International Journal of Engineering and Management Research e-ISSN: 2250-0758 | p-ISSN: 2394-6962
Volume-10, Issue-5 (October 2020)
www.ijemr.net https://doi.org/10.31033/ijemr.10.5.1

Factors Influencing the Efficacy of Agile Usage

Shahzeb Hussain[1], Namrata Bhadri[2] and Syed Razauddin Shahlal[3]
[1]Systems Engineer, Infosys Limited, INDIA
[2]Graduate Student, Department of Electronics and Communication Engineering, SDM College of Engineering and Technology, INDIA
[3]Graduate Student, Department of Mechanical Engineering, SDM College of Engineering and Technology, INDIA

[1]Corresponding Author: shahzeb.sdm@gmail.com

ABSTRACT

Agile techniques that utilize iterative development are broadly used in various industry projects as a lightweight development technique which can satisfy the continuous changes of requirements. Short repetitions are used that are required for efficient product delivery. Traditional and old software development methods are not much efficient and effective to control the rapid change in requirements. Despite the benefits of Agile, criticism on agile methodology states that it couldn't succeed to pay attention to architectural and design issues and therefore is bound to produce small design-decisions. The past decade has observed numerous changes in systems development with many organizations accepting agile techniques as a viable methodology for developing systems. An increase in the number of research studies reveals the growing demand and acceptance of agile methodologies. While most research has focused on acceptance rate and adaptation of agile practices, there is very limited knowledge of their post-adoption usage and incorporation within organizations. Several factors explain the effective usage of agile methodologies. A combination of previous research in Agile Methodologies, Diffusion of Innovations, Information Systems implementation, and Systems Development has been carried out to develop a research model that identifies the main factors relevant to the propagation and effective usage of agile methodologies in organizations.

Keywords— Agile Methodology, Agile Usage, Effectiveness of Agile Usage

I. INTRODUCTION

Agile Methodologies are a set of software development methods that are based on repetitive and incremental development. The four major properties that are fundamental to all agile methodologies are adaptive planning, iterative and evolutionary development, rapid and flexible response to change, and promote communication [1]. Its main attention is in following the principles of "Light but sufficient" and being communication-centered and people-oriented. As it is termed as a lightweight process, it is more appropriate for the development of small projects. Agile software development takes the view that production teams should begin with simple and predictable estimations to the final requirement and then continue to increment the detail of these requirements throughout the life cycle of the development. This incremental requirement further refines the design, testing, and coding at all the stages of production activity. In this manner, the requirements work product is as accurate and useful as the final product itself [2].

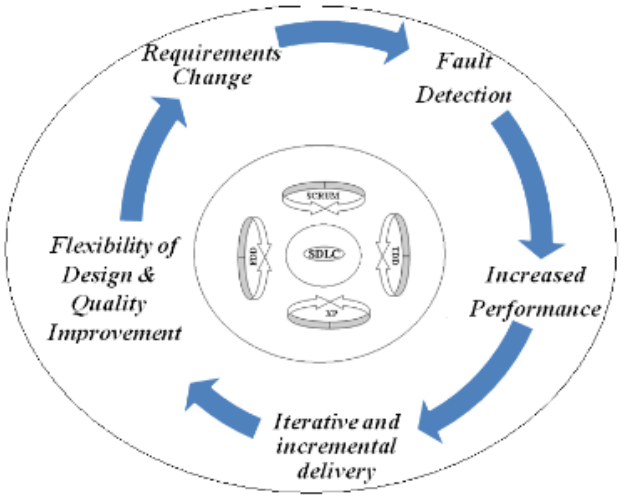

Figure 1: Agile Software Development Methodologies

Agile methodologies (AM) appeared as a popular alternative to address the problems inherent in established methods to systems development. They have gained widespread acceptance in both the academic and industrial contexts with an increase in the number of studies reporting their high adoption and success rates over the past decade. However, most academic research has mainly emphasized on the adoption and adaptation of agile methods [3]. Moreover, they offer a very broad range of experiences without providing a unified view of current practice, which suggests that there is an imprecise understanding of their utilization and practice in organizations beyond the adoption phase. This variance can be explained in a number of ways. One explanation is that most organizations that have adopted agile methodologies are still dragging on a project by project basis, and their routinized usage and

e-ISSN: 2250-0758 | p-ISSN: 2394-6962
Volume-10, Issue-5 (October 2020)
https://doi.org/10.31033/ijemr.10.5.1

spread throughout the organization is yet to happen. Moreover, researchers have highlighted the deficiency of quality and decreasing reliability in the findings of agile empirical. More research is therefore needed to understand the actual practice of AM in organizations [4].

