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Review of Agile Practices Using Factor Analysis Technique

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Abstract : In this paper we review agile methodologies which are used to improve the cost effectiveness and agile process improvement. The effectiveness and cost of product depends upon the requirement and methodology applied. To reduce the cost and increase the effectiveness we will use strong relationship between agile practices and based upon the correlation between these practices, factor analysis technique will be used which extracts the related methodology factors out of large number of agile practices. By doing this we are measuring the effectiveness of these agile practices and their positive and negative relationship among them then according to responses of organizational people we analyze the most widely used agile practices which helps to increase the effectiveness and success rate of these practices.

Keywords: Agile Methodologies, Agile Process Improvement, Agile Practices Extracted Factors, Factor Analysis.

1. INTRODUCTION

Agile software development is the process which uses a set of methods and techniques to deliver a software product to customers as per their requirement. To deliver a faster product with less cost and full of functionalities agile software model, agile software methodology or agile techniques are used to achieve this aim. To satisfy the need of customers agile process or agile software development helps to fulfill this.

With changing of environment and need of customers their requirements are also changing. So our old models and methodologies are not able to fulfill these new requirements and need of customers. Agile methodology is one of the latest technologies in software development which helps to achieve a goal of customer satisfaction and provide more flexible and productive software product.

There are many agile methodologies which are used to improve the cost effectiveness and agile process improvement. This improvement helps in this way that when numbers of agile practices or agile methodologies are used then to reduce the cost of requirement and time on developing a Software product by applying number of agile methodologies, we use selective and commonly agile practices by factor analysis technique. There are following more useful methodologies which are:

In **Extreme programming** methodology pair to pair communication is done between team members or developers. It means at least two team members must be together for implementation. It provides various values, practices and principles in order to complete a software project. That's why it's also called pair programming technique. Here one person is making a code and other is giving ideas and noticing any mistake¹.

Agile modeling is also collection of values, methods and principles which are applied on software development in a light weight and effective manner to solve the issues which are coming before addressing them in programming.

In **Scrum** methodology particular project and different roles are assigned like product owner, who is the voice of business or team. Other role is scrum master who manages all and focuses on team problems when they appear. This is done for the fulfillment of customer needs and requirement. Product is done in various phases and until one phase is not completely tested or developed, team does not move to next phase.

There are various agile practices in software development¹. Other important agile methodologies are like feature driven development (FDD), crystal methodologies and adaptive software development (ASD).

2. LITERATURE SURVEY

In this section we would be looking at various research papers with related work they have proposed.

1. Lists out the various agile methodologies which are commonly used and it describe the key points of customer requirements. To satisfy the customer need various methodologies are used while developing a software product. The methodologies which are described in this paper are extreme programming, agile modeling, scrum, feature driven development, crystal methodology and adaptive software development. By using these methodologies, author concluded that agile software product will be effective and it will give optimum results and fulfill the need of customers¹.
2. Describe the agile environment that agile main focusing among interaction between team members to share knowledge. Based on preliminary conceptual model author gives influencing factors like:
 - a) Organizational strategy
 - b) Communicational flow and channels
 - c) Inter-team knowledge sharing (KS) Effectiveness in agile environment.

Then based on influencing factors, they collected the data of 7 Brazilian agile software development organizations. Analysis of data done by statistic techniques that is:

- a) Structural equation modeling and
- b) Cross table analysis

According to author, the influencing factors have strong relationship between the agile companies and in between these also. First, the main focus of this paper is to find the characteristics of organizational strategy and communication flow. Second is to find the influence of these agile factors on inter-teamsharing knowledge effectiveness. Then they do research by taking a sample and population parameter.

Sample and population category: They take a sample as choosing those Brazilian agile communities, those had a work experience in agile of at least two years and who attends the lectures and organizational events. By this survey they collected 57 respondents from 7 Brazilian agile communities².

Then they make a research sample table of the people of those who had experience of less than 2 years or greater than 4 years. The following data shows the brief idea.

