general statements in the *Lean and Agile Deployment Survey* to correspond with the terminology and processes of the case organization. Some generic examples of the statements are presented below:

- The product backlog prioritization is clear
- The product owner guides the Scrum team by prioritizing the user stories
- I understand when the user stories are complete and can be accepted within the sprint

IV. CASE ORGANIZATION

The case organization designs software for network protocol analyzers. One of the organization's sites in Finland started their agile transformation with pilots during the spring of 2010. They further changed that site's organization of around 30 employees to an agile way of working in the beginning of fall of the same year by starting to follow the methods of Scrum development [1]. During 2011, after initial results and experiences in Finland, similar processes were taken in use at a development unit in India and were planned to be taken in use in other sites as well.

The *Lean and Agile Deployment Survey* was conducted twice in the organization. The first survey took place after the agile methods had been taken in place in Finland and had been in place for about 6 months. The second survey was conducted 12 months later and was expanded to include the site in India, which had adopted similar agile practices during that time.

The targets of the survey assessment were i) to review the current status of agile adoption at two of the case organization's sites, ii) to see how the unit in Finland had been progressing with agile methods between the two survey rounds, iii) to identify focus areas for continuous improvement efforts and iv) to receive feedback on the impressions and assumptions on agile and Scrum processes in other sites of the organization.

To obtain results for the last goal, the survey was also conducted in a third site, which had not yet fully adopted similar processes as the two case sites. The responses of the third site are omitted from the results presented in this publication.

The total number of respondents for the first round in Finland was 25. For the second round, there were 62 responses in total, 25 responses from Finland and 37 from India.

V. RESULTS

The survey was very successful in terms of response rate, which was a full 100 percent in the first round and 80.5 percent in the second round. The high response rate was

attributed to the close collaboration between the case organization and researchers and extensive communication to the survey participants. Personnel of the case organization also sponsored the survey noticeably, so its conduction was well received.

TABLE I. RESPONDENT EXPERIENCE

	How many years of experience in software industry do you have?			
	Round 1 (Finland)	Round 2 (Finland)	Round 2 (India)	Round 2 (Total)
None	0	0	0	0
Less than 2	1	0	6	6
2-5	4	2	13	15
5-10	5	5	16	21
10-20	13	16	2	18
More than 20	2	2	0	2
Total	25	25	37	62

A comparison of the respondents' experience shows that the personnel that participated in the survey were generally very experienced in software development (see Table I). There is also some difference between the experiences between the two sites. Many respondents in Finland had over a decade of experience in software development, which may amount to some opinions reflected in the survey results.

TABLE II. RESPONDENT ROLES

	Round 1 (Finland)	Round 2 (Finland)	Round 2 (India)	Round 2 (Total)
Developer	13	16	18	34
Tester	4	1	10	11
Product owner	4	4	2	6
Scrum master	3	2	6	8
Other	1	2	1	3
Total	25	25	37	62

Most of the responses in the survey came from developers and testers (see Table II). The other roles with significant number of responses were the product owner and Scrum master. As the focus of the survey was at the implementation of agile development process, the responses from these roles also provides a solid basis for the analysis of the results.

Because of the case organization's preference, the statements were evaluated by the respondents on a four-point scale, with an additional option of 'I don't know' instead of a 5-point Likert-type scale [14] usually utilized with the *Lean and Agile Deployment Survey*. The answering options with corresponding weights used in average

calculation in the following results section were as follows (see Table III).

TABLE III. SURVEY ANSWERING OPTIONS

Option	Option weight
Disagree	1
Partially agree	2
Largely Agree	3
Fully Agree	4
I don't know	-

The following tables and figures present selected findings from the survey which may be interesting in the context of multi-site agile adoption. The results for individual statements (see Figures 1-10) are presented as the distribution of responses and an average result in the statements in four separate rows. The first row presents the results received in the first survey that was conducted around 6 months after the agile adoption had taken place in the Finland unit. The second and third row include responses 12 months later from the Finnish and Indian units, respectively. The final row shows the combined answers in the second survey round from both sites (Finland and India).

Please note that the 'I don't know' –answers are not included in the average calculations. However, in some statements the amount of 'I don't know' –responses itself is significant.

Firstly, a very interesting finding can be made by looking at the collective average of the overall responses between the two survey rounds (see Table IV).

