Scrum based scaling using agile method to test software projects and its future solutions using artificial neural networks

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ABSTRACT: Nowadays the software development steps are evident and unavoidable in developing software projects. Every day software demands have been growing in this field, provides new innovative ideas and support to incorporate the customer needs in software development. In this paper Agile methods with scalability have been focused which are very important to pre-planning software development process and business cost estimation. It has not provided an optimal solution to all projects in past history. So, in this paper, scrum procedure is applied which is based on Agile methods with scalability projects, and are estimated by some of the criteria such as function point, use case point, object point, and storyboard points based effort estimation parameters similar to the waterfall model, spiral model, and rapid development model. But none of them gives an accurate result. The main reason for most of the projects failure is because of inaccurate estimation. So scrum-based agile method with extended version providing reasonable accurate result in developed software projects is considered which is estimated using various metrics. Scrum procedure with Agile method is used on different projects. It is constructed based on an agile framework. Its categories are estimated in the machine learning procedure, whose results are meted based on different types such as small projects, medium projects, and large projects which are estimated in extended versions of scrum based Agile methods. They construe 70% of software based on agile methods. Its estimation results are justified in the machine learning processes such as Bayesian regression using back propagation neural network.

Keywords: Artificial neural networks, Agile, scrum, DAD, SAFE, LeSS, RDSF

I. ONLINE RETAILING SCENARIO

Software development and estimation are very important to the business case of constructing software [1]. They measure the estimation on several members involved for constructing a project, in which team size and time required are important for completing projects within target schedule. In 70% of software, project industries the conventional process models are followed such as an Agile method [2]. Agile is a software product development model organization, which organized a small project and completed within time. It is used to model software projects. It has emerged as a big challenging issue in handling large size projects. Additionally, Agile master meets out, major issues in constructing a very large scale of software and it is difficult to complete in very less time. So scrum-based agile model provides a smart solution to the problem. [3]Scrum-based agile methods are the most popular and modern for the present time. And it is a light-weight framework. It is used it for the small size projects with less team size. There are many software companies that use scrum-based agile methods.

Scrum roles [3]: Scrum has three important roles which are team, scrum master, and product owner. The team comprises developer and tester, who produce codes and test it. The result of a team is stored in several sprints based on the agile method [4]. The sprint information is checked whether or not cohesions are together. The scrum master takes full responsibility for the software development process. It aims to run and organize the various software development processes which interact between the software developer and customer, give several backlogs in which the scrum master takes decision by using certain backlogs for constructing software. [5] Meta scrum became the primary active method. While many agile methods are familiar with team practices, the specific procedure is most important. Considering these factors to team members, the business case approval provides a decisive endorsement on the budget plan or by contacting the related vendors. Scrum is a well-known technology and is a dynamic method. The scrum based scaling using Agile method's rules are defined by its coalition and includes the minimum practices, the product owner, the scrum master, and the cross-function group.

Figure 1 Agile model for software development practices[6]

Figure 1 shows the interaction between the product owner and product master, the product owner gives several backlogs, product master selects specific backlog for project development. The backlogs are categorized based on time. It
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is analysed by the scrum master. This process is iterative to construct a project in software development. Figure 2 shows the several roles of DAD which is of two types such as a primary role and supporting roles. Primary roles are managed by scrum-based agile method for constructing software projects which include stakeholder i.e., an actor of development and team lead, product owner, team member, and architecture owner. When Agile meets scalable projects, then it does not provide a solution. Hence scrum based Agile method gives a solution. The supporting roles are specialist, independent tester, domain expert, technical expert, and integrator.

Figure 2. The roles of Disciplined Agile Delivery[7]

Figure 3 shows the hybrid model of Agile methods such as Scrum, Extreme Programming (XP), Kanban, Agile Modeling, Cynefin, safe, Agile Data, devops, Lean Software Development, Unified Process, Traditional Software Development and so on.

Figure 3. DAD is a hybrid model[7]

Large scale projects are developed by using a scrum-based agile method which provides a result. But it is not recommended for a future based software project. So in our proposed work, the results of scrum based agile method are compared with a neural network, which include four scalable methods of Agile whose results are trained and tested in neural networks. Neural networks are predictive and prescribed algorithms are used for analysing scrum based Agile method. The results are tested to predict the outcomes with minimal errors.

The Artificial Neural Network (ANN) does not contain algorithms for the input, processing, and output generation [8]. It acts as a human brain neural network form, which is used to make a prompt decision. So, using ANN, the database is trained. ANN is evaluated using a sample output from sample data. ANN networks make decisions based on training data, without any use of the mathematical model. Most nerves can be attached into either a single layer or one or more layers on a particular network. First, a layer of neurons is considered

A layer of Neurons : first layer neural network with S neurons and R input edges are shown in Figure 4.
The row indices in the matrix W represents the terminal neuron of weight $w_{s,l,R}$, and the column indices represent the input of weights $w_{s,1}$. Therefore from the row indices in $w_{1,2}$, the strength of the signal from the input of the second element to the first neuron is $w_{1,2}$.

