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I. ABSTRACT

It is a common assumption that practicing Agile Project management methodologies will help in successful completion of projects achieving timely delivery and happy stakeholders. The problem is that organizations claim to be following Agile project management methodologies are unable to meet the criteria of practicing agile methodologies and hence fail to achieve the claimed success from agile project management. In this study, we have analyzed three different IT organizations that claim to practice Agile methodologies and studied the factors that are essential for practicing agile project management methodologies. After conducting a quantitative survey, it has been found out that there is a direct relationship between practicing Agile methodologies and self-organizing teams. The questionnaire survey used in this study serves as an evaluation tool that will help any organization [i.e. claiming to practice Agile methodologies] to answer the question that is they really are practicing the agile methodologies and fulfill its criteria. It will help an organization to identify their current standing and improvement areas to get the benefit of practicing Agile project management methodologies.

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II. LITERATURE REVIEW

Project Management is an essential part in Software development Organizations. According to survey VersionOne, Inc (2013), it was observed that many organizations practicing the Agile methodologies in project management, still face delays in schedules or compromise with quality in case of timely delivery. According to survey Scott W. Ambler (2010), failure is mainly due to:

- Agile team's lack of experience with agile methods.
- Agile team's lack of understanding the organizational strategies.

Professionals use Agile Project management to achieve customer satisfaction and to address the fast-changing requirements, as a common practice in project management. So rapid change management can be handled by the usage of Agile project management.

It is the assumption of the software industry that Agile project management ensures incremental and timely delivery of products, especially in case of software projects. But the most important principle of following Agile project management that is not understood is to build a motivated team that is well aware of Agile practices and methodologies. Agile project management ensures involvement of all stakeholders and regular feedbacks from the customer for complete the customer satisfaction. Agile methodologies require the communication among the team, management and customer should be open and effective (i.e it should be ensured that all information from customer is understood by the team and all feedbacks from customer are taken care of, during the product development).

So basically Agile project management requires self-organizing teams having technical excellence,

capable of providing best architectures, design and adaptable to frequently changing technologies to keep aligned with the competitive business requirements. According to our study in this paper effectiveness of agile project management depends on a highly capable and confident Team. Software Projects get delayed or are unable to meet the customer requirements even after using Agile methodologies is mainly due to the reason of not following all the principles of agile project management.

The success of agile project management methods depends on:

- Efficient and Effective team
- Rich communication among all stakeholders.

These two factors help in practicing the agile management processes effectively and help in contributing towards the successful agile software development projects in terms of cost, scope, time and quality as described by Tsun Chow and Dac-Buu Cao (2008).

The Effectiveness of Agile management processes is related to a highly capable team that can help the organization, in completing it projects on time with continuously changing requirements by the customer Ali Rezaeean and Parisa Falaki (2012). According to Ali Rezaeean and Parisa Falaki (2012), effective project management is a core factor that needs to align with organizational business strategy. In today's Business market it's very important to handle the fast-changing business requirement due to the competition as an external factor/constraint that every business needs to handle. To achieve effective Agile project management, one needs a highly capable Team with strong bonding cater these external constraints.

It requires six different roles to make the team self- organizing by practicing in agile project management processes Rashina Hoda (2011). As in Agile project management, it's necessary that:

- The project team understands the agile practices.
- Understand the customer requirements.
- Maintain effective communication with management
- Ensure that stakeholders are satisfied with the ongoing development.
- Ensure all risks hampering the agile project management processes are eliminated as soon as possible with the consent of senior management.

A different point of view is mentioned in M Eccles, J Smith, M Tanner, JP Van Belle and S Van der Watt (2010) about the Team Collocation for Agile project management but that's only true in case team is small. As negative impacts of collocation were identified as a part of M Eccles, J Smith, M Tanner, JP Van Belle and S Van der Watt (2010) research, which correlate Agile effectiveness with culture of the organization, or one may say the environment where a collocation team is working.

The Effectiveness of Agile methodologies is best evaluated where project management is done for Distributed software development (DSD). According to Fabio Q. B. da Silva1, Rafael Prikladnicki 2, A. Cesar C. França1, Cleviton V. F. Monteiro 1, Catarina Costa1 and Rodrigo Rocha1 (2011) Agile project management of DSD is more complex as compared to the collocated project management. As claimed in Fabio Q. B. da Silva1, Rafael Prikladnicki 2, A. Cesar C. França1, Cleviton V. F. Monteiro 1, Catarina Costa1 and Rodrigo Rocha1 (2011) that human factor is of greater importance in case of Distributed project management.

