Scrum based scaling using agile method to test software projects and its future solutions using in 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 has 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 issuein 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 popularm and modern for the present time. And it is a light-weight framework. It is used it for the small size projectswith 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 organizethe various software development processes,which interact between the software developer and customer, give several backlogs in which the scrum master takes decision by usingcertain 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

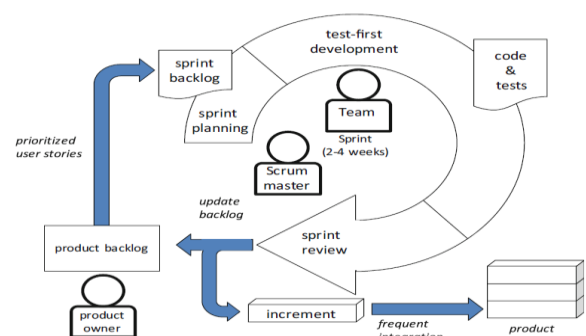S.Hariharan is with the Research Scholar, Saveetha University, Department of CSE, Chennai, Tamilnadu, India

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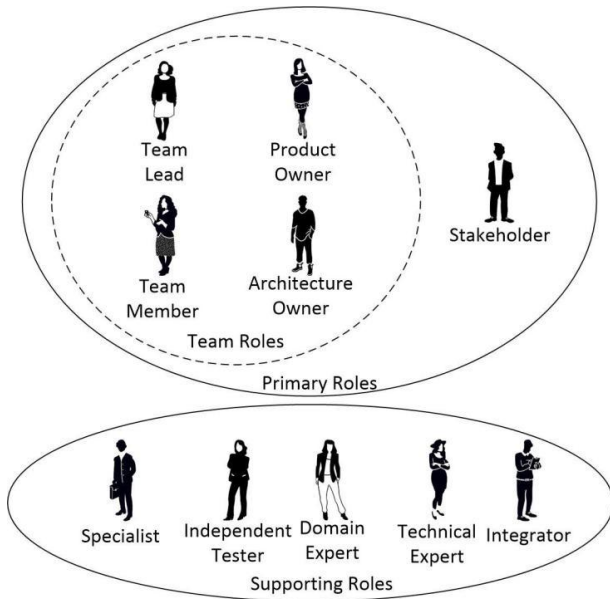
Figure 2. The roles of Disciplined Agile Delivery[7]

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.
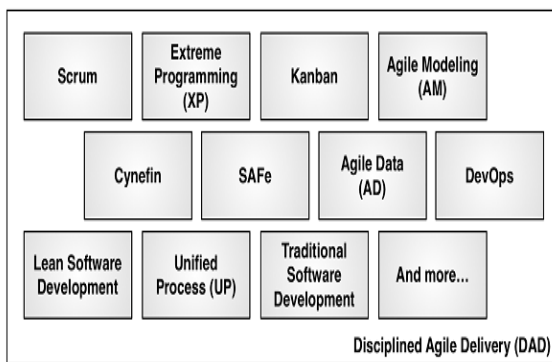

Figure3. DAD is a hybrid model[7]

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.

$$a = f(Wp + b)$$
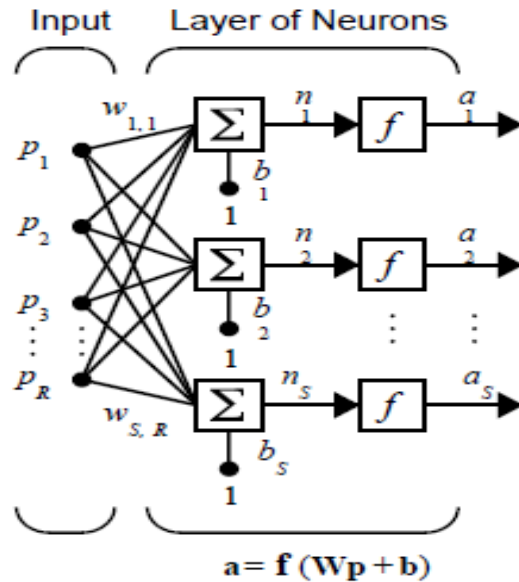
Figure 4 multiple input neurons and multiple output neurons

Where S denotes number of layers involved in ANN and R denotes number of input vectors used in ANN.