TABLE IV. SURVEY AVERAGE

	Round 1 (Finland)	Round 2 (Finland)	Round 2 (India)	Round 2 (Total)
Response average	3,04	2,76	3,28	3,07

The fact that the average score in Finland in the second survey is lower than 12 months earlier is an alerting sign, as the statements were formed in a positive form in accordance of the case organization's process description. There was some indication from the case organization that they had not had sufficient resources to actively react to issues raised in the first survey and subsequent retrospectives during the 12 month period between the two surveys. A possible cause for the reduction in the average results may also be increased experience and awareness in the agile methods. This could affect the results as people become more aware of their processes and the issues concerning them than before.

Also, perhaps surprisingly, the average score in India was much higher than it was in Finland as seen from the second round average scores. Several reasons may affect this difference, with cultural reasons perhaps being the most obvious explanation.

Reasons for the drop in score are evident in some survey results. One main improvement area for the case organization based on the first survey was the lack of identified value of continuous improvement activities (see Figures 1 and 2).

Round 1 (Finland) Avg. 2,62
Round 2 (Finland) Avg. 2,23
Round 2 (India) Avg. 3,29
Round 2 (Total) Avg. 2,88

■Disagree ■Partially agree ■Largely agree ■Fully agree ■I don't know
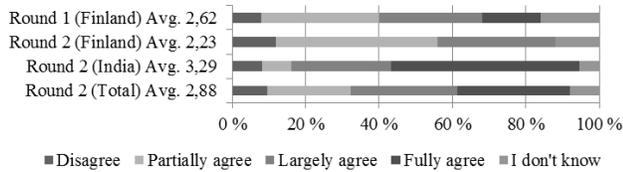
Figure 1. Scrum teams change their ways of working based on retrospectives.

Round 1 (Finland) Avg. 2,48
Round 2 (Finland) Avg. 2,32
Round 2 (India) Avg. 3,35
Round 2 (Total) Avg. 2,95

■Disagree ■Partially agree ■Largely agree ■Fully agree ■I don't know
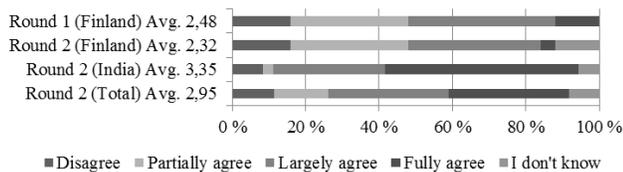
Figure 2. We reduce wasteful activities frequently.

The lack of resources assigned for following up on this improvement area show as reduced results in the second round in the Finland unit. Again, results on the topic are higher in the India site.

A second major improvement area identified based on the first survey round was the lack of measured and communicated evidence of the benefits of the agile methods for the organization (see Figures 3-6).

Round 1 (Finland) Avg. 2,68
Round 2 (Finland) Avg.2,53
Round 2 (India) Avg. 3,57
Round 2 (Total) Avg. 3,20

■Disagree ■Partially agree ■Largely agree ■Fully agree ■I don't know
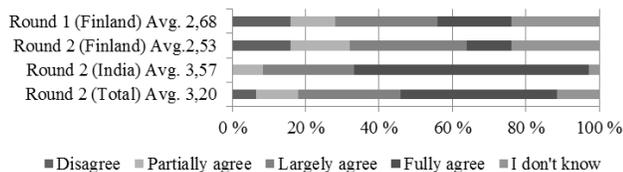
Figure 3. I am more productive with the agile way of working.

Round 1 (Finland) Avg. 3,15
Round 2 (Finland) Avg. 2,31
Round 2 (India) Avg. 3,34
Round 2 (Total) Avg. 3,02

■Disagree ■Partially agree ■Largely agree ■Fully agree ■I don't know
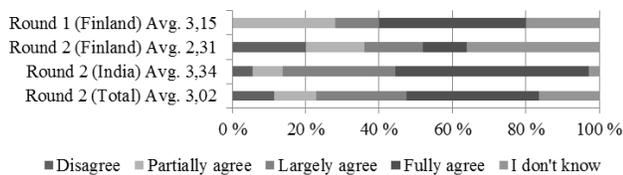
Figure 4. We are more productive as a Scrum team.

