ISSN 2288-4866 (Print)
ISSN 2288-4882 (Online)
http://www.jiisonline.org
J Intell Inform Syst 2019 September: 25(3): 141~160 http://dx.doi.org/10.13088/jiis.2019.25.3.141

The Role of Clients in Software Projects with Agile Methods*

Vladimir Kim
University of Seoul
(koresaram777@gmail.com)

Wooje Cho
University of Seoul
(wjcho@uos.ac.kr)

Yoonhyuk Jung
Korea University
(beyond@korea.ac.kr)

Agile methodologies in software development, including the development of artificial intelligence software, have been widespread over the past several years. In spite of the popularity of agile methodologies in practice, there is a lack of empirical evidence to identify determinants of success of software projects in which agile methods are used. To understand the role of clients in software project where agile methods are used, we examine the effect of client-side factors, including lack of user involvement, unrealistic client expectations, and constant changes of requirements on project success from practitioners' perspective. Survey methods are used in this study. Data were collected by means of online survey to IT professionals who have experience with software development methodologies, and ordered logit regression is used to analyze the survey data. Results of our study imply the following managerial findings. First, user involvement is critical to project success to take advantage of agile methods. Second, it is interesting that, with an agile method, constant changes of client's requirements is not a negative factor but a positive factor of project success. Third, unrealistic client expectations do negatively affect project success even with agile methods.

Key Words : agile methodology, project success, project management, ordered logit regression, survey

Received : May 20, 2019 Revised : June 17, 2019 Accepted : August 16, 2019
Publication Type : Regular Paper Corresponding Author : Wooje Cho

1. Introduction

Agile methodologies in software development have been widespread over the past several years. As of 2017, 94% of organizations have practiced agile methods, according to the VersionOne's State of Agile Report[1]. Surveys in this report show that organizations have adopted agile methods for various reasons including accelerating development speed, increasing productivity, increasing software quality, managing changing priorities, and better alignment between business and IT. In spite of the popularity of agile methodologies in practice, there is a lack of empirical evidence to identify determinants of success of software projects in which agile methods are used.

* This work was supported by the 2017 Research Fund of the University of Seoul.

1) https://explore.versionone.com/state-of-agile/versionone-12th-annual-state-of-agile-report (lastly access on Sep 2018)

Prior studies have discussed about how to define project success and make projects successful (Atkinson, 1999; Baccarini, 1999; Linberg, 1999; Procaccino and Verner, 2006). Success factors of project management have been identified in previous studies (Blaskovics, 2016; Dvir et al., 1998; Misra et al., 2009; Procaccino and Verner, 2002). The success factors can be found at various dimensions, including organizational, people, process, and technical (Chow and Cao, 2008). However, there is lack of studies that have identified client-side factors of project success.

Reasons for many of project failures were often on managerial, not on the technical side (Boehm, 1991; Phan et al., 1988). However, people have a propensity to focus on technical aspects than managerial variability (Session, 2003). An appropriate relationship management with clients would be a significant managerial skill to project managers for project success, and understanding client-side factors of project success would be helpful for project managers to develop the managerial skill for project success.

Agile methods are often compared with a traditional software project management methodologies (e.g., Waterfall methodology), which appeared in 1970 (Ahimbisibwe et al., 2015; Ahimbisibwe et al., 2017; Royce, 1970). Advantages of the waterfall approach include that the model itself progresses linearly through discrete, understandable, and explainable phases and hence overall the progress of the project are easy to understand and track. It also provides easily identifiable milestones in the development process. Perhaps, because of these advantages, the waterfall model is used as a beginning example of a development model in many software engineering texts and courses in universities. However, this traditional paradigm may not effectively respond to fast-changing business environment and tough competition because it has disadvantages such as inflexibility in changes of project requirements and unsustainability in “soft” requirements (Briner et al., 1993).

Obviously, a vendor is expected to develop software systems within budget and schedule, meeting a client’s requirements, and one of essential questions in software project management is how to develop high quality software products with a lower cost and deliver it faster in order to satisfy customers (Boehm, 1979; De Roze and Nyman, 1978). To overcome the disadvantage of the traditional paradigm, vendors often adopt agile methodologies, which include Kanban, Scrum, XP, Adaptive software development, etc. The agile approach is characterized by close collaboration between vendors and clients (Misra et al., 2009). Although vendor-side factors of project success have been identified in many previous studies, there have been a limited number of studies that focus on client-side factors.

The purpose of this study is to identify success factors in projects that adopt agile software development methodologies. In particular, we examine the effect of client-side factors, including user involvement, unrealistic client expectations, and constant changes of requirements on project success from practitioners’ perspective. We found

that these client-side factors have a significant effect on project success when agile methods are used.

2. Theoretical background

2.1 Agile software development approach

The Agile Manifesto advocates that one of the most important requirements for successful software development is customer collaboration (Fowler and Highsmith, 2001). One of key principles of agile software development is to obtain high customer satisfaction. Fowler and Highsmith (2001) claim four values for agile software development: (1) individuals and interactions over processes and tools, (2) working software over comprehensive documentation, (3) customer collaboration over contract negotiation, and (4) responding to changes over following a plan. These four principles are followed by twelve principles that describe an agile process. In general, agile software development can be characterized by the following attributes: incremental, cooperative, straightforward, and adaptive (Abrahamsson and Warsta, 2002). Incremental means releasing small software with short development cycles. Cooperative means a close interaction between clients and developers. Straightforward implies that the method is easy to learn and to modify, and it is sufficiently documented. Adaptive means the ability to make and respond to changes rapidly.

