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A Review on Agile Development Process

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ABSTRACT: Growth in the number of software and types of software for various applications has led to the responsibility of carrying out these systems effectively. It is more important than ever to lay the framework and develop a particular system to complete each of these developments in the right amount of time but also keeping the quality in check. The paper discusses the upcoming development for agile software development. Agile is all about iterative steps to carry out a project undertaken by self-organizing cross-functional teams. It focuses on developing and improving the project step by step resulting in a high quality product and early delivery. Our aim is to explore this field to gain a wider understanding of the uses and benefits of Agile Software Development.

KEYWORDS: Software, Agile, Development, teams, project, process, methods, XP, Scrum, traditional, empirical

I. INTRODUCTION

Agile development process is a set of processes that aim to overcome drawbacks in traditional software development and deliver the working software efficiently by incorporating incremental changes and collaborative efforts between the customers and developers. In agile the main areas of focus are: Customer-developer collaboration, interaction between individuals, working software and responding to change. Customer-developer collaboration is necessary to make sure the customers and stakeholders are continuously involved in the project. Interaction between individuals is prioritized over process. Working software ensures that the software is running successfully at the time of delivery to the clients instead of just producing documents. One of the main features of agile is that it can respond and adapt to changes even if they are made at a later stage of development. There is a lot of emphasis on the quality of the product. Agile focuses on a wide range of life cycles in software development. There are methods like Extreme Programming(XP),pragmatic and agile modeling that focus on the practices, SCRUM focuses on managing the work flow, Feature-driven development focuses on a particular feature development, Crystal family of methodologies that focuses on efficiency and habitability and also other methods like Dynamic systems development method and RUP that focus on the full development life cycle.

In this paper we have reviewed research papers on the different areas of agile software development. Some of the papers that were reviewed discussed the difference between traditional and agile methodology. They further discussed the benefits of adopting agile over traditional methods. The other papers did a comparative analysis of the different agile methodologies. The suitability of certain agile methods for specific projects has been discussed. The quality assurance and the success factors of using agile were explored. We have also discussed the challenges the companies face for adopting agile and the limitations that come with it

Further this paper covers the reviews of the various research papers and summarizes the topics given in the introduction and concludes our findings.

II. REVIEW

Dybå, T &Dingsøyr T [1] talk about the existence of different agile methodologies but very less is known about their practical use and empirical evidence. They have discussed the importance of agile methodologies and how that they support changes and welcome feedback and focus more on the people on the team and their ideas than the pre-planned course of the project. They have discussed the various reviews and points on different agile methods on the basis of many authors. They focus on exploring the evidence and efficiency of the methods based on practical studies and

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havebased the studies on various criteria. The focus of research was on all kinds of team that contained a combination of mature and beginner teams. Their study focused mainly on agile development and XP. They based the studies on 11 quality criteria that used a set of questions to assess each study. They have given a table that takes the 33 studies they performed against the 11 quality questions and marked them. Based on this information they could decide whether a particular study gave a valuable contribution to the community. They also broadly classified the studies into three categories: those that talk about the introduction into the field of agile and also adopting it, those that discuss how agile changes the entire process of developing a product and those that talk about how every aspect is managed. A few reviews were analyzed on different human and social elements based on organizational culture and collaboration. They have also discussed results and methods that support certain other factors such as how agile is accepted and the different views such as: customer, developer and student. They further discuss that agile methods may have certain limitations when it comes to large groups and incorporating something like XP would be difficult to apply to large complex teams. But the benefits are that there is better customer collaboration, better team work while handling problems and defects and so on. Agile thrived in changing environment and could inculcate various traditional practices. There was an increase in interpersonal skills. There are certain factors such as job satisfaction and the product of the work that do not validate the better working of agile than traditional. They stress on the importance of focusing on studying more about the practical evidence of agile development.