Each perceptron connection is called as an edge which is assigned the input vector p from the first layer network called perceptron, and we use the mathematical notation that is attached to the neurons of each of the layers. The weighted of Matrix W,output of its layer and flexible inputs are used to create n (i). The Selement collect the total input vector n. Finally, the outputs of neurons form a linear vector. A layer is not limited to have the number of its inputs same as the number of output neurons. A single layer of neurons can be formed by using different transfer functions by putting two networks in parallel. Both the two networks contain the same inputs, and each network could generate any of the outputs.

A neural network layer is divided into three sections, the first section has an input layer member, the output sectionis made up of, the neurons. Combine two networks with different transition functions using a single layer can be created with neurons. Both are the same inputs that have two networks, and publish which can create each network. The elements of the input are passed into the network through the weighted matrix W.

$$W = \begin{vmatrix} w1,1 & w1,2 \ldots & w1,R \\ w2,1 & w2,2 \ldots & w2,R \\ ws,1 & ws,2 \ldots & ws,R \end{vmatrix} \qquad (1)$$

The row indices in the matrix W represents the terminal neuron of weight Ws,R, and the column indices represent the input of weight ws,R. Therefore from the row indices in w1, 2, the strength of the signal from the input of the second element to the first neuron is w1, 2.
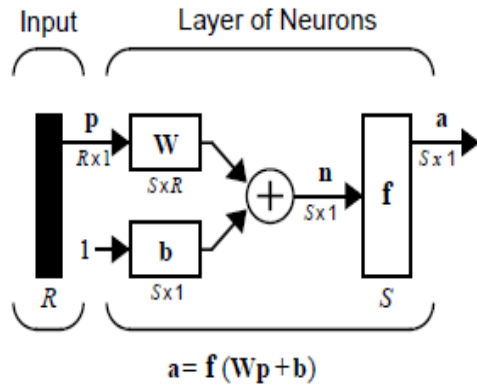The S neuron R input one-layer network is shown in Figure 5.

$$a = f(Wp + b)$$

Figure 5 Multiple neurons with input.

Where R is the input vector's elements and S is the number of neurons in a layer. In the above one-layer network p is an input vector with length R, weighted matrix W and a and b are S length vectors, and W is an sxr matrix

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.
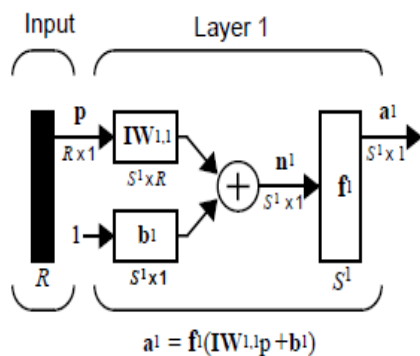

$$a^1 = f^1(IW^{1.1}p + b^1)$$

Figure 6 Single layer multiple neuron

Where R is the input vector's elements and S is the number of neurons in the layer.
From the one-layer with multiple networks shown above, the weighted matrix to the input vector p is labelled as an Input Weighted matrix (IW1,1) with a source 1 and destination 1. Also the elements of layer one such as its total input, bias and output are having a subscript 1 to show that they belong to the first layer. Section 2shown related work of scrum based scaling using Agile methods. Section 3 presents the methods and methodology of scrum based scaling using Agile methods. Finally, Section 4 shows results and discussions of scaling using Agile methods and finally we conclude our work on scrum based scaling using Agile methods.

II. RELATED WORK

Agile is a well organized formal project management, which consists of several procedures such as frequent inspection and adaptation based engineering practices [9]. Agile method has several advantages. It provides full satisfaction to customers, done by project management. It provides away for interaction among process tools, developer, tester, and customer [10]. Developer and tester should contact each other, they must interact with their project through their own communication tools or group counselling. The software development organization aims to complete software projects in time. Face to face communication is very important in agile development process. Customer and developer must meet every day and analyse their needs daily. Software product must be flexible and support varying circumstances. There are some shortfalls in the agile methods: it is hard to estimate when a large scale software is produced. It does not give importance to the necessity for design and development documentation [11]. The client's representative follows a clear policy of their will and final decision in software developments. Only senior executives in the group have the full right to make the most necessary and important decisions on developing software. In the unrealistic expectations times, the practice of Agile method is likely to fail. Agile methods is generally believed that to be set as a practice, processes and tools are the main characteristics of a software development [16]. For implementing or incorporating of a new feature in existing software projects, developers haveto spend   a specific day or a specific hour frequently. A Scrum technique is important to develop the project which works with Agile method.Scaled Agile Framework (safe) [12], Large Scale Scrum (less) [13]. Disciplined Agile Delivery (DAD) [14], and Risk Driven Scaled Framework (RDSF) [15]. To be elaborated as a table 1 of content

