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A Study on Agile XP Engineering Practices

S. Chandramouli
PH.D (PT) Research Scholar
Department of Management
Bharathiar University
Coimbatore, India

Dr. G. Rajesh Kumar
Assistant Professor
Department of Business Admin
Nandhanam Arts College (Autonomous)
Chennai, India

Abstract— In agile projects team development and employee development is given preference. Agile Coach and scrum masters continuously concentrate on these aspects (Chandramouli S & Dr.G Rajesh Kumar, 2014 a). Today's business, political and economic environment is very much dynamic, and customers are adapting their software requirements to adjust with these new environment. This research is the first step of an endeavour to embark on a comprehensive study of Agile XP method with specific focus on IT Industries. This study on XP engineering practices should also provide a record for future developers to get new ideas, methods to develop software and also helps to choose the right methodology. We used both quantitative and qualitative analysis to carry out this research.

Keywords— Agile, Agile methodologies, Software Development, XP Methodology

I. INTRODUCTION

Agile is a topic of growing importance and nowadays lot of customers wants their projects to be executed using agile methodologies due to its "Deliver value early" principle (DeMarco and Lister 1987). There has been a paradigm shift of project organization from local and regional scope into a global context involving several multi-stakeholders working under different geographic regions. Ives (2005) acknowledged the implementation of strategic change has been a business problem for decades and still is a problem. Competencies, Knowledge and Experience are different from each other (S.Chandramouli & Dr.G Rajesh Kumar, 2013, b). This paper is trying to understand Engineering practices that are helpful in executing Agile XP Projects.

II. RESEARCH OBJECTIVES

The Primary Objective of the study is to identify the engineering practices of Agile XP method with specific focus on IT industry in the current scenario. We are aiming to find at least Ten (10) XP engineering practices leading to the project success using the literature survey. The second objective of the study is to develop increased understanding of all the XP engineering practices, finding out relationship between them (Success Factors) leading to project success. To devise methodological recommendations for future research and design the work in the area of Agile XP methods.

III. AGILE METHODOLOGIES

Agility is the ability to both create and respond to change in a turbulent business environment and depends on the common sense. Common sense of the team is the primary driving factor of agile. In agile projects team development and employee development is given preference. Manage People related Risks and Issues proactively (SCRUM TEA Model). Agile is a philosophy that uses Organizational Models based on people, Collaboration and shared Values. (Source: PMI Agile Specification). In Agile we try to deliver things periodically throughout the life cycle of the project instead of one great big bang at the end (NORVIEW 863, 2011). A methodology is a study of a group of related methods for software development (Cronholm and Ågerfalk, 1999). Agile projects are driven completely by team who are self-organized and self-motivated. Thus, team and individual psychological factors plays a crucial role in the success of any agile project (Chandramouli S & Dr.G Rajesh Kumar 2014 e). Balancing the interaction among various stakeholders of agile projects like scrum masters, product owners, Team members and safe guarding each one's interest with others is a challenge (Chandramouli S & Dr.G Rajesh Kumar 2014 d).

IV. XP METHODOLOGY

Recognizing that people are individuals and respecting that is a key pillar upon which XP is built. These fundamental principles lead to a set of values that will form the basis of XP: good communication, simplicity, feedback, courage, and respect. Another important point is that the XP approach is evolving all the time as we learn from experience. However, it is possible to adapt XP successfully for this situation, and a number of companies have been very successful at doing so (Mike Holcombe, 2008). Customer Expectations on team members changes from one agile project to another depending on various agile methodologies chosen. For example: the customer expectation varies from Scrum methodology to Extreme programming (Chandramouli S & Dr.G Rajesh Kumar 2014 c).

V. PRINCIPAL COMPONENT ANALYSIS

Principal component analysis is appropriate when you have obtained measures on a number of observed variables and wish to develop a smaller number of artificial variables (called principal components) that will account for most of the variance in the observed variables. The principal components may then be used as predictor or criterion variables in subsequent analyses. Principal component analysis is a variable reduction procedure. The data analysis indicates the relationship between the original variables and the factors, so that we know how to make the substitutions. Principal components are frequently used to simplify a data set prior to conducting a multiple regression or discriminate analysis.