The S neuron R input one-layer network is shown in Figure 5.

$$W = \begin{bmatrix} w_{1,1} & w_{1,2} & \ldots & w_{1,R} \\
 w_{2,1} & w_{2,2} & \ldots & w_{2,R} \\
 w_{s,1} & w_{s,2} & \ldots & w_{s,R} \end{bmatrix}$$ (1)

Inputs and Layers: The weighted matrices connected to inputs are called input weights, and the weighted matrices one resulting from the output layer are called layer weights. To identify the source and destination, subscripts are used for different weights and elements of the network. To describe this, the multiple networks with one layer are redrawn in abbreviated. Form as shown in Figure 6.

Table 1: Scrum based scaling using Agile methods are characterized by its sample resources

<table>
<thead>
<tr>
<th>Factor</th>
<th>DAD</th>
<th>Less</th>
<th>Safe</th>
<th>RDSF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Well defined</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Simple</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Books</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Web portal</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Results</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Measurable</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Consultants</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Training and certified</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Popularity</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Tools</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Fortune 500</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>International</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Lean-kanban</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Government</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Disciplined Agile Delivery (DAD): It is helpful in filling the gap by extending the scrum production lifecycle to deal with the entire distribution lifecycle, with the techniques to handle the game from the other Agile methods, including Lean and Kanban [7].
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As a result, DAD is a hybrid system. It is extends the scrum lifecycle incorporating many strategies from several techniques such as Agile Modeling (AM), Unified Process (UP), Extreme Programming (XP), Lean, Kanban, Agile Data (AD) And other techniques. In addition, Ambler (2012) shows that the focus on DAD is to deal with the task lifecycle from the point when the program (inception phase), the construction of the releasing solution to production (transition phase).

Figure 3. The six DAD lifecycles [7]

Figure 3 shows the lifecycles of DAD which consists of six models such as Agile, Continuous delivery, exploratory, lean, continuous delivery of lean, and program. If any new kind of software can be found then the six types of lifecycles followed.

Figure 4. DAD high-level view lifecycle[7]

Figure 4 shows the high level of DAD lifecycle which consists of 6 phases such as concept, inception, construction, transition, production and retire. Six phases is divided into two stages likes delivery stages and devOps stages.

III. MATERIALS AND METHODS OF SCRUM BASED SCALING USING AGILE METHODS

Scrum groups encourage self-management between groups, create flexible software and provide flexibility to meet growing business requirements. It provides regular customer feedback with standard time stamp, self-organized teams, and working software. Scrum based scaling using Agile process has protocols, which require minimal understanding of the principles and mechanisms of agile structures. Long term deployment in specific processes is difficult to change new technologies. Useful collaboration with developers at all levels is needed to resolve the problem. The Agile method is used to work on the project to provide a product based on project requirements, considering a plan to get feedback on the project. Figure 5 shows architecture of Scrum based scaling using Agile method with the neural network. It is used to determine which criteria is to be followed depending on the questionnaire received from developers.

The Agile system contains the following principles: Meeting customer requirements in fulfilling software needs. Customer requirements will be implemented in the project even at the last stage of the project. Software occasionally gets feedbacks from the end user. During the development of the project, developers and business people should work together. Software developed by experienced programmers have provided individuals with the support to implement this plan. The communications team should share their information. Development progress is evaluated through working software. Agile architecture helps to develop sustainable growth in sponsors, users, and developers. Good design and technical skill increases agility. Self-organizing teams form designs, requirements and structures. Simplicity is reduction of work but not completed work. Team performance is constantly reviewed to increase performance. Scrum is a framework for cooperation in a team that complements complex products. The scrum configuration is easy to implement, but its function is hard to master teams. Scrum promotes teamwork based product management. Scrum is a spinning mechanism to reduce responsibilities and achieve a defined goal. Scrum is a part of an Agile system that enables an active system to prompt product development. Scrum is received from game rugby screw which requires the alignment of the specified roles of players. Scrum method starts with known sources and improves product development and offers very useful changes in short intervals. Many software product management tools are Agile active policies in product development.
Challenging tasks are involved in meeting the risk management and maintenance product management requirements of the active roles in the company. Thus the analysis of Agile methods and project management process is done in the software product development environment distributed to smaller and larger companies.

The **major objective of scaling factors**: This paper is that Agile method did not support the scalability. So it scrum based agile development has come up with four types such as Scaled Agile Framework (safe), Large Scale Scrum (less) Disciplined Agile Delivery (DAD), and Risk Driven Scaled Framework (RDSF). Many companies deal with both types of projects like small and large. We have tested these projects using Agile practices. The Agile test is done by team members in organization. There are many problems that can be caused by the scaling. If this kind of problem comes from the expanding pilot programs. When the large scaled projects practices is easy, this working between the agile teams. Some time problems creates by the agile time work when different teams using different methods interface follows different group of teams. Extended agile practices come from other organization. Agile contains the most important issues in designing and training the team member and head, the head have their problem to assign role of their post and in offering responsibilities to, the team head and team member. They have some expectations on their post. We need to use agile methods for our research domains like DAD, Less, safe, and RDSF. They have one of these two embraces particular framework and selective practices. We have proposed selective practices as presented here. The software development lifecycle is based on two different practices such as waterfall methods and agile practices.