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

Factor	DAD	Less	Safe	RDSF
Well defined	Yes		Yes	
Simple	Yes	Yes	Yes	
Books	Yes	Yes	Yes	Yes
Web portal			Yes	
Results			Yes	
Measurable		Yes	Yes	Yes
Consultants			Yes	
Training and certified			Yes	
Popularity			Yes	
Tools	Yes	Yes	Yes	Yes
Fortune 500			Yes	
International		Yes	Yes	
Lean-kanban	Yes	Yes	Yes	Yes
Government			Yes	

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].

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 life cycle 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.
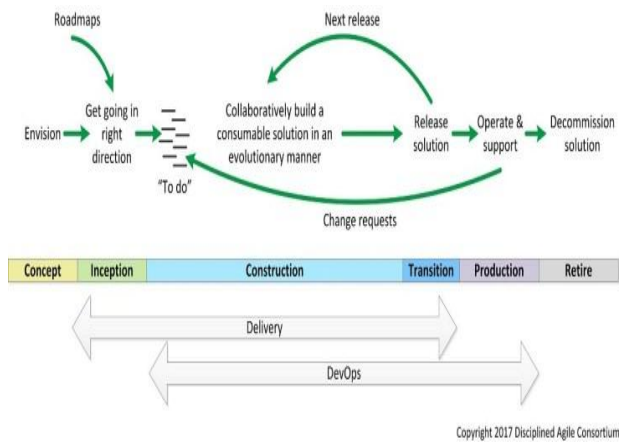

Figure 4. DAD high-level view lifecycle[7]

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.
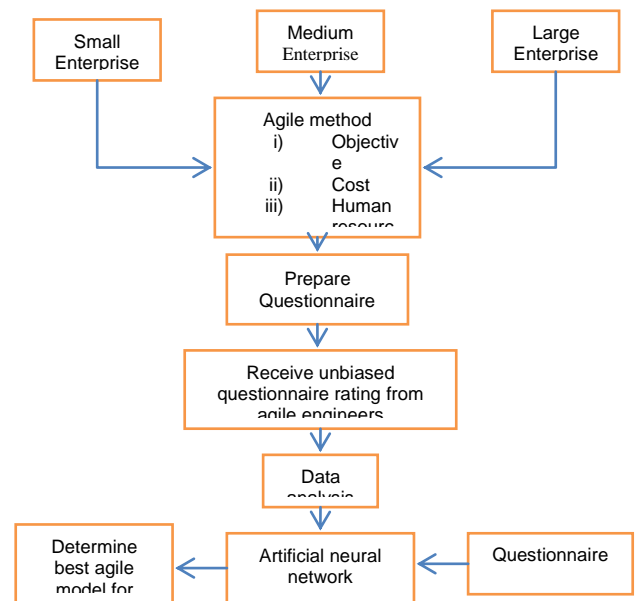

Figure 5 Architecture of Scrum based scaling using Agile method with The neural network

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 technological 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 backlog, sprint daily scrum and product increment. Scrum specifics have five types of functions for each team.

This section covers a brief background on scaling based agile methods.It is carried out along with the main procedures. We can types the projects into three categories such as small enterprise, medium enterprise, and large enterprise. All scaling types of projects are examined in Agile methods, in order to make use of any kind of scrum based scaling using agile method is used first. We have only taken some of the parameters such as objective of a project, cost, human resources and project types. Project manager forms an questionnaire for a new project based on agile parameters, and they put some scaling answers for preparing questionnaire. We get the results that have given the input of the neural network and the results in order, and we decide which technologies to use in any kind of projects scales.

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 projects which is shown in Figure 6.