VI. SAMPLING METHOD AND SAMPLING SIZE

Our target populations are agile team members. The agile team members based out of Chennai managing projects at Chennai and also based out of other locations but managing the projects located at Chennai. Simple Random sampling is the purest form of probability sampling. Each member of the population has an equal chance of being selected. Random sampling was undertaken to select the participants for this survey (Wikipedia: Random Sampling). We also used stratified method for sampling, with care being taken to get responses from team members located in Chennai city and also based out of different locations within City. We also ensured the team members based out of other locations but working in the projects based out of Chennai taking part in this survey. In turn we also ensured the sample has proportionate gender mix (Male/Female). The sample size is an important feature of any study in which the goal is to make inferences about a population from a sample. Due to time constraints the sample size chosen is small and we are not able to cover the entire population and hence sampling was considered. Total of 234 people responded our surveys out of which 28 people's response were considered erroneous. A number of criteria were used to ensure the population of projects selected supported the research without unintended bias and the study population was chosen for the following reasons:

1. The population represented a wide range of project environments. This enabled the study to increase its potential applicability to other organizations and project types.
2. The population provided good variation in project size and complexity, necessary to investigate the moderation impact of project typology.
3. The population was large and should have helped minimize sampling variance of estimates

VII. FIELD WORK , SAMPLING AND LIMITATIONS

We made several trips to the companies to do the survey in person to avoid errors while filling up the form, in particular explaining the procedure. Responses were encouraged but voluntary. Out of 234 data sheet collected from the participants, Twenty Eight (28) numbers of sheets were not considered for analysis because of the errors in the data.

A. Limitations of the Study

Inferences are said to possess internal validity if a causal relation between two variables is properly demonstrated. (Wikipedia Internal Validity)

B. Confounding variables:

The study focused on a limited number of presumed variables (Engineering practices) which the literature suggested may significantly correlate to project success. There might also have been other confounding variables that masked or affected the correlation measurements.

C. Sampling bias

Non random samples are biased samples. This study sought voluntary responses of the entire study population and, therefore, might have been biased. For example, team members with unsuccessful projects might have been less inclined to participate.

D. Ambiguous Temporal Precedence

Ambiguous temporal precedence is the inability to discern timing of which variable comes before the other (Johnson & Christensen, 2004). An underlying assumption of this study was that engineering practices, as observed by stakeholders, precede project success outcomes. It is possible that project success distorts the perceptions of observers and may have caused positive engineering practices to be more readily reported in this study.

E. Study Assumptions

The following assumptions were made for this study:

1. Project Engineering Practices will influence the successful project outcomes.
2. Participants in the study will have a background in, and are familiar with the engineering practices because of their experience in handling projects.
3. Success factors in agile project outcomes are based on the available literature.

VIII. XP ENGINEERING PRACTICES ANALYSIS

Below table (Table 1) indicates the usage of XP engineering practices by XP projects as per survey conducted. 51.98 % of XP engineering projects follow XP engineering practices fully. 41.31 % of XP engineering projects follow XP engineering practices partially. 6.71 % of projects are not using XP engineering practices at all.

TABLE 1: XP ENGINEERING PRACTICES USAGE PERCENTAGE

1	XP Project using XP Engineering practices fully %	51.98
2	XP Project not using XP Engineering practices %	6.71
3	XP Project using XP Engineering practices partially %	41.31

Below table (Table 2) indicates the usage of XP engineering practices by XP projects as per survey conducted. Iteration of phases, Incremental development, and collective ownership gets the first three spot in terms of usage in XP projects.

TABLE 2 XP ENGINEERING PRACTICES USAGE ANALYSIS

XP Projects usage of XP Engineering Practices	Score	%
1-4 week iterations	104	6.16
Iteration of phases	117	6.93
Incremental development	116	6.87
40 hour week	93	5.51
User stories usage	102	6.04
Onsite Customer	101	5.98
Small releases	105	6.22
Simple design	104	6.16
Coding standards	101	5.98
Collective ownership	109	6.46
Metaphor	106	6.28
Refactoring	108	6.40
Continuous integration	105	6.22
Test first development	105	6.22
Pair programming	106	6.28
Planning game	106	6.28

Below table (Table 3) indicates the usage of non XP engineering practices by XP projects as per survey conducted. XP projects use most of other engineering practices uniformly. XP projects use most of FDD Engineering practices along with its own engineering practices. That indicates XP project engineering practices can be combined with FDD engineering practices for better results.