Agile effectiveness is highly dependent on the project management Team (H. Sharp and H. Robinson, 2004), (A. Cockburn and J. Highsmith, 2001). As analyzed studies of (Deepti Mishra and Alok Mishra, 2009) and (H. Sharp and H. Robinson, 2004) that usage of agile project management methodologies directly depends on the Team communication, collaboration and coordination. These factors are essential in achieving the success expected from agile project management and help in ensuring the quality and productivity.

So as discussed in above literature review, it is analyzed that Team Empowerment is the factor that makes agile methodologies effective in a project management. In our research we are going to measure the four cognitions namely meaning, competence, self-determination and impact, which define the team empowerment.

III. RESEARCH METHODOLOGY

In this research, IT organizations that claim to practice Agile project management will be selected, and then we are going to analyze that how empowered Agile practicing teams are, with respect to organization history of agile project management success and failure.

This research would help in identifying the factors that would help the agile practicing organizations in improving their team communication and collaboration concerning to get maximum benefit from agile based project management.

The four factors that will be measured are for identification of a self-organizing team are:

- *Meaning:* This factor determines that a team member's personal beliefs, values, and behaviors are aligned with the type of work assigned to him in organization.
- *Competence:* This factor determines that Team member of an Agile team, believes in successfully completing the challenges of work assigned based on his skills
- *Self-determination:* This factor determines the autonomy of a Team member in terms of adapting to change management related to work. Possessing the ability of decision making to maintain the pace of work without affecting the quality and alignment from organizational strategy
- *Impact:* This factor determines that team member possesses the personality to influence strategic, administrative or operating outcomes during agile project management.

The research questionnaire as given in Dail L Fields book is selected as a part of our study to perform a quantitative study that will serve as a tool to identify that how self-organized are the teams of an Organization, claiming to practice Agile project management. It's a validated tool for measuring the empowerment of employees as used by Menon (1999) to measure the abilities of employees, regarding capability of performing their tasks and alignment to employees behaviors, skills according to the organizational strategy.

In addition to the above measurement tool, we are going to add few more question in our questionnaire to Validate that the organization selected for our research are actually practicing the Agile project management methodologies and how close they are in terms of implementation of agile methodologies.

The questions given in Appendix A Table 1 are extracted from the survey by Scott W.Ambler (2010). These questions help in identifying that the organization claiming to be practicing Agile methodologies are actually following the principles of Agile methodologies. Questions in Appendix A Table 1 are designed based on the criteria of Agile project management as described in Scott W.Ambler (2010) Criteria for Agile Teams. Following is the details of how the designed questions will help in determining the degree an organization is agile in terms of project management.

- Questions 1 to 3 from Table 1 identifies the team give value to stakeholders and ensures stakeholder involvement right from the beginning of the Project management.
- Questions 4 identifies that regular testing procedures are being followed at every iteration of project management as identified by the Agile principles.
- Question 5 ensures that continuous customer / stakeholder feedback is acquired as an agile project management practice.
- Questions 6 and 7 identify that teams follow up with the progress and organize themselves

according to the needs of a project which refers to the self-organizing team criteria of Agile project management.

- Questions 8 to 10 identify that, are the teams continuously improving their work procedures from the lessons learnt, that refers to the criteria of continual improvement in agile project management.

For Questionnaire reliability we found that Cronbach's Alpha is 0.944 for 22 items using SPSS software.

3.1 Data Collection and Analysis

Having established on the basis of literature review that self-organizing team is compulsory requirement for any agile practicing team in case of software development organizations, we surveyed to find out the is it necessary for a team to be self-organizing to benefit from practicing Agile methodologies.

To conduct our survey, we selected three different organizations that have been practicing agile methodologies for software development. The respondents and organizations were informed before filling the questionnaire that during data gathering process their organization's name and personal identities will not be recorded.

3.2 Sample Size Calculations

Power and Precision was used to calculate sample size utilizing Fisher Z approximation methodology. For computation, it was assumed that the correlation in the population is 0.92. The Criterion for significance (alpha) was set at 0.050. The test was 2-tailed (an effect in either direction is interpreted). We found that study has the power of exceeding 99.9% to yield a statistically significant result, if the sample size is minimum 50. Based on these same parameters and assumptions we can expect to observe a correlation of 0.92 with precision (95.0% confidence level) of approximately plus/minus 0.05 points (Confidence interval of 0.86 to 0.95).