Questions	Large Project				Medium Project				Small Project			
	SAFe	LeSS	DAD	RDSF	SAFe	LESS	DAD	RDSF	SAFe	LESS	DAD	RDSF
Is the agile easy to understand?	4	5	4	4	4	4	5	3	3	5	5	4
Does agile framework help achieve organization mission, vision and objective?	4	4	4	3	4	4	4	3		3	4	3
Does the management support agile framework adoption?	4	5	5	3	4	5	5	5	5	3	3	4
Is the management involved in all phases of software development?	5	4	3	4	5	3	4	4	4	4	3	3
Does the agile framework help view project status at all stages?	4	3	3	5	4	4	3	3	3	4	4	5
Does the agile framework implement lean priciples?	5	5	5	4	5	4	3	4	5	4	3	3
Does the agile framework have suitalbe help matearials?	4	5	3	3	4	3	3	3	3	4	4	4
Does agile framework improve productivity?	5	3	3	5	4	4		4	3	4	3	3
Does agile framework help in priorizating different team stories?	4	5	5	3	4	5	3	3	3	3	4	3
Does the agile framework help deliver quality?	5	4	3	4	5	3	4	4	3	4	4	3
Does the agiel framework speeds up market delivery?	5	5	3	5	3	3	4	3	3	3	4	4
Does the agile framework improve employee enagagement?	5	4	5	4	4	4	5	4	5	4	3	5
Does agile support different team working on same project?	5	4	3	5	4	4	3	3	3	3	4	4
Does agile support multi-site development?	5	4	3	5	3	5	3	5	4	4	3	3
Is agile suitable for small project development?	3	4	4	5	3	3	4	4	2	3	5	5
Is agile suitable for large project development?	4	4	4	3	4	3	4	5	3	4	4	4
Does agile framework help in individual contribution?	3	2	3	3	3	3	5	4	2	3	3	3
Does agile framework support iterative development?	4	4	4	5	4	5	5	4	5	4	4	4
Does agile framework provide contineous feedback?	4	5	3	4	4	3	3	3	3	3	4	3
Does agile framework reduce development cost?	5	4	5	5	5	5	2	3	3	3	3	3
Does agile framework help evaluate optimal solution?	5	4	4	4	4	4	4	4	5	3	3	4
Does agile feamework set milestone development?	5	5	3	3	3	2	4	4	4	4	3	2
Does agile framework manage work flow efficiently?	5	5	5	4	5	5	3	3	5	3	4	4
Does agile framework help make quick decisions?	4	4	3	5	4	4	5	3	4	4	5	5
Does agile framwork set visibility for stakeholder?	5	5	5	3	3	5	4	5	4	4	3	4
Does agile framework change work culture?	4	4	4	4	4	4	3	3	3	4	3	5
Does agile framework remove timely roadblocks?	4	4	3	5	4	2	4	4	4	3	3	5
Does agile framework provide uniform work distribution among teams?	5	5	3	4	4	4	3	5	3	4	4	5
Does agile framework reduce rework?	5	2	4	3	5	4	4	4	4	3	4	5
Does agile framework help team members to be creative?	5	5	3	4	4	3	3	4	3	4	4	4
Does agile improve overall communication among team members?	5	4	4	5	3	4	5	4	4	4	3	2
Does agile framework concentrate on technical excellence?	5	4	4	5	4	3	3	5	4	4	3	5
Does agile framework provide good foundation for software development?	4	5	4	5	3	5	5	4	5	5	5	5
Does agile framework ensure repeated stories deletion?	4	5	4	4	4	4	3	3	4	4	3	5
Does agile framework facilitate stake holders to get feedback?	5	5	4	4	4	3	4	5	4	5	5	4
Does agile framework enable synchronization among teams?	3	4	4	3	3	3	3	5	3	3	4	3
Does agile framework trace stories?	3	4	4	4	4	4	4	5	5	4	4	4
Does agile identify risk in project?	5	5	5	4	5	4	4	4	4	4	3	4
Does agile framework identify inter dependencies among stories?	5	4	4	4	4	4	5	5	5	4	4	5
Does retrospective meetings help team learn from mistakes?	3	5	5	4	3	4	3	3	4	4	5	4
Does agile framework provide project view to stakeholders?	4	5	3	4	5	5	5	5	4	3	4	4
Does agiel framework minimize roles in work?	4	4	4	4	4	4	4	3	3	3	4	5
Does agile framework showcase role and objectives of individuals?	5	5	4	3	4	5	3	3	5	3	5	5
Does agile framework idenfy technology and product framework initially for software development?	3	4	5	5	5	4	4	4	3	4	4	3
Does agile frame work allow technology customization?	4	4	4	4	3	3	3	4	3	4	3	4
Does agile address customer and stakeholders query?	5	5	5	5	4	5	5	4	4	5	5	3
Does agile improve customer satisfactin?	5	4	4	3	5	4	4	3	4	5	4	3
Does agile help in faster product delivery?	5	5	5	5	4	4	5	3	5	3	5	4
Does agile mitigate risks in project?	5	5	3	3	3	3	3	5	4	4	5	3