Agile methods especially have advantages in adapting changes due to volatile requirements. However, they are not appropriate for all projects. The weakness of this software development paradigm include complications in managing many dependent pieces of work distributed across large projects (Coram and Bohne, 2005). Agile methods are most applicable to projects where requirements are poor defined and changeable since they seek to adapt changes easily. Projects, which are unprecedented within an organization or use innovative technology, are samples of projects where changes is very likely to occur (Coram and Bohne, 2005). By means of using agile methods, software developers can produce higher quality software in a shorter period. Agile methods were emerged to improve the development process through removing barriers for receiving changes in business requirements during the development process (Lindstrom and Jeffries, 2004). All agile methods share several qualities such as prototyping, minimal documentation, and iterative development (Holmström et al., 2006).

Many disciplines have been developed as an agile method. Popular agile methods include Extreme Programming (XP), Scrum, Kanban, and Test Driven Development (TDD). XP is one of the most recognizable agile method. The lifecycle of XP consists of the following phases: Exploration, Planning, Iterations to Release, Productionizing, Maintenance, and Death (Beck, 2000). This methodology concentrates on iterative and rapid development. Scrum was specifically designed to respond to fast changing business requirements

(Livermore, 2008). The scrum methodology stimulates improving communication among team members and dividing the work into parts called "sprints". Kanban, in context of software development, drives project teams to visualize the workflow, to measure cycle of time and to limit work in progress at each stage of workflow (Kniberg and Skarin, 2010). TDD assumes that design of the software is pliable, free to change, and incomplete. The idea of TDD is that the test can be written before developing the program, and the test can facilitate in making decisions on what program interface should be like, and which code is a fundamental concept for most software developers (Janzen and Saiedian, 2005).

We cannot say that one methodology is better than others, or agile paradigm is better than traditional one and vice a versa. But we can say when agile approach can be more appropriate than traditional approach for a project, and when the traditional can be more appropriate than the agile. To choose a right method for a project, it is important to understand differences between the agile and the traditional. Traditional development methodologies produce a lot of documentation. The documents are served for design traceability and communication. Agile methodologies, on the contrary, rely on cutting down overhead and lead thinking. Development team members keep much of the knowledge in their heads (Boehm, 2002; Highsmith, 2003), which result in a case that the balance of power moves from management team to the development team, consequently organizations are getting heavily dependent on the development team. Agile development methodology excels in exploratory problem dimensions – extreme, fast-change, complex projects – and operates best in a people-centered, collaborative and organizational culture (Cockburn and Highsmith, 2001). Fundamental assumptions of traditional and agile approaches are completely different: traditional approaches presume that systems are fully specifiable, predictable, and can be built through precise and extensive planning but, agile approaches presume that small teams with continuous design improvement can develop high quality and adaptive software. In context of control, traditional paradigm is process centric but agile approach is people centric. Management styles are also different: command-and-control is for traditional methods and leadership-and-collaboration is for agile. The project cycle in traditional one is guided by tasks or activities but that in agile one is guided by product features (Nerur et al., 2005).

2.2 Project success

Project success is a critical variable in project management, and different stakeholders of a project may perceive success and failure differently (Myers, 1995; Szajna and Scamell, 1993). Even when a finished project does not meet needs of top management, it can still satisfy customers (Belassi and Tukel, 1996). The same project may be considered successful by one part and failed by another (Naquin and Tynan, 2003; Walsh and Schneider, 2002) and the outcome of a project can

be seen different ways by evaluators (DeCotiis and Dyer, 1979; Morris and Hough, 1987). A common and well-known perception of project success is meeting schedule and business goals (Linberg, 1999; Wohlin and Andrews, 2001; Wohlin et al., 2000).

Although time, budget, and specification are most common criteria in evaluating project success (Redmill, 1990; Rook, 1986; Selin, 1989; Wallace, 1990; Weltz, 1989), these terms are only a small part of success factors. In addition to the criteria, the followings are often addressed; first, the required benefit must be delivered; second, required quality thresholds must be met; third, the project should be profitable; and fourth, the need of all stakeholders should be satisfied (Wateridge, 1998). Many projects are initiated without a clear definition of project success because of difficulties in defining success (Remenyi and Sherwood-Smith, 1999). Cooke-Davies (2002) distinguishes project management success and project success. He argues that project management success is measured by time, cost and quality, and project success is measured against all objectives of a project.

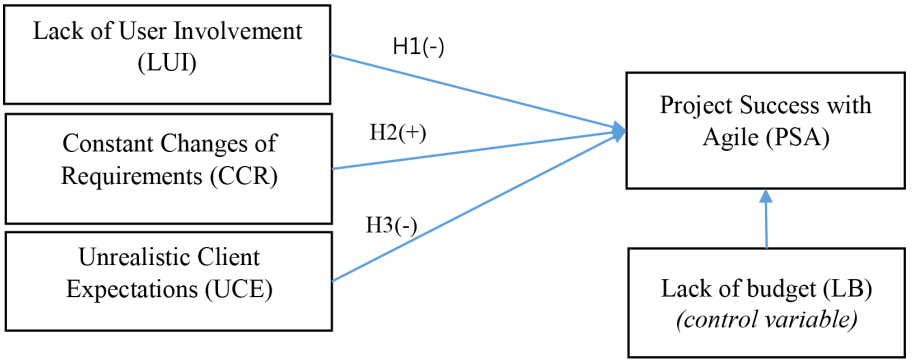
Besides of basic success factors, such as time, cost, quality and specification, there are also intrinsic factors that affect project success. Boehm (1991) has suggested that motivation is the single most important contributor to productivity of software development. Other intrinsic success factors include doing challenging work (Linberg, 1999), learning something new (Brooks Jr, 1995), having a sense of delivering sufficient quality (Saarinen, 1996), having a sense of achievement (Couger, 1988), being provided with enough independence and autonomy to work creatively on a project (Hackman and Oldham, 1980).