Most studies that describe higher adoption rates and success of agile methodologies do not define, much less measure 'effectiveness' of the utilisation of agile practices or identify the components that affect its effectiveness. The answers to these questions lie in the evaluation of the post-adoption use of agile methods. This infers that there is an increasing need for a better understanding beyond the adoption stage as many organizations have completed adoption and agile methods have started to become well-established processes of these organizations [5]. A better understanding of the various factors that affect the successful embodiment of agile methods is believed to furnish valuable insights from at least three perspectives: a) improve our understanding of post-adoption use, processes, and impact of agile methodologies, b) provide new theoretical insights into the factors affecting the effectiveness of agile usage, and c) contribute to industrial practice by supplying insights into how agile methods can be effectively used in organizations.

II. RESEARCH FRAMEWORK

The definition adopted in the current research is similar to that proposal which suggests that acceptance is based on the usage of the innovation beyond the pilot project stage, i.e., Usage -> Acceptance -> Incorporation, where usage is described using two measures: *horizontal usage* - concerned with the usage of the innovation across the organization, and *vertical usage* - concerned with the depth of usage. Applying these terms to the context of agile methodologies, Horizontal Usage is defined as the overall utilisation of agile practices across the organization– for example; percentage of projects and analysts using agile practices, and Vertical Usage is defined as the maximum potency of their use, i.e., depth of use of specific agile values, practices, and policies [6].

In software development, these terms commonly refer to one of the major agile methods such as extreme programming (XP), Scrum, crystal method, feature-driven development, and dynamic systems development method - each of which prescribes a set of core practices, values, and concept. However, practically, most of the organizations do not strictly follow or adhere to any one of the agile methods, but use a customized approach by merging a number of good agile practices from different agile methods that best fits their requirements, "*If you dump all these good practices out onto a table, you'd have quite a buffet of very good practices with which to tailor your process. And that's exactly what many organizations do*". Hence, in the current study, agile usage does not refer to one particular agile method such as Scrum but rather to the continued usage of agile practices, where practices might include a combination of practices from XP and Scrum, or implementing the core properties of a kanban system while continuing to use some XP and Scrum practices [7].

Theoretical factors		Agile Usage	Agile Usage Effectiveness
Agile innovation	Relative advantage	Horizontal usage	• Quality of developed system and development process • Productivity of development process • Customer satisfaction
	Compatibility		
Sociological	Experience		
	Knowledge/expertise		
Technological	Agile practices		
	Tool support		
Team	Team management	Vertical usage	
	Methodology champion		
Organizational	Management support		

Figure 2: Factors expected to relate to agile usage and agile usage effectiveness

There are five groups of factors potentially affecting Agile Usage: (1) Agile innovation factors (relative advantage, compatibility) acquired from the innovation diffusion literature, (2) Sociological factors (domain expertise, language expertise) acquired from extreme Programming (XP) evaluation framework, (3) Technological factors (project management adopted from XP evaluation framework, (4) Team factors (team management, methodology champion) accepted from XP literature, and (5) Organizational factors (management support) adopted from the IS implementation. Figure 1 summarizes the different perspectives researched under each of the implementation factors in terms of their relationship to the degree of agile usage and its effectiveness [8]. The final conceptual framework is depicted in Figure 2.