Figure 6 Questions are set up to find out which kind of criterion is appropriate scrum based scaling using agile methods

Figure 6 shows to find out which kind of criterion is appropriate in scrum based scaling using agile methods. Parameters are given as questions from, which we find out which is the best in these four-scaling software. The value for justification 0 is the lowest rating and 5 is the highest rating. We give questionnaire to software developer and get feedback which are accumulated. Based on answers that are given. The questions asked in this questionnaire, we conclude whether the software is easy to use, its work has been prioritized, its infrastructure is very special, it gives the optimal solution, its value is very high in the market, and the size of the time it takes. We prepare the

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

$$J(W,b) = \left[\frac{1}{m}\sum_{i=1}^{m} J(W,b;x^{(i)},y^{(i)})\right] + \frac{\lambda}{2}\sum_{l=1}^{n_l-1}\sum_{i=1}^{s_l}\sum_{j=1}^{s_{l+1}}\left(W_{ji}^{(l)}\right)^2$$

$$= \left[\frac{1}{m}\sum_{i=1}^{m}\left(\frac{1}{2}\left\|h_{W,b}(x^{(i)}) - y^{(i)}\right\|^2\right)\right] + \frac{\lambda}{2}\sum_{l=1}^{n_l-1}\sum_{i=1}^{s_l}\sum_{j=1}^{s_{l+1}}\left(W_{ji}^{(l)}\right)^2 \quad (2)$$

Neural Network Learning in equation (3)

$$J = \begin{bmatrix} \frac{\partial F(x_1,w)}{\partial w_1} & \cdots & \frac{\partial F(x_1,w)}{\partial w_W} \\ \vdots & \ddots & \vdots \\ \frac{\partial F(x_N,w)}{\partial w_1} & \cdots & \frac{\partial F(x_N,w)}{\partial w_W} \end{bmatrix}. \quad (3)$$

Understanding the data in equation (4)