Though prior studies have argued the usefulness of agile methodologies in software projects, few papers have empirically identified drivers of success in projects that use agile methods. Adopting definition of project success from the perspective of project team members, we empirically examine effects of client-side attributes on project success.

3. Research model and hypotheses

The research subject of our study is the software project that uses at least one agile method as a discipline of software development. The central constructs of the research model are client-side factors and project success. The dependent variable is project success for projects where agile methods are used. Hypotheses 1 through 3 examine the effect of lack of user involvement, constant changes of requirements and specifications, and unrealistic customer expectation on the project success. Figure 1 shows our research model.

In our study, we consider project success from the perspective of project participants including project managers and developers. We measure project success based on their evaluation. Generally, project success means different to different stakeholders (Pinto and Mantel, 1990; Wateridge, 1995). Thus, the same project can be



〈Figure 1〉 Research Model

considered successful by one stakeholder and be considered failed by another (Naquin and Tynan, 2003; Walsh and Schneider, 2002). It has also been argued that most project managers do not understand how project success is characterized or how to measure project success (Bennatan, 2000; Kanter, 1988; Linberg, 1999). Satisfying business goals and meeting the schedule of project are common criteria of successful project (Baccarini, 1999; Pinto and Slevin, 1988; Wohlin et al., 2000) from the practitioners' perspective in general, though suggest that project success factors may not be universal for all projects Dvir et al. (1998).

Successful projects should meet users' needs during developing information systems (Fortune and White, 2006). According to Salmeron and Herrero (2005), involvement of customer/users in design stage is required. The importance of customer involvement in projects have been emphasized as a critical success factor (Fan, 2010; Poon and Wagner, 2001; Purna Sudhakar, 2012). Reel (1999) also strongly recommends that customers and users should be involved in development whenever it is possible for the following two reasons. First, it helps to build higher levels of trust between developers and users. Second, it places domain experts near developers during development, which is likely to increase the probability that developers develop systems that meets the users' needs. In general, customer/user involvement was found as one of the most important critical success factors in software development projects (Procaccino and Verner, 2002, Procaccino et al., 2005). Particularly, for the projects in which agile methods are used, user involvement would be more important because collaboration between vendors and clients are one of the key elements in the agile. Thus, we hypothesize a negative relationship between lack of user involvement and success of project with agile methodologies.

H1. Lack of user involvement is negatively associated with success of projects where agile methodologies are used.

Meeting user requirements is the most important criteria for success from both users' and project managers' perspectives (Wateridge, 1998). It becomes impossible to validate the software, if requirements are unsatisfactory (Zmud, 1980). Projects that meet all customer/users requirements would result in a relatively high mean score when they are evaluated (Procaccino and Verner, 2002).

In the paradigm of traditional development methods, vendors desire to have clear and unaltered requirements from a client, and inappropriate requirements usually lead to project failure (Poon and Wagner, 2001; Salmeron and Herrero, 2005). At the beginning of the project, requirements need to be clearly defined with considerations of the characteristics of the IT project (Fan, 2010). Project schedules also suffer because of unclear requirements and it affects product quality, which may result in low quality (Abdel-Hamid et al., 1999; DeMarco, 1986).

On the contrary, in the paradigm of agile methodologies, it is presumed that project requirements are to be changed because it is inevitable for business environments to be changed (Boehm, 2002; Loforte Ribeiro and Timóteo Fernandes, 2010). In projects with agile methods, changes in requirements would not be a negative factor, but they may excel benefits of agile methodologies. Thus, we argue that changes in requirements and specifications would be a positive factor of success in projects where agile methodologies are used.

H2. The degree of changes in requirements and specifications is positively associated with success of projects where agile methodologies are used.

Having a clear and realistic objective has been identified as one of critical success factors for a successful project in a general context, and the comparative study on two projects revealed that the successful project has clear realistic objectives (Fortune and White, 2006). In addition, in order to meet and complete project on time, the project schedule should be realistic enough (Imtiaz et al., 2013). It is customers who may determine whether a project is successful or not, but expectations of the customers can be unrealistic (Myers, 1995; Szajna and Scamell, 1993). Procaccino et al. (2005) show that, among project related items that define success, "customer/user requirements are met" was one of the highest ranked item (84.8%). According to Procaccino et al. (2006), 97% of developers indicated that realistic expectations have at least some importance. In Field (1997) work, unrealistic deadline is one of key factors of the IS project failure. In projects with agile methods, unrealistic customer expectation would prohibit effective communication and understanding between clients and vendors. Thus, we maintain that whether customers' expectation is realistic or not would be a significant determinants of success in projects where agile methodologies are used.

H3. Unrealistic customer expectations are negatively associated with success of projects where agile methodologies are used.