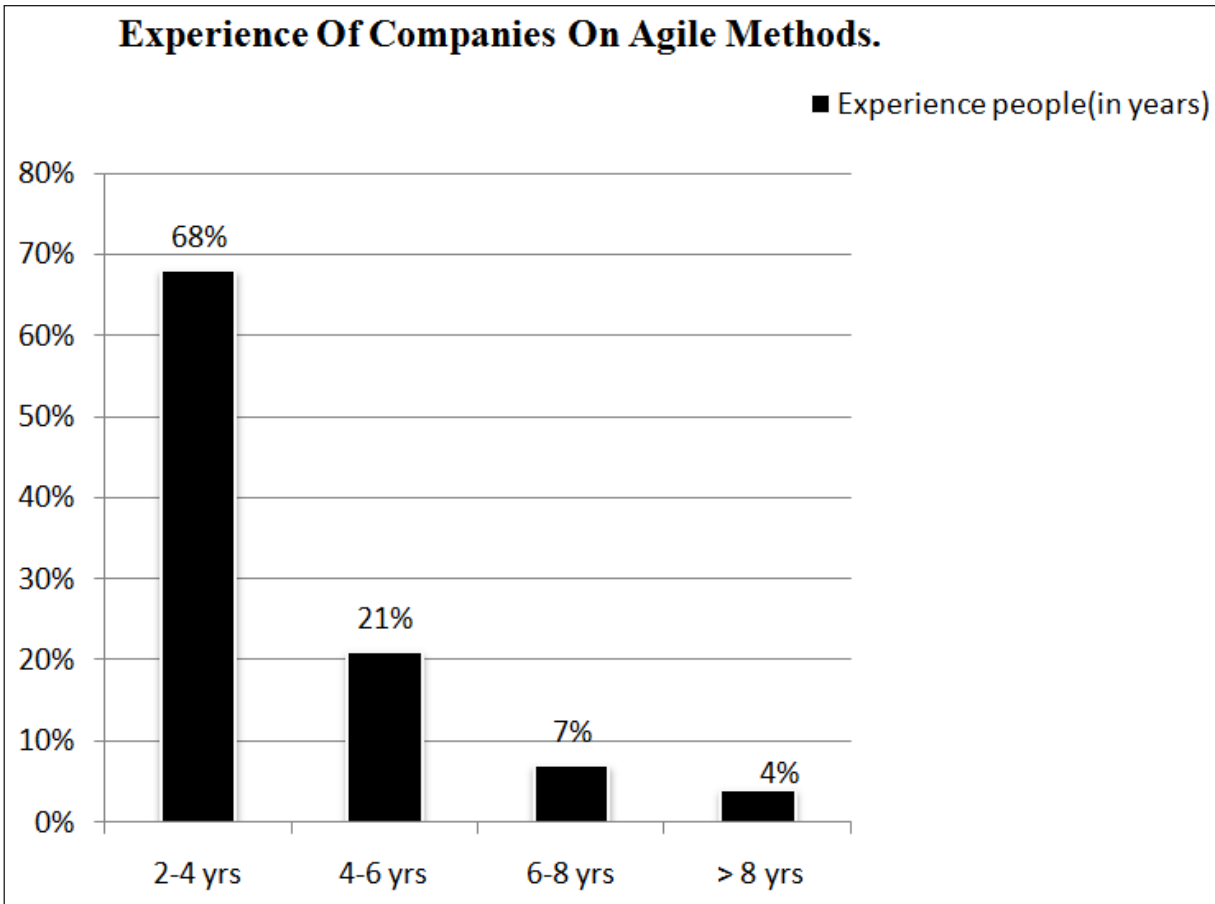


Figure 1: Experiences of People on Agile Methods²

After applying and choosing from sample further two processes are applied that are:

- a) Data Collection
- b) Data Analysis

Then **Structural Equation Modeling** technique is applied on the data. In this, covariance relationship is found with dependent and independent variables and give the condition that the index of variance must be greater or equal than 0.5. After applying structural equation modeling second technique is applied that is **Cross Table Analysis**. In this, Pearson's Chi-square values are calculated for finding the association between the influencing factors and experience agile methods.

Then at the conclusion author identifies the main relationship between communication flows, organizational strategy at the moderate level with respect to knowledge sharing effectiveness.

3. Describe about the agile motives and agile practices. According to this paper research based on survey data that was collected and according to result they found three agile motives which are:
 - a) Increase the efficiency
 - b) Increase quality and
 - c) Increase the software quality.

These agile motives for agile adoption are associated with different configuration of project management which is also focused on agile practices of software development. Further this paper describes that in an organization minimum 20% projects used at least two agile practices for development³.

2.1. Applied Approach

The research approach of this paper describes that how the survey data which are collected by author from the agile organization and agile developers is helpful for finding out the patterns and relationships between the agile practices.

2.1.1. Selection of data

The collected survey data is selected on the basis of various parameters and then according to survey response the final result is found. Author selected the data parameters which are:

The initial data set when provide with 6060 responses, many of them were incomplete then they dropped some of them and collected 5353 remaining response.

The second thing they did, they screened all the responses and considered only those who indicate that their organization had utilized at least one agile practices or agile methodology for six months.

Then third thing they apply that they remove all respondents who had very little knowledge about agile methods or agile practices and also who indicated that they had very less personal experience for less than six months in agile practices.³

Based on these selected parameters at the last, author collected 2304 respondents those were knowledgeable in agile methods and agile practices.

2.1.2. Characteristics of Sample

After selection of data, author describes the sample table on the department wise that indicates approximately how many agile experiences are in organizations department.

Table 1
Sample Department Breakdown Table³

<i>Department</i>	<i>Frequency</i>	<i>% age</i>
Software Development	1379	59.9
IT/Support	606	26.3
Services	95	4.1
Sales/Marketing	48	2.1
Other/Missing	176	7.6

Then further author applies analysis technique in which correlation matrix has formed and on the basis of this, found the relationship between these agile adoption factors with the agile practices which were found with the help of survey data collection.