$$E(W) = \frac{1}{2}\sum_{p}\sum_{k}\left(Y_k^{(p)} - \mathbf{F}_k\left(X^{(p)};W\right)\right)^2 + $$
$$\frac{\lambda_1}{2}\sum_{i,j}W_{ij}^2 + \frac{\lambda_2}{2}\sum_{i,j}W_{ij}^2(W_{ij}-1)^2(W_{ij}+1)^2$$
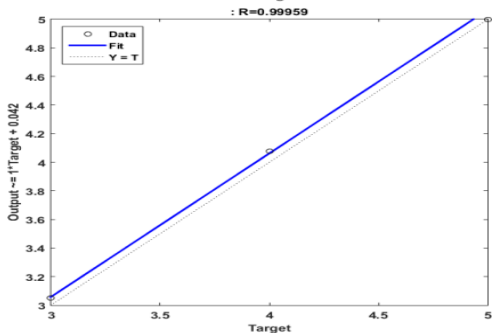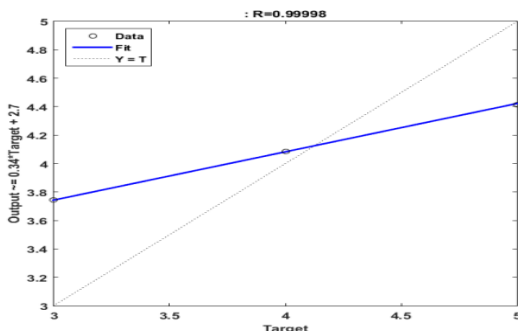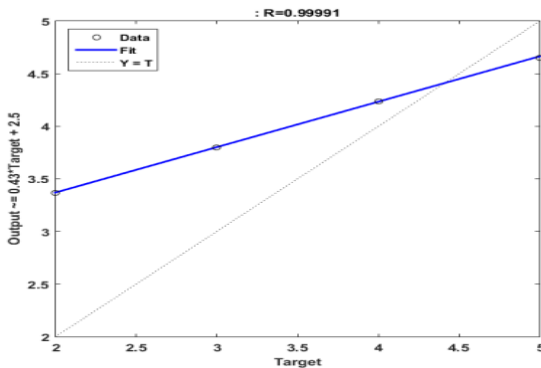
Figure 7: (a) SAFe- Large vs Small projects best fit curve of Bayesian regularization using backpropagation model. (b) LeSS - medium vs small projects best fit curve of Bayesian regularization using backpropagation model. (c) DAD agile frame work for large vs medium project best fit curve with Levenberg-Marquardt neural network
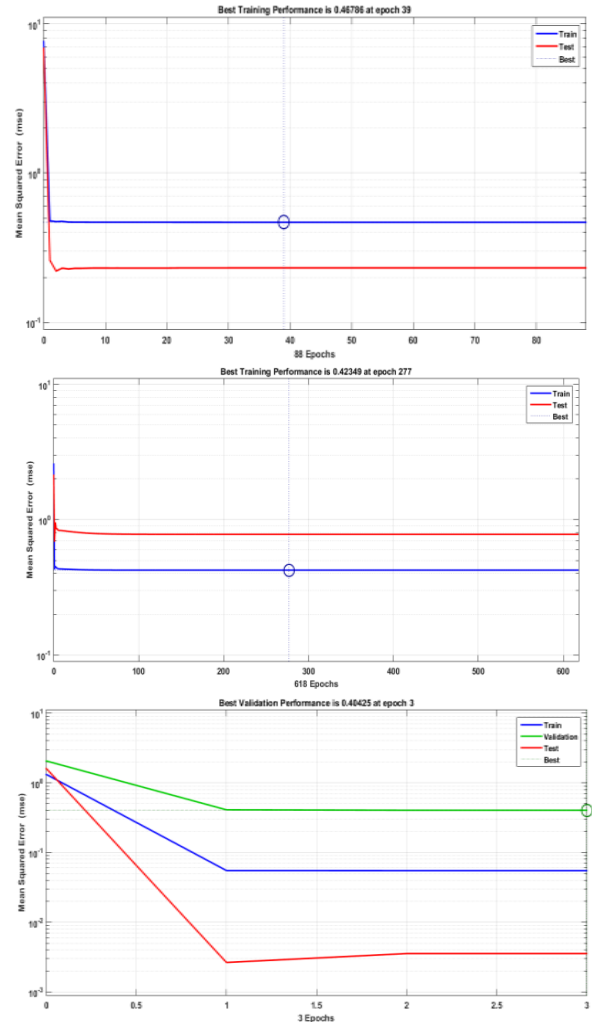