The authors Paetsch, F., Eberlein, A., & Maurer, F [2] talk about traditional requirement method and agile method. Requirement method focuses on documentation of the process and what is needed rather than how it is implemented. It has various sections: a) Elicitation-describes the boundaries of the system and focuses on the function of the application. It can be defined by taking interviews, generating use case scenarios, analyzing focus groups as well as through observations. Analysis-that analysis the requirements, Negotiation, Documentation- needed for the clarity of the requirements and functions to the stakeholders as well as the developers, Validation-validation of the requirements document, and Management-that takes care of version control and management of information. Less importance to documentation to focus more on effective adaptation to the changes is exercised in agile methods. They have further described many agile methods:
Extreme Programming: Focuses on communication and also incorporates a few traditional practices, Scrum that focuses on team work and also product backlogs that describe the features of the product, Crystal-family of many methodologies, Feature Driven Development-focuses on the design and building of features and discussion of the various features are done often, Dynamic Systems Development method-rapid development, Adaptive Software Development-iterative development. They further discuss requirement methods in agile: RE uses customer contribution in the beginning while agile use them throughout the process. So the main RE technique that can be used in agile is Interviews. Prioritization that involves focus on prioritized functions, JAD sessions for customer involvement, Modeling of the process, Documentation, Validation of the system and management are a few of the RE techniques that are used. Therefore, most of the techniques in RE are used in agile but not all are well defined as they are in RE. They may be used repeatedly in different phases. And hence both the approaches have similar goals but differ on the level of documentation.

Abrahamsson, et al [3] talk about the various agile methods available and how researchers and other users can make a calculated decision as to which method they should use. The different agile methods are introduced briefly such as: adaptive software development, agile modeling, crystal family, dynamic systems development method, extreme programming, scrum, internet speed development, pragmatic programming and feature driven development (FDD). They developed various perspectives or criteria for the analysis of these different methods. They are: Software development life cycle-the stages of processes that the project undergoes, Project management-to make sure of the efficiency of the project, Abstract principle v/s Concrete guidance-which differentiates between the behavior of work and the proper activities, Universally predefined v/s situation appropriate-an agile method that fits all kinds of projects or one that is suitable for a particular one and Empirical support-whether it has practical proof. They have made graphs that indicate the support of each of the agile method by three of the lenses and have discussed it. The universal / situation appropriate and empirical evidence are evaluated separately for each method again. The implication of each lens has been tabulated. Under software development life cycle it is suggested to widen the dimensions covering the

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phases of the process/project. Project management is of utmost importance since the efficiency of the project is dependent on it and only 5 out of 9 agile methods support project management and also not truly. In abstract v/s concrete ideas only 3 out of 9 support concrete and the rest focus on the acceptance of the proposed idea. There are different methods that are situation appropriate or are universally pre-defined and that depends on the practitioner. The empirical evidence of the efficiency of the various methods is not readily available and thus do not assure the user that it is practical and cost efficient to use them or if they contribute in any way to the development of the project. Hence, the different methods of agile have been discussed based on a comparative analysis based on the five criteria for analysis and most methods do not have enough empirical evidence. They have stressed on the importance of the quality of the agile method applied rather than the quantity of methods.

Moe, N. B., Dingsøyr, T., &Dybå, T. talk [4] about the self-organizing teams and how agile methods define the barriers in autonomy of a team as a whole. They introduce agile developments and also discuss that changing from plan-driven model to change driven such as Agile is not easy since it may affect the culture, mind-sets and a lot of other factors. They stress on high functioning individuals and also team autonomy i.e. self-organizing teams. The focus in this research is Scrum method that supports self-organizing teams. It involves incremental updates and meetings of all teams to discuss the future of the process and they also have a scrum master that takes care of the decisions on a managerial level. The term-'self-organizing teams' has been explained. They are basically teams that organize themselves and are also independent and highly functional. This increases the team bonding and also gives other positive contributions like commitment to the project. There are autonomies on different levels such as: external, internal and individual autonomy. The research focuses on the barriers while coming up with self-organizing teams on an actual project. They evaluated the first Scrum project of the analyzed company. All the autonomy aspects were considered through observations by the team on their daily meetings and discussions and iterative progress. They observed that compared to all the autonomies they found the lack of internal autonomy of the observed team as compared to the original agile process. They were more independent individually and highly flexible since each individual had more than one skill and hence gives less rise to internal autonomy which is one of the main barriers to self-organizing teams. More importance was given to individual success than group success. There is also a decrease in external autonomy due to lack of external support. And thus they identified the barriers to self-organizing teams and stressed on being difficult to change the workings so soon but can be developed over time.