4. Research Methodology

4.1 Data

Survey methods are used in this study. To collect data, we developed online survey form regarding to software development methodologies. A preliminary questionnaire was developed and used to collect data for the pre-test. Then, the preliminary questionnaire was revised according to results of the pre-test to reflect the feedback from the pre-test respondents. Elicitation of the relevant responses on agile methodologies required us to identify a population of IT professionals with SDM (Software Development Methodologies) experience. This population of professionals was found via social network, Linkedin. The survey was sent via the Linkedin personal message with link to survey (Serrador and Pinto, 2015). The targeted audience is mostly professionals working in software development field (e.g., Software developers, IT project managers, software testers, software architectures and agile coaches). We did not make any restrictions to our survey in context of industry type, sector, company size, team size, experience, project size, culture and nationality. Through this approach, we were able to collect responses from IT professionals, which are widely geographically distributed across continents. Moreover, for better understanding the questions, the survey was translated into three languages (English, Korean, and Russian).

The structure and questions of our survey was based on surveys of existing studies (Misra et al., 2009; Pereira et al., 2008; Procaccino and Verner, 2006). Most of the questions in survey are closed-ended, multiple-choice questions and some of the questions are open-ended. Multiple-choice questions are used by respondents to rank their responses on a scale of 1 to 5 (Likert's scale). The close-ended and multiple-choice questions facilitates us to perform statistical analysis using the data. Totally, we have sent more than 4238 invitations for filling out the survey and we got 248 valid answers. The response rate of survey was about 5.85%. Out of the 248 responses, 213 answered that they used at least one agile method in their projects. Thus, our empirical results are based on the analysis of the 213 responses. Survey questionnaire we used is in Appendix.

4.2 Descriptive statistics

Table 1 shows the result of descriptive statistics. For each question corresponding to independent and dependent variables, we tried to get understanding of the mean, minimum, maximum and standard deviation of the survey data, collected from respondents.

Correlation analysis can help us to understand the relationship between the dependent variable Project success and all our independent variables. Table 2 shows the summarized correlation results between all variables.

〈Table 1〉 Summarized descriptive statistics

	N	Minimum	Maximum	Mean	Std. Deviation
PSA	213	1	5	4.25	0.848
LUI	213	1	5	2.91	1.191
CCR	213	1	5	3.46	1.211
UCE	213	1	5	2.47	1.283

LUI = lack of user involvement; CCR = constant changes of requirements; UCE = unrealistic client expectation

〈Table 2〉 Correlations of variables

	PSA	LUI	CCR	UCE
PSA	1			
LUI	-0.230	1		
CCR	-0.012	0.203	1	
UCE	-0.171	0.285	0.381	1

LUI = lack of user involvement; CCR = constant changes of requirements; UCE = unrealistic client expectation

5. Analysis and results

5.1 Ordered logit regression analysis

Ordered logit regression (OLR) is used in our analysis because dependent variables in our study is an ordered measure. This analysis enables us to see how well that response can be predicted by the responses to other questions in the survey (McCullagh, 1980). Ordinary linear regression may result in inefficiency of the regression, and the estimates may have values outside the range of the dependent variables (Greene, 2000). OLR simultaneously estimates multiple equations based on categories of the dependent values. Table 3 shows categories of the ordinal values of the

〈Table 3〉 Equations used with the ordered logit model

Eqn. *j*	Pooled categories	compared to	Pooled categories
Eqn. 1	*1*		*2+3+4+5*
Eqn. 2	*1+2*		*3+4+5*
Eqn. 3	*1+2+3*		*4+5*
Eqn. 4	*1+2+3+4*		*5*

dependent variables and equations of our logit model.

The ordered logit model has the following form:

$$logit(p_j) = \log \frac{p_j}{1-p_j} = \alpha_j + \beta' X + \varepsilon \quad (1)$$

The variable p_j refers to the probability of being in the set of categories on the right versus in the set of categories on the left in Equation j of Table 3, and ε is the error term. We examined the effect of four variables on client side, as noted earlier, our model includes lack of user involvement, constant changes of requirements and specifications, unrealistic client expectation, and lack of budget. The our model can be give by:

$$logit(p_j) = \alpha_j + \beta' X = \alpha_j + \beta_1 LUI + \beta_2 CCR + \beta_3 UCE + \beta_4 LB + \varepsilon \quad (2)$$

where LUI denotes the lack of user involvement, CCR is the constant changes of requirements, UCE is the unrealistic client expectation, and LB is the lack of budget.

5.2 Results

Results of the ordered logit regression analysis is depicted in Table 4. We found that our model has some relevant explanatory power. The difference between the log likelihood of a model with no predictors (-370.60264) and that of our model (-225.69878) is significant (prob > chi2 = 0.000). In addition, the McFadden's pseudo R-squared of our model (0.0552) is in a reasonable range, which can support explanatory power of our model[2]. Since the ordered logit regression assume that the relationship between each pair of outcome groups is assumed to be the

〈Table 4〉 Parameter estimates of the generalized OLR model

Ind. Variables	Coefficients	Std. Error	*t*	Sig.
LUI	-.305**	.122	-2.50	0.012
CCR	.230*	.125	1.84	0.065
UCE	-.235*	.121	-1.93	0.053
LB	-.284**	.112	-2.54	0.011
/cut 1	-6.277	.882		
/cut 2	-4.717	.622		
/cut 3	-3.291	.552		
/cut 4	-1.213	.510		

LUI = lack of user involvement; CCR = constant changes of requirements; UCE = unrealistic client expectation; LB = lack of budget.
** Significant at p<0.05; * Significant at p<0.1

2) http://www3.stat.sinica.edu.tw/statistica/oldpdf/A16n39.pdf

same, we test the proportional odds assumption. Results of the test indicate that we have not violated the assumption (Prob > chi2 = 0.104) and we do not need to relax the proportional odds assumption in this study.