Figure 8: (a) Training performance of Bayesian regularization using using backpropogation algorithm forsafe(large vs small projects). (b) Training performance of Bayesian regularization using backpropogation algorithm for less (medium vs small projects). (c) Training performance of BFGS quasi-Newton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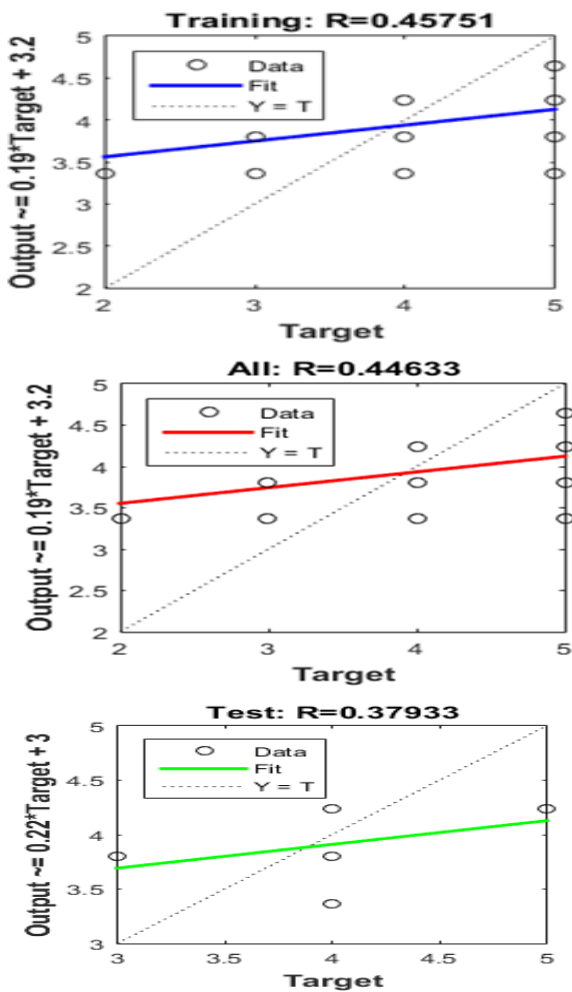
Figure 9: Bayesian regularization using backpropagationnetwork performance analysis for safe method (Large vs Small) projects.
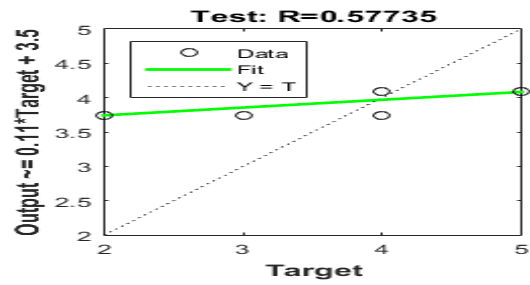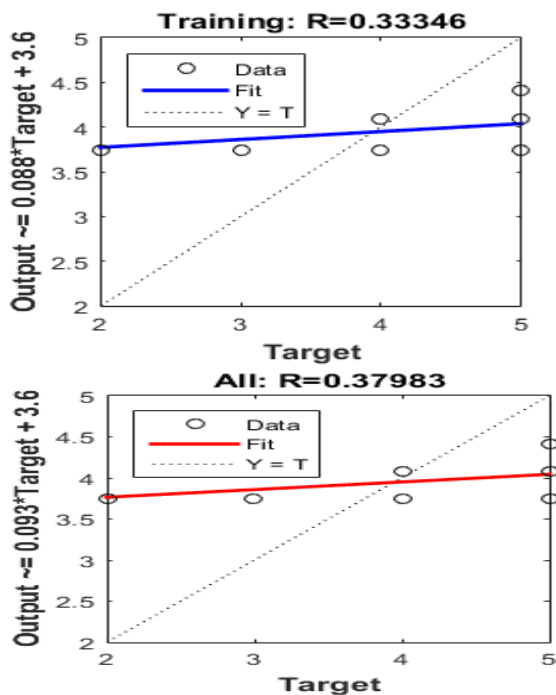

Figure 10: Bayesian regularization using using backpropagation network performance analysis for less method (medium vs small projects)
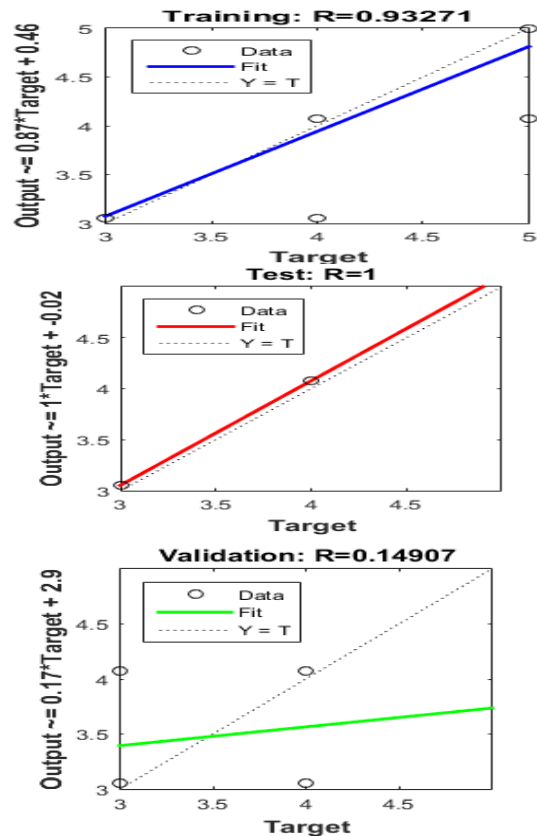

Figure 11: Levenberg-Marquardt neural network performance analysis for DAD method (Large vs medium projects)

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.

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