Turk, D., France, R., &Rumpe, B. [5] discuss that they need to understand the application of agile processes and also what the limitations could be to agile methods. Agile methods are used for adapting with regular changes in the environment and focuses on the project on a coding and managerial level. They have focused on a few processes under agile. They also discuss about agile alliance and their principles. They have formed underlying assumptions to validate the process such as cost of change does not dramatically increase overtime. Not all agile processes suit the given assumptions. They have further discussed the limitations through the assumptions given. There is some limitation when it comes to distributed environments and communicating face to face since some members may not be located at the same place. There is also some difficulty when it comes to building and working on projects that are problem specific and not general enough. It becomes difficult to apply agile processes when it comes to large groups and thus the face to face interaction becomes time consuming and confusing. Agile processes do not exactly guarantee that the products will be safe to use or economically better as compared to other formal and rigorous analysis. There are limitations when it comes to large and complex soft wares. Therefore there are some projects that are suitable for agile and some that are totally inclined towards non-agile processes. Agile processes have to be evaluated through empirical studies.

Nerur, S., Mahapatra, R., &Mangalaraj, G. [6] talk about the challenges when it comes to shifting from a traditional method to an agile method of processes. It is said that teams should come to balance between agile and traditional methodologies. In traditional way, they follow a specific process model such as waterfall, spiral and so on. They have further gone on to explain the difference between both the methodologies. Agile methods focus on iterative and social collaboration. They have mentioned the issues in adopting agile methods. The main challenges that come are managerial and organizational: problems that arise due to cultural values, autonomy and also changing from authority to a collaborative environment. The lack of proper documentation of the details of the project may shift the power from

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managerial to developer team. There needs to be proper performance evaluation since all the processes are team-work. It may come as a difficult method to cope with non-agile members and also members who have been working in an environment where they work alone or limited number of people and are thus not used to it. It is not easy to find customers who will greatly contribute to the development process of the agile process. The major change is to shift from a life-cycle based model to a model that is feature driven and thus stresses on changes in techniques and tools. The one problem that the project manager faces is that they need to select the right agile method to successfully carry out the project suiting the project requirements as well. Lastly, they may also have to invest in tools to shift to agile since their technology may not support it. Therefore, it is of extreme importance for the company to check before taking up agile since only those capable of changing environment and cultural bonding among the members are suitable for agile and not those based on formal rules and management since agile is all about a collaborative effort.

Vijayasarathy, L. E. O. R., and Turk [7] surveyed those companies that have adopted agile. They are mostly positive reviews. There are some benefits that one cam gain by adopting agile and they are: an increase in productivity, there are fewer defects, saving up on time and costs, easily understood, better maintainability, encouraging and motivating environment, greater focus on customer satisfaction and a better collaborative environment. They basically analyzed the decision of these companies to adopt agile, the consequences of adopting agile and all the challenges they may have faced. The agile method XP seemed to be the most popular one in the early surveys. The early adopters were mainly small companies but they were later adopted by others as well. Pair programming is said to be used lesser than XP followed by Scrum, Agile modeling and then AUP. They found that respondents felt that agile is applicable more for web based and rarely for software systems. The agile use is pretty high when it comes to projects for more than 75% of use. The influence behind adopting agile is that it was a personal drive for most of them. The basic need for switching is for faster software development and incorporating changes. Problems are the differences in cultural values, lack of facilities, disinterest from the managerial side and lack of formal guidelines. While the benefits are that there is an increase in job satisfaction, efficient transfer of knowledge, reusability, and flexibility and so on. Many people also have seem to taken training for adopting agile methodologies. Further they shared some of the thoughts the users of agile had regarding the technology. All in all, the resistance from the organization to adopt agile should be taken into consideration. Therefore, the benefits of agile development methods would be a driving force to increase the number of teams adopting agile methods.