The effect of lack of user involvement on the project success is significantly negative and the first hypothesis is accepted. Constant changes of requirements show a significantly positive relationship with the project success and H2 is accepted. It implies that constant changes of requirements are not what impede but what is helpful in a project where agile methodologies are used. Unrealistic clients' expectation is significantly and negatively associated with the project success, and H3 is accepted. Lack of budget, a control variable, also shows a significantly negative relationship with the project success, which is consistent with our intuition.

Coefficients of logit analysis cannot be read as regular OLS because they are in log-odds units (Williams, 2006). But we can compare magnitude of influences of the independent variables. The coefficient of LUI is the greatest out of the four variables (-0.305), which implies that user involvement is vital for success of project where agile methods are adopted. We would say that for a one unit increase in LUI, CCR, UCE, and LB, we expect a 0.305 decrease, a 0.230 increase, a 0.265 decrease, and a 0.284 decrease in the log odds of being in a higher level of project success respectively, given all of the other variables except the observed variable in the model are held constant.

6. Discussion and conclusion

6.1 Implication for research and practice

We collected data from practitioners, who use agile methodologies in practice. Agile methodologies are widespread in software projects, but few prior studies empirically examine determinants of success in projects where the agile methodology is used. The results of our study imply the following managerial findings. First, user involvement is critical to project success to take advantage of agile methods. This finding is consistent with theoretical benefits of agile methodologies. Without user involvement, agile methods would not benefit project managers because customer collaboration is one of key elements in the agile (Fowler and Highsmith, 2001). Second, it is interesting that, with an agile method, constant changes of client's requirements is not a negative factor but a positive factor of project success. A possible explanation is that constant changes of client's requirements can mean frequent interaction or communication between a client and a vendor, which would help the vendor to meet clients' needs. Third, unrealistic client expectations do negatively affect project success even when agile methods are used. The unrealistic client expectations is identified as one of the three highest project risks in a list of 27 risk factors derived from the literature (Baccarini, 1999). It implies that an agile approach is not a magic stick that can solve that risk.

Before moving to agile paradigm from

traditional one, companies and project managers must analyze their situation and realize the need for the migration, because agile methodologies may not be appropriate for some projects. They also need to find out whether a team is capable to use an agile method and can implement the required procedures. Otherwise, traditional approaches may be more proper (Coram and Bohner, 2005). Another reason is that software developers may prefer one method than others, and the developers will be demotivated if her or his preferred methodology is not used (Linberg, 1999). Hence, organizations need to migrate to agile paradigm carefully and assess their capabilities before moving to agile path. But, once they decide to adopt an agile method in their projects, they need to understand determinants of project success with the agile method. Findings of our study show that user involvement, constant changes of requirements, and realistic client expectation will be helpful for practitioners to increase probability of project success with agile methods.

6.2 Limitation and future studies

Like most of survey-based studies, we have the following limitations. Firstly, respondents may not be encouraged to provide accurate and honest answers. Secondly, respondents may not be fully aware of the reason for a given answer due to lack of memory on the topic. However, we tried to minimize above-mentioned limitations by letting the respondents answer the questions more thoughtfully by taking their own time, and we did not give them any time constraint. In addition, we believe the responses are reliable because we do not provide any reward for participants. They did not have any incentive to take their time and send false responses.

Survey results of Ahmed et al. (2010) has shown that the most commonly used methodology was “Scrum”, about 31% of industry practice. In our survey results, the most commonly used methodology is “Scrum” too, about 57.26% of industry practice. It seems that Scrum methodology is getting popular faster than other methodologies. In future work, it might be worthwhile to focus on Scrum method and find out determinants of success in projects when the scrum methodology is used.

References

Abdel-Hamid, T. K., K. Sengupta, and C. Swett. "The Impact of Goals on Software Project Management: An Experimental Investigation." *Mis Quarterly*, Vol. (1999), 531~55.

Abrahamsson, P. S. O. R. J. and J. Warsta. "Agile Software Development Methods: Review and Analysis." *Espoo, Finland: Technical Research Centre of Finland, VTT Publications*, Vol. (2002), 478.

Ahimbisibwe, A., R. Y. Cavana, and U. Daellenbach. "A Contingency Fit Model of Critical Success Factors for Software Development Projects: A Comparison of Agile and Traditional Plan-Based Methodologies." *Journal of Enterprise Information Management*,

Vol. 28, No. 1(2015), 7~33.

Ahimbisibwe, A., U. Daellenbach, and R. Y. Cavana. "Empirical Comparison of Traditional Plan-Based and Agile Methodologies: Critical Success Factors for Outsourced Software Development Projects from Vendors' Perspective." *Journal of Enterprise Information Management*, Vol. 30, No. 3(2017), 400~53.

Atkinson, R. "Project Management: Cost, Time and Quality, Two Best Guesses and a Phenomenon, Its Time to Accept Other Success Criteria." *International Journal of Project Management*, Vol. 17, No. 6(1999), 337~42.

Baccarini, D. "The Logical Framework Method for Defining Project Success." *Project Management Journal*, Vol. 30, No. 4(1999), 25~32.