Describe test driven development of relational database is used in which developers express and implement the detailed design iteratively one test case at a time. Test driven development is also called test driven design methodology and it combines with new factors of test driven whereas developers make a small code and do a small changes to improve the code without change their actual method or function. When agile developers are decide to use the test driven methodology they first confirm that the new feature which we are going to add is the easiest or possible way in feature point or not.

Test driven development methodology extends in databases and used various techniques and steps which are following:

1. **Database Regression Testing :** In this, we regularly database check and validate new features. If any case database schema has changed then test and validate database interface and database it. Then further testing is applied:
 - a) Interface testing
 - b) Internal testing
2. **Database Refactoring :** In database refactoring we do small changes and add new feature to improve the code design without changing their actual meaning or function.
3. **Continuous Database Integration :** In this integration developers are simultaneously integrated the own database instance including functional and informational change.

If any case anyone changes the databases then all developers have to download the new data from the automated system.
4. **Adopting Test Driven Development :** In test driven development this is the last step in which overall integration done of all the development process. Then author conclude that instead of using test driven methodology in coding or testing we can extend this agile methodology in databases by using these techniques⁴.

Describe the ERP (Enterprise resource planning) system that integrates and systematizes the company business process. It defines the problem that many large number of ERP implementations are not fulfill or make the implementation over the time and budget. But implementation of any large enterprise is most important factor in any business and organization. So author introduces the two main approaches which are:

1. Agile implementation approach and
2. Big bang approach.

Then differentiate has been done between these approaches and author uses a one new hybrid approach to remove the disadvantage like instead of using huge number of resources, cost and risk of these approaches, hybrid approach defines ERP dependency diagram to show the input and output of each module⁵.

Used the factor analysis technique and generate clusters of agile practices or agile methodologies. Author uses 58 different agile methodologies and then factor analysis technique has applied on set of data. Analysis extracts 15 factors which are related with agile practices. These practices are used for the agile process improvement. Then further in analysis correlations between the extracted factors were calculated⁶. According to co-relationship, positive and negative relationships of agile practices are measured and also determined the high or low success rate between them.

3. EXISTING METHODOLOGY

According to author⁶ the factor analysis technique has been used and it extracts the data from the existing “Agile Adoption Survey 2007” and did the analysis on agile process improvement effectiveness. The survey data is available for the all users and also it gives the 781 responses from the different organizational developers. They choose the existing survey response because this data collected the information of agile projects and effectiveness of agile practices. Analysis on adoption survey has done based on 58 different agile practices and categorized in to five categories.

1. Development.
2. Work product.
3. Testing and quality practices.
4. Modeling and documentation practices.
5. Management and organizational practices.

3.1. Applied Factor Analysis

After divided the categories of agile practices the huge data has been collected from the survey and to reduce the set of data in more convenient size the factor analysis technique has been used. This analysis reduces the 58 agile practices into set of related factors by explaining the small explanatory concepts by finding maximum amount of collective variance of co relation matrix.

3.2. Initial Considerations Taken

The factor analysis they had applied on the basis of taking some initial considerations parameter. The following considerations were taken:

Sample Size : The software reliability of factor analysis depends upon the sample size. They had suggested having sample of 5-10 participants per variable up to 300 cases provides the stable factor solution.

Data Screening : Data screening done before running the analysis to eliminate the variables on the basis of co relate procedure to create a co relational matrix of all the variables. The elimination done on the matrix basis that does not correlate with other variable and that co relate with some variable.

Factor Extraction : After the data screening factor extraction has been done. SPSS tool extracts the 15 factors. The extracted factor can be seen in component matrix which is given by factor extraction consideration process. Matrix contains the loading of each factor onto each variable which is also depends upon the correlation of variable to the factor.

Factor Rotation : Factor rotation is one of the parameter to improve the interpretability of factors. Rotation maximizes the loading of extracted factors and minimizes the other factors. By doing this process, it clears that which variables are related with which factors. There are two types of rotations; one is orthogonal rotation and oblique rotation. Rotation type applied on the basis of dependent and independent variable.

Oblique rotation has two matrices: the pattern matrix and structure matrix. The pattern matrix contains those factors which are loading and calculated before rotation.

For example the practices that load highly only on 15 factor are:

1. Iterative development
2. Incremental delivery
3. Agile quality assurance practices
4. Continuous code integration
5. Test driven development

There are some practices which are related to more than one factor.

Factor Scores: The last factor analysis parameter is to calculate the factor scores. This is the most important another way of output in factor analysis. A factor is represented as measured variable. By this it can be easily estimated the person's scores on the factor basis and can carry out the future analysis ⁶.

4. CONCLUSION

The research basically introduces the agile practices and extracting few factors as compare to the previous proposed work. To reduce the cost and increase the effectiveness we have to use most importantly strong relationship agile practices. By applying the factor analysis technique; we extract the related methodology factors out of large number of agile practices and measure the effectiveness of these agile practices and their positive and negative relationship among them. We will analyze this by taking responses of organizational people which helps to increase the effectiveness and success rate of these practices.

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