TABLE 3 USAGES OF NON-XP ENGINEERING PRACTICES BY XP PROJECTS

XP Projects using other methods' Engineering Practices	Score	%
FDD	820	20.10
ASD	1216	29.80
DSDM	1101	26.99
SCRUM	943	23.11

A. Adequacy of the Correlated Matrix of Scrum Analysis

TABLE 4 KMO ANALYSIS RESULTS

Determinant of the matrix	= -0.000043161708005
Bartlett's statistic	-1.$ (df = 120; P = 0.500000)
Kaiser-Meyer-Olkin (KMO) test	0.71395 (fair)

A value close to 1.00 indicates that patterns of correlation are relatively compact and so factor analysis should yield distinct and reliable factors (Field, 2005). However, literature recommends that the KMO value should be greater than 0.50 if the sample size is adequate (Child, 1990 and Field, 2005b). KMO measure of this study (Table 4) achieved a high value of 0.71395 suggesting the adequacy of the sample size for the factor analysis. The Bartlett‟s test of sphericity was also significant suggesting that the population was not an identity matrix.

B. Indices of Factor Simplicity of XP Analysis

TABLE 5 BENTLER'S SIMPLICITY INDEX

Bentler (1977) & Lorenzo-Seva (2003)	
Bentler's simplicity index (S) :	0.85903 (Percentile 97)
Loading simplicity index (LS) :	0.30239 (Percentile 94)

Bentler's simplicity index (Table 5) indicates perfect fit.(0 means no fit , 1 means perfect fit)

C. McDonald's Omega (Reliability Test) of XP Analysis

McDonald's Omega = 0.862386
The above data indicates that our data is reliable.

D. Sample Size Adequacy of XP Analysis

According to Pallant (2001), 2 main issues have to be considered in determining whether a data set is suitable for factor analysis: sample size and the strength of the relationship among the factors. In terms of sample size, Nunnaly (1978) recommends a 10 to 1 ratio; that is, "10 cases for each item to be factor analyzed". The minimum number for factor analysis suggested by Pallant (2001) is 150.

There were 16 variables in our survey, so according to Nunnalyys' recommendation (1978), 160 respondents should be obtained. Actually 206 respondents have been obtained in this study. The number was larger than 160. Therefore, the sample size was enough for factor analysis.

E. Associated Communalities (Reliability Test) of XP Analysis

After satisfying all the necessary tests of reliability of survey instrument, sample size adequacy and population matrix, the data was subjected to factor analysis using principal component analysis (PCA), with varimax rotation. Prior to principal component analysis, the communalities involved were first established. Communality explains the total amount an original variable shares with all other variables included in the analysis and is very useful in deciding which variables to finally extract.

TABLE 6 COMMUNALITY OF VARIABLES

Variable	Communality
1	0.820403
2	0.226714
3	0.183464
4	0.551457
5	0.882264
6	0.637818
7	0.666770
8	0.674529
9	0.976421
10	1.000104
11	0.889748
12	0.584313
13	0.994043
14	1.000104
15	0.892182
16	0.848671

Average Communality = 0.739313

The communality measures the percent of variance in a given variable explained by all the factors jointly and may be interpreted as the reliability of the indicator. The communalities of variables clearly indicate that the Components are acceptable

F. Rotated Loading Matrix of XP Analysis

TABLE 7 ROTATED LOADING MATRIXES

Variable	C1	C2	C3
V1	0.396	-0.335	0.807
V2			

V3			
V4	-0.613		
V5			0.327
V6		0.650	-0.345
V7	0.699		
V8		0.623	
V9	0.848		
V10	-0.763		0.424
V11			0.912
V12		0.663	
V13	-0.545		0.676
V14	-0.328		0.839
V15	0.735	0.462	
V16	-0.636		0.395

Above table (Table 7) indicates that all the variables are used uniformly across projects.

IX. Conclusions and Recommendations

The field of agile project execution is growing, and replication of this research to a larger sample is recommended to validate or refute these results to enhance statistical validity and testing. Investigate additional factors that may influence XP project success.

RECOMMENDATION 1: USE BEST PRACTICES OF FDD

XP projects use most of FDD Engineering practices along with its own engineering practices. That indicates XP project engineering practices can be combined with FDD engineering practices for better results.

RECOMMENDATION 2: TRAIN XP TEAM IN ENGINEERING PRACTICES AND IMPORTANCE

If people are motivated then they commit. If people are committed then they are motivated. Since all XP Engineering practices are important and is being used, we can create a training plan to all team members showcasing the importance of those which will help them to execute the projects better.

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