Cho, J [8] differentiates between traditional and agile software development methods while focusing mainly on the popular agile method, scrum. Traditional models have been in widespread use because they have a structured nature, are straightforward and methodical. The problems related to traditional methods are budgets blowing out of proportion, missed schedules and defective products. Agile software development methods on the other hand focus on customer collaboration and incremental development by making use of rapid development life cycle. The scrum methodology is used to increase the efficiency of development process through the use of iterative and incremental approach. Scrum has an empirical process control with transparency of process, frequent inspection and adaptation forming the pillars of its foundation. The basic structure of scrum consists of three main elements, roles, ceremonies and artefacts. Like all processes scrum methodology has its fair share of issues and challenges. The issues include lack of specific documentation, lack of communication between team and inefficient scrum ceremonies.

Jammalamadaka, K., & Krishna, V. R [9] have dealt with the challenges encountered in the field of agile software development and mentioned the same in a paper. That paper also discusses a few pitfalls of the waterfall model and reinforces the need to have a better software development model. The waterfall model is not very suited to the current because of its rigid structure and inability to adapt to change. The principles of agile like customer satisfaction, delivery of product frequently, communication among teams, adaption to change make it agile a suitable choice for software development. The different agile methodologies are discussed. The challenges of agile are mentioned. Poor communication within teams, agile being meant for highly motivated and skilled personals etc. are a few drawbacks of agile. The choice of software development model is a critical one and should be done with care.

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Lonel, N [10] states the major contributions done in the field of agile research. Agile is the representation of a set of methodologies of software engineering that promise faster delivery of product, increased productivity and an overall increase in the success rate of software development projects. The emphasis of software development on the social scene is discussed. All agile methodologies take into consideration values like communication or courage. Other practices involved are pair programming, daily deployments and continuous integration. It was gathered that more developed teams have a finer understanding of the technical and social adherence. In terms of the implementation the major topic of debate that arose was the issues related to migration to agile. The major problems were related to technology, management, people and process. With regards to communication the main problem noticed is that the different players communicate from different perspectives regarding the same product. The paper is concluded by emphasizing on the need for more empirical studies as there is lack of studies that do analysis of the implementation of agile methods in organizations.

Sagheer, M., Zafar, T., &Sirshar, M[11] have discussed the quality of software developed using agile methodology. The different parameters that help in defining the quality of software are also discussed. Agile software development aims at providing working product within short time duration. But this does not mean that the quality of the product will be compromised. The quality of the software being developed has to be kept in mind by the developers. In software development, the backbone of any project is formed by the quality assurance activities. The different activities affecting the quality of the project are time constraint, reliability, efficiency etc. The various quality factors on which a software is measured are maintainability, reliability, reusability, testability, timing constraint, portability, efficiency, generalized, scalability, ease of use, security, tool support, productivity, cost effectiveness, correctness, flexibility, robustness, compatibility and performance. By analysing these parameters the quality assurance is achieved.

Darwish, N. R., &Rizk, N. M [12] provide a glimpse into several dimensions of the different success factors in agile software development projects. The factors are classified into dimensions and also into main factors and sub factors to provide an understandable and multidimensional view. These factors were classified into five dimensions with each classification having main and sub factors. The five dimensions are organizational, technical, people process and project. An approach to find out how committed the success factors are is proposed based on the classification along with an algorithm and flowchart. The paper is concluded with hopes that by implementation of the approach the number of success factors required for the success of a project can be reduced in the future.