3.3 Data Collection

A total of 50 samples were collected using the questionnaire discussed in above section, also given in Appendix A. In our analysis we have calculated the reliability of 50 samples and performed Pearson correlation calculation to find out the overall relation of teams practicing agile methodologies concerning criteria that teams are self organizing teams.

3.4 Data Analysis

For Data Analysis SPSS tool was used. All 50 samples data was validated, and then we calculated mean and standard deviations which are in Table 1. We confirmed results using Factor Analysis.

Table 1: Descriptive Statistics (N=50 for Each Item)

Question Numbers	Mean	Std. Deviation
1	4.52	1.282
2	5.02	1.407
3	5.00	1.309
4	4.84	1.315
5	5.16	1.315
6	5.38	1.427
7	5.06	1.583
8	4.24	1.492
9	4.42	1.341
10	4.50	.931
11	5.48	1.266
12	5.34	1.099
13	5.40	1.069
14	5.68	1.133
15	5.50	1.093
16	5.20	.990
17	5.26	.803
18	5.16	1.017
19	5.18	.962
20	4.42	1.090
21	4.16	1.057
22	4.22	1.016

Overall items mean is 4.961 (minimum=4.160, maximum=5.680), items variance 1.436, inter-item covariance 0.622 and inter-item

correlations 0.439. Afterwards, Pearson Correlation calculations were carried out for all 50 samples which generated following results as given in Table 2 and Table 3. Q1 to Q22 in column/row refers to a serial number of questions from Appendix A. The numbers on Table are Cronbach's α **P<.01 (i.e., correlation is significant at the 0.01 level (2-tailed), *P<.05.

Table 2 represents the correlation of items (Q1- Q10) that represent the level at which Team is practicing Agile methodologies, with the items (Q11 – Q22) that represents the level of team called as Self-organizing team.

Similarly, Table 3 represents the inter-item correlation of Q11-Q22 which defines the teams, as self-organizing teams and here we find a correlation of four attributes of self-organizing teams (i.e. Meaning, Competence, Self-determination and Impact).

Table 2: Bi-Variate Pearson Correlations 1 (Test of Significance. 2 Tailed, N=50)

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
Q11	.283*	.533**	.480**	.501**	.591**	.564**	.566**	.186	.143	.225
Q12	.437**	.471**	.510**	.547**	.583**	.436**	.422**	.248	.123	.269
Q13	.411**	.510**	.569**	.555**	.636**	.487**	.432**	.335*	.194	.205
Q14	.482**	.772**	.757**	.718**	.720**	.758**	.489**	.445**	.332*	.368**
Q15	.466**	.724**	.642**	.653**	.625**	.740**	.395**	.375**	.299*	.431**
Q16	.512**	.510**	.425**	.480**	.367**	.480**	.175	.409**	.274	.266
Q17	.342*	.447**	.388**	.407**	.308*	.375**	.276	.253	.200	.286*
Q18	.420**	.682**	.705**	.614**	.453**	.576**	.336*	.310*	.309*	.280*
Q19	.402**	.525**	.567**	.588**	.428**	.440**	.194	.055	.067	.307*
Q20	.586**	.447**	.515**	.447**	.451**	.486**	.186	.351*	.226	.231
Q21	.435**	.314*	.354*	.268	.363**	.297*	.250	.532**	.369**	.228
Q22	.443**	.225	.353*	.317*	.386**	.293*	.144	.422**	.275	.313*

Table 3: Bi-Variate Pearson Correlations 2 (Test of Significance. 2 Tailed, N=50)

	Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20	Q21	Q22
Q11	1											
Q12	.702**	1										
Q13	.700**	.906**	1									
Q14	.622**	.679**	.664**	1								
Q15	.472**	.535**	.559**	.758**	1							
Q16	.264	.443**	.424**	.550**	.604**	1						
Q17	.156	.337*	.375**	.385**	.407**	.164	1					
Q18	.320*	.279*	.372**	.559**	.496**	.373**	.472**	1				
Q19	.330*	.443**	.444**	.559**	.476**	.390**	.572**	.679**	1			
Q20	.265	.304*	.396**	.541**	.489**	.431**	.479**	.490**	.491**	1		
Q21	.369**	.409**	.520**	.453**	.371**	.359*	.359*	.279*	.192	.685**	1	
Q22	.376**	.498**	.556**	.506**	.395**	.300*	.404**	.222	.293*	.726**	.841**	1