Round 1 (Finland) Avg. 2,88
Round 2 (Finland) Avg. 2,06
Round 2 (India) Avg. 3,32
Round 2 (Total) Avg. 2,86

■Disagree ■Partially agree ■Largely agree ■Fully agree ■I don't know
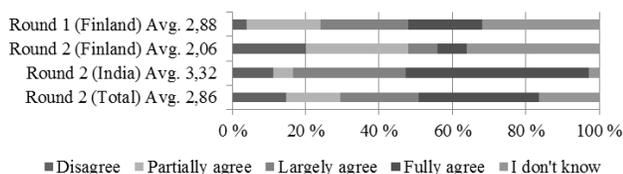
Figure 5. Product quality has been improved by applying agile development.

Round 1 (Finland) Avg. 2,88
Round 2 (Finland) Avg.1,92
Round 2 (India) Avg. 2,56
Round 2 (Total) Avg. 2,38

■Disagree ■Partially agree ■Largely agree ■Fully agree ■I don't know
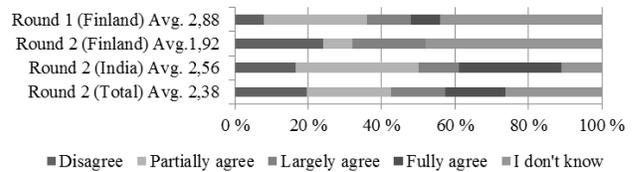
Figure 6. Development time has decreased by applying agile development.

An action point after the first survey round was to provide the teams more information on the benefits of agile in comparison with earlier working methods. This issue had apparently not received enough attention because the second survey round indicated some decrease in results on the matter as well as an increase in 'I don't know' –responses in Finland. Another possibility for the results is that the quality and productivity have actually not been improved with the new methods. The measuring of the benefits of agile is a very interesting and difficult topic among all organizations implementing the methods, but high consideration should be used on how to provide teams more information on actual benefits of agile.

There was also possible need for further training within the organization (see Figures 7 and 8).

Round 1 (Finland) Avg. 2,96
Round 2 (Finland) Avg. 2,88
Round 2 (India) Avg. 2,83
Round 2 (Total) Avg. 2,85

■Disagree ■Partially agree ■Largely agree ■Fully agree ■I don't know
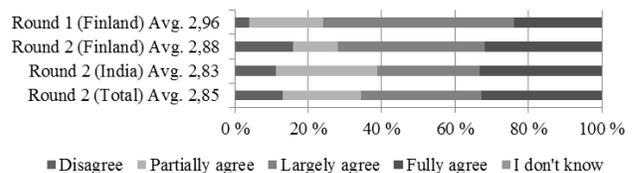
Figure 7. I have received enough training for carrying out my work.

Round 1 (Finland) Avg. 3,44
Round 2 (Finland) Avg. 2,72
Round 2 (India) Avg. 3,58
Round 2 (Total) Avg. 3,23

■Disagree ■Partially agree ■Largely agree ■Fully agree ■I don't know
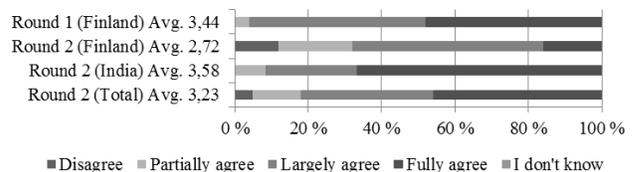
Figure 8. I feel confident with myself with the agile way of working.

When comparing the results between the sites in Finland and India, it can be seen that the training needs appear to be equally divided between the two sites. However, there is a noticeable difference between the sites in the confidence in individual capabilities. This can possibly again be explained by cultural differences.

There was also some difference in statements about the preference of team co-location between the sites. There is a noticeable change in the answers between Finland and India (see Figures 9 and 10).
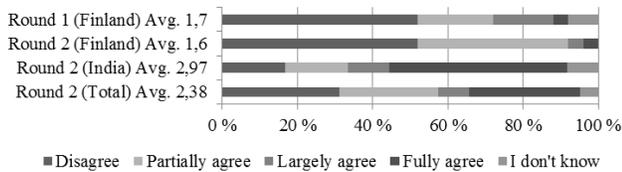
Figure 9.   I prefer to work in a multisite Scrum team.
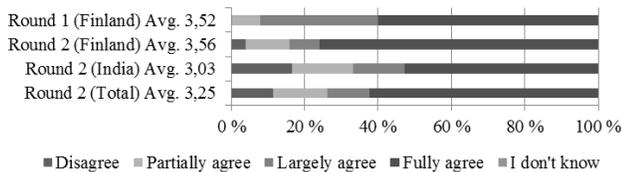
Figure 10. I prefer to work in a local Scrum team.