Pathak, Kaushal, and Anju Saha [13] have reviewed the various agile methodologies in use at present. It also describes the differences between agile and traditional methods as well as weighs the pros and cons of applying agile technologies to software projects. Agile has had a huge impact in software process development. Agile methodology is focused on being effective, light, sufficient and manoeuvrable. The principles of agile methodology like prioritizing customer satisfaction, valuing individuals over processes, giving preference to working software and responding to change are discussed. The major differences between traditional and agile approach is cited. The various agile methodologies like extreme programming, scrum and feature driven development along with their major components are discussed. The difficulties faced during the implementation of agile methods like skill deficiency, need for a broader skill set, poor social skills and weak understanding of agile principles are summarized.

Andrew Begel and NachiappanNagappan [14] give an introduction to various popular agile methods. A variety of software developers as well as managers were chosen from 28,000 in order to gain knowledge about the usage of agile methods for software development. Respondents were solicited an aggregate from 46 questions, which were separated into three segments: socio-economics, lithe programming improvement, and combine programming. Agile benefits came to a count of 678, under 44 common themes. Agile disadvantages scaled to 565 problems grouped into 58 themes. The people using different methodologies were individually recorded, with Scrum topping the charts. The average time taken to adapt to each and every particular agile method has also been recorder. The team attributes and morale factor has been recorded to have increased. On overall improvement in Communication and Coordination, swiftness of Releases, expanded adaptability of Plan with Sensible process, Expanded Quality, Better Client Centre, Enhanced

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Concentration, Expanded Profitability, Better Confidence was observed. Problems faced while using agile methods were understood and strategies to avoid the same were discussed.

Tomanek, M., &Klima, T [15] have explained the trade-off occurring in Scrum between the security and the time taken to respond to the customer. The significant advantage of the Scrum structure is the iterative improvement approach and the chance to robotize infiltration tests. Improvement of the new data framework infiltration tests system PETA with concentrate on utilizing COBIT 4.1 as the structure for administration of these tests, and on past work concentrated on fitting the project administration system PRINCE2 with SCRUM, has been produced. This paper provides information and ease to employees of all levels. The waterfall model expects all the requirements to be mentioned stated upfront, causing the success rate to fall to 39%. The fact that it is not only faster and simple, but also applicable for big and complex software, has been realized. Penetration testing, done in order to strengthen the security system by enabling the system from previous vulnerabilities, is achieved by using a hybrid of “extreme Programming” and “Scrum”. From these set of requirements a few of them are prioritized and loaded into sprint backlogs. Later the feasibility of each sprint is checked by reviewing with the development team. These are later used in working increment of the software. Scrum is useful for automation which helps in iteratively reducing the cost of the penetration test; therefore it can be easily embedded. Manual embedding is very effective, as it is done by ethical hackers on running information systems. Security measures have been taken up specifically for different automated threats and vulnerabilities.

Kumar, G., & Bhatia, P. K [16] discuss how the agile methodologies affect the software development process. An introduction to what agile methods are is given. The objectives of agile methods for software development are defined as customer satisfaction through quick delivery of software, harnessing change according to customer, regular meetings among motivated and creative individuals to create better soft wares frequently, popular agile methods like “Extreme Programming”, “Scrum”, “Crystal” and “feature driven development”. Perceptions of enhanced correspondence between colleagues, fast arrivals of delicate products and adaptability of plans, were made. The benefits of agile methodology are denoted as a cycle of requirements change, fault recognition, expanded execution, iterative and incremental conveyance and adaptability of outline and quality changes.

Li, J [17] has provided the timeline of software development process based on agile methodologies. In this paper, the evolution of agile methods from the traditional methods due to software crisis has been elaborated. Traditional models like “Waterfall Model”, “Structured design and structured analysis” and “Rational Unified Process” were explained in detail, with graphic representation. The advantages and disadvantages of the traditional models were stated as well. The definition and objectives like people and associations over process and instruments, working programming over distinct documentation, consumer loyalty and arrangement were expressed. The effects on adaptability and teamwork in contrast with traditional and agile methods were realized. The two main methods of “Extreme Programming’ and “SCRUM” were elaborated with explicitly explained. A practical and functioning of PUB distribution system was developed by Agile to display and broadcast information for all stations at the railway of Netherlands, which transported 1.2 million passengers on a daily basis. It was started with the waterfall model, with a 3-week preparation phase, managed by a project manager, an architect and a Scrum master. Proper breakdown of man force was done, such that easy testing could be done. There were separate teams for requirement management, architecture and testing separately. Customers were satisfied with the result. An insight into possible application of agile methodologies in universities was given.