**Agile scaling frameworks**: The software development lifecycle has been changed to the agile approach. It is adopted from scrum based agile method using for specific practices. It had not received a significant guidance for larger projects based organization. It provides specific practices. The most important consideration is the team level practices such as budgeting, front end, project on boarding and business case approaches. Agile methods provide specific practices to team level such as budgeting, front end, business case approach, and project on boarding. Agile with scrum practices are used in the industry. They have two types: Scrum alliance and scrum specifics. Scrum alliance has three roles such as product owner, scrum master and cross functional team. In each of these team has four artifacts like sprint backlog, product owner, scrum master and cross functional team. Extended agile practices comes from different teams using different methods interface follows different group of teams. Extended agile practices come from other organization. Agile contains the most important issues in designing and training the team member and head, the head have their problem to assign role of their post and in offering responsibilities to, the team head and team member. They have some expectations on their post. We need to use agile methods for our research domains like DAD, Less, safe, and RDSF. They have one of these two embraces particular framework and selective practices.

**IV. RESULTS AND DISCUSSION**

Scrum based scaling using Agile methods consider four types of scaling using development processes such as Scaled Agile Framework (safe), Large Scale Scrum (less), Disciplined Agile Delivery (DAD), and RDSF. Many companies deal with both types of projects like small and large. We have tested these projects using Scrum based scaling using Agile practices. We have prepared a questionnaire based on size of the project which is shown in Figure 6.
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summarization of the results from this questionnaire, to give input the Neural Network with Bayesian regression using back propagation for large, medium and small projects which results shown in figure 7, figure 8, figure 9 and figure 10. Backpropagation equation (2), it is fast matrix based solution is identified, which contain weighted matrix W and b number of biases by applying equal distance in Bayesian regression

$$J(W,b) = \left[ \frac{1}{m} \sum_{i=1}^{m} J(W,b;x^{(i)},y^{(i)}) \right] + \frac{\lambda}{2} \sum_{l=1}^{n} \sum_{i=1}^{s_{l}} \left( w_{lij}^{(l)} \right)^2$$

$$= \left[ \frac{1}{m} \sum_{i=1}^{m} \left( \frac{1}{2} \| h_{W,b}(x^{(i)}) - y^{(i)} \|_2^2 \right) \right] + \frac{\lambda}{2} \sum_{l=1}^{n} \sum_{i=1}^{s_{l}} \left( w_{lij}^{(l)} \right)^2$$

(2)

Neural Network Learning in equation (3)

$$J = \left[ \frac{\partial F(x_1,w)}{\partial w_1}, \ldots, \frac{\partial F(x_1,w)}{\partial w_W}, \ldots, \frac{\partial F(x_N,w)}{\partial w_1}, \ldots, \frac{\partial F(x_N,w)}{\partial w_W} \right]$$

(3)

Understanding the data in equation (4)

$$E(W) = \frac{1}{2} \sum_{p} \sum_{k} \left( y_k^{(p)} - F_k(x^{(p)};W) \right)^2 + \frac{\lambda_1}{2} \sum_{i,j} W_{ij}^2 + \frac{\lambda_2}{2} \sum_{i,j} W_{ij}^2(W_{ij} - 1)^2(W_{ij} + 1)^2$$

Figure 7: (a) SAFe- Large vs Small projects best fit curve of Bayesian regularization using backpropagation model. (b) LeSS - medium vs small projects best fit curve of Bayesian regularization using backpropagation model. (c) DAD agile frame work for large vs medium project best fit curve with Levenberg-Marquardt neural network

Figure 8: (a) Training performance of Bayesian regularization using using backpropagation algorithm for SAFE (large vs small projects). (b) Training performance of Bayesian regularization using backpropagation algorithm for LESS (medium vs small projects). (c) Training performance of BFGS quasi-Newton back propagation algorithm for DAD (Large vs medium projects)
Figure 9: Bayesian regularization using backpropagation network performance analysis for safe method (Large vs Small) projects.

Figure 10: Bayesian regularization using backpropagation network performance analysis for less method (Medium vs Small projects).

Figure 11: Levenberg-Marquardt neural network performance analysis for DAD method (Large vs Medium projects).

VII. CONCLUSION

Software development organization has important roles for selecting best practices in software project. The organization give their requirements in various sizes and various types. But Software manager does not apply common rules to all. The Software manager takes decisions based on cost and time. The performance of agile methods is more suitable nowadays. Water Fall model as traditional project management practices has some shortcomings. To overcome the same agile methods are introduced. Each Software development model has its own policy, operations and work flow. Every Agile method has its types, size and development.
group of expertise based on the projects handled by its own ability. The agile algorithm's performance is assessed to select based on responses to select among SAFe, LeSS, DAD and RDSF based on questionnaire. It is tested in Artificial neural networks with Bayesian regression using back propagation. The different size of the projects like large and medium, large and small, medium and small projects are considered and performance is evaluated. The neural network along with to verify the results the performance review model and multiple regression model to verify the results.

REFERENCES