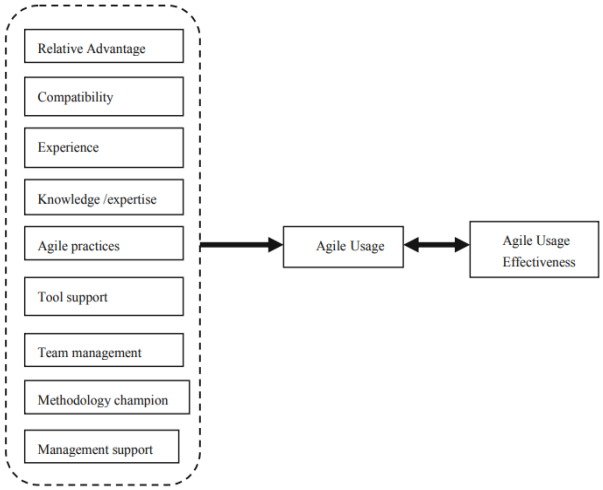

Figure 3: The research framework

Now we will briefly discuss these factors and their influence on agile usage and its effectiveness.

Innovation Factors

Relative Advantage: This implies the degree to which the innovation is discerned well than its predecessor. There is sufficient factual proof to suggest that relative advantage is a significant factor in estimating the usage of Systems Development Methodologies [9]. In the context of agile methods, the relative benefit would refer to the degree to which the chosen agile practices are found to better meet the contextual needs of the project and provide specific advantages such as improved quality, increased productivity, reduced time and costs, and higher customer satisfaction in comparison to its predecessor practices.

Compatibility: The amount to which the innovation is discerned as being adaptable with the requirements, extant values, and previous experiences of adopters. Since the adoption of agile methodologies represents a major shift in the pattern of systems development, it entails major alterations to work practices, JUnits, configuration management, investment in tools that support and facilitate rapid iterative development, refactoring, and other agile methods. In terms of post-implementation levels, compatibility is described as the fit between an innovation and a particular context, which implies that the chosen agile practices must match its context in to be efficacious and successfully infused in the organization. For example, the use of multiple programming languages such as C++, Java, and Motif, in a large project caused serious challenges to the adoption of XP practices such as code ownership, refactoring, and automated testing [10].

Sociological Factors

Though organizations play a major role in accepting contemporary innovations such as agile methodologies, their continued usage beyond the adoption stage depends on the actual users and teams that use the practices to develop software. Some of the specific individual sociological factors that affect the usage include technical knowledge, experience, attitude, and expertise.

Experience: People and organizations with the right knowledge and expertise will embrace the newer practices easily and swiftly, and a high level of team experience is said to contribute to increased productivity.

Knowledge/Expertise: Users and teams that have high levels of technical expertise in programming languages, different application domains, and other related software development technical practices, are not subjected to the learning curve associated with an unfamiliar domain, or with learning a new programming language [11].

Technological Factors

Agile Practices: There is often a considerable difference between the textbook 'vanilla' version and the actual 'method-in-action' used in practice as most prescribed practices are altered to meet the contextual requirements of software development. For example, different XP practices reached different stages of assimilation at different periods of utilisation, and practices that addressed specific requirements of the adopting team hit deeper assimilation levels [12].

Tool Support: While the importance of tool support in the adoption of software process innovations, in general, has been addressed, their significance in facilitating the acceptance of agile practices in terms of providing support in adhering to specific XP practices is also documented.

Team Factors

Given the increasingly significant role of teams in agile software development, team characteristics, and practices that ease the usage of agile methods are more likely to affect their effective use.

Team Management: Team practices that entitle the teams to be more autonomous and key decision-makers in deciding project scope, schedule, and choice of tasks, practices, tools, etc., are deemed critical in easing the acceptance and continued usage of agile practices.

Methodology Champion: Any innovative idea or practice without a champion is not likely to thrive. In the context of agile techniques, methodology champions play the important role of change agents in supporting and facilitating the on-going usage of agile practices [13], which include responsibilities such as mentoring, and guaranteeing that agile practices are strictly followed and adhered to by team members.

Organizational Factors

Top Management Support: It refers to ongoing support and encouragement of the top management executives in the acceptance and implementation of innovations, and is one of the main organizational components that are consistently reported to facilitate systems development methodology implementation. Lack of management support and attentiveness has been observed to be one of the major hurdles in implementing systems development methodologies and successful diffusion of agile methodologies [14].

III. AGILE USAGE AND EFFECTIVENESS

(a) Agile Usage

Usage is a key estimate of the successful implementation of a Systems Development Methodology in organizations. Since the current study is more focused on the usage of extensively and deeply agile practices after adoption rather than its acceptance per se, the interpretation was done using the following two measures:

1) *Horizontal usage* - Percentage of projects and developers using agile techniques.