———. "The Logical Framework Method for Defining Project Success." *Project Management Journal*, Vol. 30, No. 4(1999), 25~32.

Beck, K. *Extreme Programming Explained: Embrace Change*: addison-wesley professional, 2000.

Belassi, W. and O. I. Tukel. "A New Framework for Determining Critical Success/Failure Factors in Projects." *International Journal of Project Management*, Vol. 14, No. 3(1996), 141~51.

Bennatan, E. M. *On Time within Budget*: John Wiley and Sons, 2000.

Blaskovics, B. "The Impact of Project Manager on Project Success－the Case of Ict Sector." *Society and Economy in Central and Eastern Europe*, Vol. 38, No. 2(2016), 261~81.

Boehm, B. "Get Ready for Agile Methods, with Care." *Computer*, Vol. 35, No. 1(2002), 64~69.

Boehm, B. W. "Software Engineering: R & D Trends and Defense Needs. Research Directions in Software Technology." *MIT Press: Cambridge MA*, Vol. (1979).

Boehm, B. W. "Software Risk Management: Principles and Practices." *IEEE Software*, Vol. 8, No. 1(1991), 32~41.

Briner, W., M. Geddes, and C. Hastings. *Project Leadership*: Gower Publishing Company, Limited, 1993.

Brooks Jr, F. P. *The Mythical Man-Month: Essays on Software Engineering, Anniversary Edition, 2/E*: Pearson Education India, 1995.

Chow, T. and D.-B. Cao. "A Survey Study of Critical Success Factors in Agile Software Projects." *Journal of Systems and Software*, Vol. 81, No. 6(2008), 961~71.

Cockburn, A. and J. Highsmith. "Agile Software Development, the People Factor." *Computer*, Vol. 34, No. 11(2001), 131~33.

Coram, M. and S. Bohne. "The Impact of Agile Methods on Software Project Management." Paper presented at the 12th IEEE International Conference and Workshops on the Engineering of Computer-Based Systems, 2005.

Couger, J. D. "Motivators Vs. Demotivators in the Is Environment." *Journal of Systems Management*, Vol. 39, No. 6(1988), 36.

De Roze, B. C. and T. H. Nyman. "The Software Life Cycle－a Management and Technological Challenge in the Department of Defense." *Ieee Transactions on Software Engineering*, Vol., No. 4(1978), 309~18.

DeCotiis, T. A. and L. Dyer. "Defining and Measuring Project Performance." *Research Management*, Vol. 22, No. 1(1979), 17~22.

DeMarco, T. *Controlling Software Projects:*

Management, Measurement, and Estimates, Prentice Hall PTR, 1986.

Dvir, D., S. Lipovetsky, A. Shenhar, and A. Tishler. "In Search of Project Classification: A Non-Universal Approach to Project Success Factors." *Research Policy*, Vol. 27, No. 9(1998), 915~35.

Fan, D. "Analysis of Critical Success Factors in It Project Management." Paper presented at the Industrial and Information Systems (IIS), 2010 2nd International Conference on 2010.

Fortune, J. and D. White. "Framing of Project Critical Success Factors by a Systems Model." *International Journal of Project Management*, Vol. 24, No. 1(2006), 53~65.

Fowler, M. and J. Highsmith. "The Agile Manifesto." *Software Development* 2001, 28~35.

Greene, W. H. *Econometric Analysis*. Upper Saddle River, New Jersey: Prentice Hall, 2000.

Hackman, J. R. and G. R. Oldham. "Work Redesign (Vol. 72)." *Reading: Addison-Wesley*, Vol. (1980).

Highsmith, J. "Agile Project Management: Principles and Tools." *Cutter consortium*, Vol. 4(2003), 1~37.

Highsmith, J. and A. Cockburn. "Agile Software Development: The Business of Innovation." *Computer*, Vol. 34, No. 9(2001), 120~27.

Holmström, H., B. Fitzgerald, P. J. Ågerfalk, and E. Ó. Conchúir. "Agile Practices Reduce Distance in Global Software Development." *Information systems management*, Vol. 23, No. 3(2006), 7~18.

Janzen, D. and H. Saiedian. "Test-Driven Development Concepts, Taxonomy, and Future Direction." *Computer*, Vol. 38, No. 9 (2005), 43~50.

Kanter, R. M. "Three Tiers for Innovation Research." *Communication Research*, Vol. 15, No. 5(1988), 509~23.

Kniberg, H. and M. Skarin. *Kanban and Scrum-Making the Most of Both*: Lulu. com, 2010.

Linberg, K. R. "Software Developer Perceptions About Software Project Failure: A Case Study." *Journal of Systems and Software*, Vol. 49, No. 2(1999), 177~92.

Lindstrom, L. and R. Jeffries. "Extreme Programming and Agile Software Development Methodologies." *Information systems management*, Vol. 21, No. 3(2004), 41~52.

Loforte Ribeiro, F. and M. Timóteo Fernandes. "Exploring Agile Methods in Construction Small and Medium Enterprises: A Case Study." *Journal of Enterprise Information Management*, Vol. 23, No. 2(2010), 161~80.

McCullagh, P. "Regression Models for Ordinal Data." *Journal of the Royal Statistical Society: Series B (Methodological)*, Vol. 42, No. 2(1980), 109~27.

Misra, S. C., V. Kumar, and U. Kumar. "Identifying Some Important Success Factors in Adopting Agile Software Development Practices." *Journal of Systems and Software*, Vol. 82, No. 11(2009), 1869~90.