IV. DISCUSSIONS

Observation from the calculation of mean:

- It is evident from the overall mean of 4.961 that to practice Agile methodologies the teams have to become self-organizing team.
- In case the team is not self-organizing then it means it will not be able to practice Agile methodologies and get benefit out of it.
- Q8, Q9, Q20, Q21 and Q22 show minimums values of mean (i.e. 4.24, 4.42, 4.42, 4.16 and 4.22 respectively) out of all question items.
- It shows two major areas of concern about criteria of "continual process improvement" required for the agile project management and "attribute of Impact" that's required for self organizing team practicing agile project management.

Observation on Cronbach's alpha if Item deleted:

- Out of twenty-two, four items Q2, Q3, Q6 and Q14 if deleted, affects most on Cronbach's alpha reducing it to 0.938.
- This shows that in surveyed organizations giving value to the stakeholder and involving stakeholder in Agile project planning is the most important factor as measured by Q2 and Q3 (i.e., At the start of the project we identify our key stakeholder groups and their goals, We have regular discussions with key stakeholder groups to understand their goals throughout the project).
- As claimed in this study that the most important factor of self organizing team as measured via Q6 (i.e Each iteration/sprint we hold a planning meeting where the team determines who will do what, in that iteration) can also affect the Cronbach's alpha as evaluation of team progress and organizing the team according to project needs is also a criteria of Agile project management practices.
- Observation also show the requirement of self organizing team measured via Q14 (i.e. I am confident about my ability to do my job) is the most critical factor as if the team members do not possess the ability to do a job well then they cannot benefit from practicing Agile project management methodologies.

Observation from the Correlation calculations:

- Bi-variate statistics and Pearson correlations for most of the entries show the strong relationship and high confidence level. As evident from Table 3, all four dimensions measured in Q11 to Q22 are strongly correlated.
- As observed from Table 2 strong correlation is seen in variables (Q1 – Q10) that measure the level of Team in following Agile project management practices with the variables (Q11 to Q22) that measure if the Team is self organizing.
- If we closely study Table 2 it is observed that Q17 and Q19 (I have significant autonomy in determining how I do my job, I have considerable opportunity for independence and freedom in how I do my job.) does not show any strong correlation with Q7 to Q9 which means that in surveyed organizations attribute of self determinations needs to be focused on, with respect to the criteria of continual process of improvement.
- Comparison of respondents in groups of three Organizations surveyed:
- As mentioned above the three different organizations have been selected, and in this study, the organizations will be represented as Company A, Company B and Company C for the sake of confidentiality.

A comparative analysis for software development teams in three selected organizations is done, to better analyze the relation of practicing agile methodologies and self-organizing teams with variable team size and experience in practicing agile methodologies.

Following Table-4 shows the comparison of means for three organizations:

Table 4: Comparison of Means for Company A, B, and C

Questions	Mean Company-A	Mean Company-B	Mean Company-C
Q1	3.75	4.78	5.14
Q2	3.95	5.67	5.76
Q3	4.2	5.11	5.71
Q4	4.3	4.89	5.33
Q5	4.5	5.11	5.81
Q6	4.2	5.89	6.29
Q7	4.3	5.33	5.67
Q8	3.7	4.78	4.52
Q9	3.75	5.22	4.71
Q10	4.05	5	4.71
Q11	5	6	5.71
Q12	5.05	5.44	5.57
Q13	5.15	5.33	5.67
Q14	5.1	6	6.1
Q15	4.9	5.78	5.95
Q16	4.95	5.22	5.43
Q17	5.05	5.44	5.52
Q18	4.75	5.11	5.62
Q19	4.95	5.22	5.57
Q20	4	4.11	5
Q21	4.1	4.33	4.19
Q22	4.15	4.22	4.29

- From the comparison of means, it can be stated that the Team A from company A claiming to be following Agile management practices is not able to fulfill the agile project management criteria.
- When we compare Means of Company B and Company C, the means for Q1 to Q10 are observed to be greater than equal to 5 representing that these organizations are meeting the criteria of Agile project management.

To further investigate the relationship of meeting Agile project management criteria and attributes of Self-organizing teams we perform a comparison of Means from Q11 to Q22 for Company A, Company B, and Company C.