2) *Vertical usage* - Magnitude of usage – i.e., depth and intensity of use of specific agile values, practices, and policies.

(b) Agile Usage Effectiveness

Agile effectiveness as a component affecting agile usage will be estimated using three variables: two of these are associated with the successful implementation of systems development techniques and have been identified as the core measure for assessing post-implementation effectiveness. They are: 1) Generating improvements in the development process, and 2) Better quality of the delivered system. In addition, 3) customer fulfillment, which is found as a key measure of agile effectiveness was used to measure agile effectiveness [15].

IV. CONCLUSION

In this research, our basic aim was to develop a theoretical model in order to understand the factors that facilitate the effective usage of agile methods. Though the findings from this study confirm that the various factors identified in the framework play an important role in influencing the increased and continued use of agile practices, it should be noted that these factors represent general components conducive to agile usage. However, usage effectiveness or success in certain organizations may be affected by specific factors or measures not found in the model. Case studies will be required to refine the factors identified in the research model. Existing literature on agile research will then be utilized to design the survey instrument by recognizing potential indicators to measure each factor of the model. A worldwide survey targeting all agile practitioners will be regulated to finalize the model. The goal of the survey would be to empirically substantiate the factors and the relationships proposed in the agile model and their importance for the overall effective usage of agile practices.

REFERENCES

[1] Andrew Begel & Nachiappan Nagappan. (2007). Usage and perceptions of agile software development in an industrial context: An exploratory study. *1st International Symposium on Empirical Software Engineering and Measurement*, pp. 255-264.

[2] Michael J Rees. (2002). A feasible user story tool for agile software development. *Proc. of 9th Asia-Pacific Software Engineering Conference (APSEC' 02)*.

[3] Mangalaraj, G., Mahapatra, R., & Nerur, S. (2009). Acceptance of software process innovations – The case of extreme programming. *Empirical Software Engineering, 18*, 344–354.

[4] Dyba, T. & Dingsoyr, T. (2008). Empirical studies of agile software development: A systematic review. *Information and Software Technology 50*, 9-10.

[5] Abrahamsson, P., Conboy, K., & Wang, X. (2009). Lots done, more to do: The current state of agile systems development research. *European Journal of Information Systems, 18*, 281–284.

[6] McChesney, I.R. & Glass, D. (1993). Post-implementation management of CASE methodology. *European Journal of Information Systems*, *2*(3), 201–209.

[7] Patton, J. (2009). *Kanban development oversimplified*. Available at: http://www.agileproductdesign.com/blog/2009/kanban_over_simplified.html.

[8] Williams, L., Layman, L., & Krebs, W. (2004). *Extreme programming evaluation framework for object-oriented languages version 1.4*. Available at: https://www.csc2.ncsu.edu/techreports/tech/2004/TR-2004-18.pdf.

[9] Hardgrave, B.C., Davis, F.D., & Riemenschneider, C.K.. (2003). Investigating determinants of software developers' intentions to follow methodologies. *Journal of Management Information Systems, 20*(1), 123–151.

[10] Rajlich, V. (2006). Changing the paradigm of software engineering. *Communications of the ACM*, *49*(8), 67–70.

[8] Williams, L., Layman, L., & Krebs, W. (2004). *Extreme programming evaluation framework for object-oriented languages version 1.4*. Available at: https://www.csc2.ncsu.edu/techreports/tech/2004/TR-2004-18.pdf.

[12] Pikkarainen, M., Wang, X., & Kieran, C. (2007). Agile practices in use from an innovation assimilation perspective: A multiple case study. In: *Twenty Eighth International Conference on Information Systems, Montreal*.

[13] Van de Ven, A.H. (1986). Central problems in the management of innovation. *Management Science*, *32*(5), 590–607.

[14] Roberts, T.L., et al. (1998). Factors that impact implementing a SDM. *IEEE Transactions on Software Engineering 24*(8), 640–649.

[15] Misra, S.C., Kumar, V., & Kumar, U. (2009). Identifying some important success factors in adopting agile software development practices. *The Journal of Systems and Software 82*, 1869–1890.