Morris, Peter WG, and George H. Hough. "The anatomy of major projects: A study of the reality of project management." (1987).

Myers, M. D. "Dialectical Hermeneutics: A Theoretical Framework for the Implementation

of Information Systems." *Information Systems Journal*, Vol. 5, No. 1(1995), 51~70.

Naquin, C. E. and R. O. Tynan. "The Team Halo Effect: Why Teams Are Not Blamed for Their Failures." *Journal of Applied Psychology*, Vol. 88, No. 2(2003), 332.

Pereira, J., N. Cerpa, J. Verner, M. Rivas, and J. D. Procaccino. "What Do Software Practitioners Really Think About Project Success: A Cross-Cultural Comparison." *Journal of Systems and Software*, Vol. 81, No. 6(2008), 897~907.

Phan, D., D. Vogel, and J. Nunamaker. "The Search for Perfect Project Management." *Computerworld*, Vol. 22, No. 39(1988), 95~100.

Pinto, J. K. and S. J. Mantel. "The Causes of Project Failure." *Ieee Transactions on Engineering Management*, Vol. 37, No. 4 (1990), 269~76.

Pinto, J. K. and D. P. Slevin. *Critical Success Factors in Effective Project Implementation*. Vol. 479, *Project Management Handbook*, CRC Press, 1988.

Poon, P. and C. Wagner. "Critical Success Factors Revisited: Success and Failure Cases of Information Systems for Senior Executives." *Decision Support Systems*, Vol. 30, No. 4 (2001), 393-418.

Procaccino, J. D. and J. M. Verner. "Software Practitioner's Perception of Project Success: A Pilot Study." *International Journal of Computers.The Internet and Management*, Vol. 10, No. 1(2002), 20~30.

———. "Software Project Managers and Project Success: An Exploratory Study." *Journal of Systems and Software*, Vol. 79, No. 11(2006), 1541~51.

Purna Sudhakar, G. "A Model of Critical Success Factors for Software Projects." *Journal of Enterprise Information Management*, Vol. 25, No. 6(2012), 537~58.

Redmill, F. J. "Considering Quality in the Management of Software-Based Development Projects." *Information and Software Technology*, Vol. 32, No. 1(1990), 18~22.

Reel, J. S. "Critical Success Factors in Software Projects." *IEEE Software*, Vol. 16, No. 3(1999), 18~23.

Remenyi, D. and M. Sherwood-Smith. "Maximise Information Systems Value by Continuous Participative Evaluation." *Logistics Information Management*, Vol. 12, No. 1/2(1999), 14~31.

Rook, P. "Controlling Software Projects." *Software Engineering Journal*, Vol. 1, No. 1(1986), 7~16.

Royce, W. "The Software Lifecycle Model (Waterfall Model)." Paper presented at the Proc. WESTCON 1970.

Saarinen, T. "An Expanded Instrument for Evaluating Information System Success." *Information & management*, Vol. 31, No. 2 (1996), 103~18.

Salmeron, J. L. and I. Herrero. "An Ahp-Based Methodology to Rank Critical Success Factors of Executive Information Systems." *Computer Standards & Interfaces*, Vol. 28, No. 1(2005), 1~12.

Selin, G. "Organizational Support: Building a Framework for Project Success Pmi Seminar." 1989.

Serrador, P. and J. K. Pinto. "Does Agile Work?— a Quantitative Analysis of Agile Project

Success." *International Journal of Project Management*, Vol. 33, No. 5(2015), 1040~51.

Session, H. "Leadership in Real Time: A Model of Five Levels of Attributes Needed by a Project Manager in Erp Implementations." Vol. (2003).

Szajna, B. and R. W. Scamell. "The Effects of Information System User Expectations on Their Performance and Perceptions." *Mis Quarterly*, Vol. (1993), 493~516.

Wallace, D. "Get It Done." *Project management your most valuable tool.Success*, Vol. 30 (1990), 46~47.

Walsh, K. R. and H. Schneider. "The Role of Motivation and Risk Behaviour in Software Development Success." *Information research*, Vol. 7, No. 3(2002), 15.

Wateridge, J. "How Can Is/It Projects Be Measured for Success?" *International Journal of Project Management*, Vol. 16, No. 1 (1998), 59~63.

———. "IT Projects: A Basis for Success." *International Journal of Project Management*, Vol. 13, No. 3(1995), 169~72.

Weltz, L. "How to Implement Projects Successfully." *Software Magazine*, Vol. 9 (1989), 13.

Williams, R. "Generalized Ordered Logit/Partial Proportional Odds Models for Ordinal Dependent Variables." *Stata Journal*, Vol. 6, No. 1(2006), 58~82.

Wohlin, C. and A. A. Andrews. "Assessing Project Success Using Subjective Evaluation Factors." *Software Quality Journal*, Vol. 9, No. 1(2001), 43~70.

Wohlin, C., A. Von Mayrhauser, M. Höst, and B. Regnell. "Subjective Evaluation as a Tool for Learning from Software Project Success." *Information and Software Technology*, Vol. 42, No. 14(2000), 983~92.