- From Table 4 it can be observed that Company A has a lower set of mean values in comparison to other two companies from Q1 to Q19 which proves that there is a direct relationship, in how one team practice Agile methodologies and the extent to which a team is self organizing.
- Company B, and C seems to have all significant attributes of Meaning, Competence, and Self-determination and they can perform well in practicing Agile methodologies whereas Company A does not fulfill the criteria of practicing Agile methodologies and their team does not possess the attributes of a self-organizing team that Company B and C have.
- An additional observation from Table-4 is that in all three cases the attribute of Impact is low having neutral response overall.

V. CONCLUSIONS

According to the analysis, it is concluded that there is a direct relationship between practicing

Agile methodologies and self-organizing teams. As discussed in literature review many authors have pointed out the importance of self-organizing teams for successful implementation of agile methodologies in project management. But no one has provided a tool that can help organization in measuring the level of practicing agile methodologies and building self organized teams, who can successfully implement agile methodologies in project management.

As evident from analysis of the data collected that although companies do claim to practice Agile methodologies but are unable to fulfill the criteria of agile project management.

This study will help the organizations evaluating their teams with respect to criteria defined for practicing the agile methodologies. It will also help the organization to determine that, are their teams self-organizing and posses the minimum attributes of self-organizing teams that in our study Company B and Company C posses.

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Appendix A

1-Very Strongly Disagree
2- Strongly Disagree
3- Disagree
4- Neutral
5- Agree
6- Strongly Agree
7- Very Strongly Agree

Table 5: How Agile you are?

SNo		1	2	3	4	5	6	7
Questions For measuring How Agile Organization is? According to Team under analysis								
1	We are producing working software every iteration/sprint during product development							
2	At the start of the project we identify our key stakeholder groups and their goals							
3	We have regular discussions with key stakeholder groups to understand their goals throughout the project							
4	We perform our own regression testing on a regular basis							
5	We demo the solution to stakeholders every iteration/sprint during product development							
6	Each iteration/sprint we hold a planning meeting where the team determines who will do what, in that iteration							
7	We hold daily stand-up meetings to coordinate our activities							
8	We hold a retrospective/reflection session at the end of each iteration/sprint to identify potential improvements for our team							
9	We measure and track our progress of adopting improvements to our process							
10	We are implementing improvements to the business process							

Table 6: Measuring Self Organizing Teams

SNo		1	2	3	4	5	6	7
Meaning Items								
11	The work I do is very important to me.							
12	My job activities are personally meaningful to me.							
13	The work I do is meaningful to me.							
Competence Items								
14	I am confident about my ability to do my job							
15	I am self-assured about my capabilities to perform my work activities.							
16	I have mastered the skills necessary for my job.							
Self-determination Items								
17	I have significant autonomy in determining how I do my job.							
18	I can decide on my own how to go about doing my work.							
19	I have considerable opportunity for independence and freedom in how I do my job.							
Impact Items								
20	My impact on what happens in my department is large.							
21	I have a great deal of control over what happens in my department							
22	I have significant influence over what happens in my department.							

APPENDIX B

Power and precision Report

Power for a test of the null hypothesis

One goal of the proposed study is to test the null hypothesis that the correlation in the population is 0.00. The criterion for significance (alpha) has been set at 0.050. The test is 2-tailed, which means that an effect in either direction will be interpreted.

With the proposed sample size of 50 the study will have power of exceeding 99.9% to yield a statistically significant result.

This computation assumes that the correlation in the population is 0.92. The observed value will be tested against a theoretical value (constant) of 0.00

This effect was selected as the smallest effect that would be important to detect, in the sense that any smaller effect would not be of clinical or substantive significance. It is also assumed that this effect size is reasonable, in the sense that an effect of this magnitude could be anticipated in this field of research.

Precision for estimating the effect size

A second goal of this study is to estimate the correlation in the population. Based on these same parameters and assumptions the study will enable us to report this value with a precision (95.0% confidence level) of approximately plus/minus 0.05 points.

For example, an observed correlation of 0.92 would be reported with a 95.0% confidence interval of 0.86 to 0.95.

The precision estimated here is the. Precision will vary as a function of the observed correlation (as well as sample size), and in any single study will be narrower or wider than this estimate.

Notes

Power computation: Fisher Z approximation (when null=0, exact formula is used)
Precision computation: Fisher Z approximation