KudaNageswara Rao, G. Kavita Naidu, PraneethChakka [18] have explored the subject thoroughly and stated the implementations and applications of agile software development. A general definition of agile software development has been stated along with the survey of various papers based on the same. Unlike other papers, the actual questions regarding this topic has been narrowed down and answered specifically and in detail. Through these questions, a general knowledge of the subject, the issues in implementation, an understanding of the applicability and the step required to transition from traditional to agile methods have been stated. Three companies with different organizational structures have been examined to realize the pros and cons of extreme programming. Also, the paper literally convinces the reader to adopt agile methodologies, by stating the reasons “Motivating Adoption of Agile” in a tabular format.

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However the disadvantages have also been stated in a similar manner. Research papers that have successfully achieved effective agile methods have been emphasized upon, highlighting the reasons for such a success. Various threats arising due to the structural differences were also consolidated in this paper.

Muhammad Amir1, Khalid Khan2, Adnan Khan3 and M.N.A. Khan4 [19] have consolidated the results of various agile methodologies. The agile methodology has been majorly defined as a way to avoid heavy documentation and get faster results. The four values and 12 principles of agile software development have been stated in this paper. The functional requirements are defined by the customers, while the non-functional requirements like performance, durability and reliability. The requirements of the engineer have also been defined such as being able to estimate cost, guide and support the customers. Detailed studies have led to certain points of discussion needed for designing the architecture and software, like semantics, scope, lifestyle, role, documentation, methods, value and cost. A detailed literature survey has also been performed. Agile methods like Scrum, Agile Modelling, test driven modelling and Extreme programming have been extensively described in this paper. Benefits such as reducing production and delivery time, flexibility in making changes and removing additional documentation costs have been mentioned here. Major problem of application of agile methods is that, with bigger group of people and complex methods, the implementation tends to be inefficient. Along with these troubles, the general resistance from employees, manager quality requirement and the risk involved in cost estimation acts a major hurdle.

III. DISCUSSION

Due to agile being a trending technology at the moment and because of its many benefits it seems to be an ideal choice for companies and organizations to switch from traditional or current processes to agile. But before adopting a technology such as agile, the company should review and analyse to check if it is technically feasible and whether they have the necessary funds to invest in tools to shift and adapt. Cultural differences should be taken into account as the success of agile depends on collaborative effort by the whole team. There could also be a shift in managerial power which would not sit very well with employees at higher positions working with traditional ideologies. So far we have seen many types of agile processes that can be adopted suiting to the needs of the project but this does not guarantee a total success of the project. We understand that agile is a relatively new field in software development and much needs to be explored since not all the results of the various types have been documented yet.

IV. CONCLUSION

In this paper, we have reviewed various papers under the domain of agile methodologies. We have come across papers that talk about other plan driven methods used for software development and also their comparisons with agile. Agile is an upcoming technology that companies and project teams are adapting to with increasing importance on collaboration for better product development which makes use of various skills of different people involved in the project. Agile is highly flexible and stresses on working as a team and developing a project by conducting frequent reviews and by incorporating customer/user views. It is collaborative, incremental, customer-oriented, modular and time bound. But not all agile processes suit the problem at hand. There are certain limitations when we consider distributed environments and communicating face to face as members may not be present at the same place at the same time and they also do not guarantee that the product would be economically better or even safe to use. Lack of proper documentation could also lead to a problem since it would be difficult for the employees at the managerial position since mostly all information is intangible. It would also be tedious work and would require lots of effort for legacy systems to shift from their traditional ways to the new agile methods.

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