Differing from the answers in India, there seems to be a clear preference to co-location of team members in Finland. The co-location in generally viewed as an important part in Scrum processes and the results in Finland show the preference that has come by experience in that site. The conflictingly high results of India in both of the two tables above may involve cultural influences, but also some lack of experience since the agile methods had been in use there for a shorter period of time.

An additional interesting comparison was made between the two survey rounds in the overall amount of 'I don't know' –answers (see Table V).

TABLE V.   PERCENTAGE OF 'I DON'T KNOW' RESPONSES IN ALL STATEMENTS

Round 1 (Finland)	Round 2 (Finland)	Round 2 (India)	Round 2 (Total)
9,8%	12,7%	7,62 %	9,8%

In the second survey round, the amount of 'I don't know' -answers in Finland is quite a lot higher than in India. When results between the two rounds are compared, we find that the percentage in Finland has increased between the two rounds and that the percentage in India is even lower than Finland in the first round. There was a similar amount of time elapsed from the agile adoption in Finland in the first round and India in the second. This could indicate that the amount of knowledge acquired during the 12 months between survey rounds in Finland lead to an increase in awareness of issues, or to some other reasons which lead to this result.

VI.   DISCUSSION

Based on the survey results, the main improvement areas identified in the first survey round were not given enough attention after conducting the survey. This was also admitted by the case organization because of reduced resources for the improvement efforts. This is one of the main reasons why the results in the Finland site appear lower in the second round.

However, the other main reason for the reduction in response averages in some statements is believed to be increased awareness on the topic of agile methods and possible issues related to them. The combined average result in all statements between Finland in round 1 and India in round 2 are similar. The amount of time that these two sites had been using the agile development methods before their first respective survey rounds was also similar.

The first important improvement suggestion for the case organization in the opinion of the researchers was to improve the resources currently utilized for change management and improvement efforts. The teams may need more support and resources for successful organizational transformation. This should include more support for continuous improvement activities and the follow up of these activities, since there were no definitive improvements that could be identified from the first assessment round.

The identified decrease in results should be taken seriously to see what kind of improvement actions could be taken. This should also include very active participation from all members of the development organization, since they will be most aware of the issues regarding their daily work. The practices and processes that do not work should be adapted according to the organization- or unit-specific preferences while remembering to include the agile principles and mindset.

Continuous improvement activities should have a strict process to follow, which includes communication to all interested stakeholders on the progress of the activities and a responsible individuals who have allocated time to conduct the activity. Many additional success factors can support the sustainability of improvement activities as well, which should be kept in mind when implementing changes [15].

The follow-up of the activities should also include a larger scale follow-up of the adoption of agile methods. Some forms of quantitative or qualitative measurements of the possible benefits of agile (in productivity, quality, etc.) should be measured and communicated in all units, including the sites that may take the agile methods into use in the future. This shows that the organization is committed to the changes and that the activities that are requested of the members of the organization have justifications behind them. There was already some evidence of doubt in the agile methods in the first survey round and these doubts should be addressed properly through discussion.

In addition to the assessment results changing with time elapsed between the organizational change and the assessment, the results of the survey also indicate bias in the results based on cultural differences. When assessing the success of multisite organizational changes, it should be noted that the results may vary between locations for reasons that may not be possible to affect with any change management processes. Therefore, it may be useful in some

cases to assess different global sites individually, instead of comparing the results of sites between each other.

VII. CONCLUSION

The results of this research can be used by researchers and practitioners when assessing organizational changes. Assessment results between geographically distributed sites may not always be directly comparable between each other. Cultural differences in results and the difference in elapsed time from the organizational change may also affect assessment results and should be noted when analyzing data.

It would also be beneficial to compare results of a similar assessment with a different scaling method, like e.g., the Likert-type scale. The scaling itself should not be a contributing factor in this study, but additional assessment cases with similar backgrounds could be used to validate the influence of the used survey scale.

The assessment process could be repeated in the case organization for a third time to analyze further progress of the organizational change. The findings of this assessment were used to focus future improvement efforts in the case organization and to provide feedback on how they understand their agile transformation so far. The results were presented to all participants through an open discussion session by the researchers and a written report was communicated openly inside the organization. The report was also brought into general knowledge by giving access to it within the organization.

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