Appendix. Survey questionnaire

1. Which main development methodology was used in this project?	Traditional methods (e.g., Waterfall model) Agile methods (e.g., Test Driven Development (TDD), Extreme Programming (XP), Scrum, Kanban)

Statement	Strongly Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Strongly Agree
	1	2	3	4	5
2. This project has been successful					
3. We had lack of user involvement					
4. We had lack of budget					
5. Customer's expectations were unrealistic					
6. Requirements & Specifications were constantly changed					

국문요약

애자일 방법론을 사용한 소프트웨어 프로젝트에서의 사용자 역할 분석

김블라디미르* · 조우제** · 정윤혁***

애자일 방법론은 인공지능 소프트웨어를 포함한 소프트웨어 개발 프로젝트에서 지난 몇 년 동안 널리 사용되고 있다. 이처럼 산업에서 애자일 방법론이 많이 사용되고 있음에도 불구하고, 애자일 방법론을 사용하는 소프트웨어 프로젝트의 성공 요인을 분석한 실증적 연구가 부족한 실정이다. 애자일 방법론을 사용하는 소프트웨어 프로젝트에서 고객의 역할을 이해하기 위해 사용자 참여 부족, 비현실적인 고객 기대치, 지속적인 요구 사항 변경의 고객 측 요인들이 프로젝트 성공에 미치는 영향을 조사하였다.

본 연구의 분석 대상은 애자일 방법을 소프트웨어 개발 방법론으로 사용하는 프로젝트이다. 일반적으로 소프트웨어 개발에서의 주 목표는 적은 시간과 비용으로 고품질 소프트웨어를 개발하는 것이다. 과거에는 프로젝트의 초기 단계에서 정한 고객 요구사항의 변화를 최소화하여, 그 변화에 수반되는 비용을 줄이려고 했다면, 오늘날의 프로젝트 관리에서 고객 요구사항의 변화는 고객이 원하는 시스템 개발을 위해 필수적인 것이라 인정하고 이 불가피한 변화에 보다 잘 대응하는 것이 중요하다고 볼 수 있다. 이에 효과적인 방법론으로 애자일 방법론이 많이 사용되고 있고, 본 연구에서는 이 애자일 방법론을 사용하는 프로젝트의 성공요인을 찾아내고자 한다.

본 연구를 위해 설문 방법이 이용되었다. 소셜 네트워크 사이트인 링크드인(LinkedIn)을 이용하여 소프트웨어 프로젝트 참여 경험이 있는 개발자들을 대상으로 온라인 설문을 하였고, 분석에 사용한 데이터는 213개의 응답 데이터이다. 이 설문 응답 데이터를 Ordered Logit Regression을 이용하여 세 가지 가설을 검증하였다.

분석 결과, 위 세 가지 클라이언트 측 요인들 모두가 애자일 방법을 사용하는 프로젝트의 성공에 크게 영향을 미친다는 사실을 실증적으로 찾아내었다. 첫째, 애자일 방법을 이용하기 위해서는 고객의

* 서울시립대학교
** 교신저자: 조우제
서울시립대학교
서울시 동대문구 서울시립대로 163
TEL: 82-2-6490-2258, Email: wjcho@uos.ac.kr
*** 고려대학교

프로젝트 참여가 필수적이다. 이 결과는 애자일 방법론의 이론적 효과와 일치한다. 사용자와의 협업이 애자일 방법론에서 가장 중요한 요소 중에 하나인 만큼 고객의 참여는 매우 중요하다고 볼 수 있다. 둘째, 애자일 방법이 사용된 프로젝트에서는 고객의 요구 사항을 지속적으로 변경하는 것이 부정적인 요인이 아니라 프로젝트 성공의 긍정적인 요인이라는 흥미로운 결과를 얻었다. 고객의 요구 사항을 지속적으로 변경하는 것은 클라이언트와 공급 업체 간의 빈번한 상호 작용이나 의사 소통을 통해 사용자가 진정으로 원하는 시스템을 만드는데 도움이 되어 긍정적인 요인이 된다는 설명이 가능하다. 셋째, 비현실적인 고객의 기대는 애자일 방법이 사용된 프로젝트에서도 프로젝트 성공에 부정적인 영향을 준다는 결과를 얻었다.

주제어 : 애자일 방법론, 프로젝트 성공, 프로젝트 관리, Ordered Logit Regression, 설문

논문접수일 : 2019년 5월 20일 논문수정일 : 2019년 6월 17일 게재확정일 : 2019년 8월 16일
원고유형 : 일반논문 교신저자 : 조우제

저 자 소 개

Vladimir Kim

Vladimir Kim holds a BSc in Software Engineering from Kyrgyz State Technic University in Kyrgyzstan, a MSc in Management Information Systems from University of Seoul. He is interested in Big data analysis, machine learning, deep learning and data mining.

Wooje Cho

Wooje Cho is an associate professor at the University of Seoul. He earned his Ph.D. in business administration from the University of Illinois at Urbana-Champaign. His research focuses on strategic IT investment, M&As with IT firms, and information systems quality. He has publications in journals such as Journal of Management Information Systems, Information Technology and Management, Decision Support Systems, and IEEE Transactions on Engineering Management.

Yoonhyuk Jung

Yoonhyuk Jung is an associate professor in the School of Media and Communication at Korea University in South Korea. Before joining Korea University, he was a faculty member at at Ulsan National Institute of Science and Technology (UNIST). He holds a PhD in Business Administration (Information Systems & Decision Sciences) from E. J. Ourso College of Business at Louisiana State University. His current research interests include digital media, Internet of Things (IoT), social consequences of ICT, and business analytics. His research papers have been published in *Information Systems Journal*, *European Journal of Information Systems*, *International Journal of Information Management*, *Information & Management*, *Journal of Computer-Mediated Communication*, and so on.