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Title:

A Study of IT Project Management Methodology with Agile Development

Abstract

This research is intended to create a mathematical model to properly choose the agile method in IT project, and to provide a boundary condition of the effective area of agile and a management method selection direction (management methodology). Researches have illuminated a trend of cases using a hybrid approach that uses plan driven and agile methods together, and project management organizations have been facing needs of systematic evaluation technologies to choose an appropriate management method. To address those issues, this thesis aims at presenting a fundamental mathematical model to compare the total work effort of agile with the one of plan-driven, and then at constructing a multi-parameter mathematical model to illustrate the effective area of the three methods including the hybrid approach. The originality of this research is (1) to implement a multi-parameter mathematical model to analyze effective area of management methods in conjunction with work effort, and (2) to present quantitative effective area of three methods including hybrid approach with diverse characteristics of projects. This dissertation consists of 7 chapters. Chapter 1 describes the objective and goals and structure of this research. The chapter begins with a research background around a stagnant trend of IT project success rate and challenges of agile method, and presents an importance of analyzing project characteristics of project for appropriate usage of agile method. Our literature review reveals a lack of structural causal understandings of agile method benefits and challenges. Chapter 2 presents the issue analysis result of agile method and the overall design of our models. The statistical analysis results show that agile method can reduce rework likelihood but implies the possibility that a low maturity of agile development leads lower project success rate. The case studies provide 4 model parameters: rework probability and its reduction rate, project size, and criticality of projects. Chapter 3 introduces a fundamental mathematical model to analyze the effective area of agile method. The model introduces the reduction rate of rework probability in addition to the overhead workload of iterative development (coordination cost increase compared with the overall workload of plan driven), which was pointed out by a past research. Our numerical experiments show that the bigger the reduction rate of the rework probability in each iteration is, the wider the effective area of the agile is. Besides we indicate that the effective area should be impacted significantly by the overhead workload. Chapter 4 documents a multi-parameter mathematical model by

adding the project size and criticality parameters to generate the effective areas of three methods containing the hybrid approach. Due to the increasing number of case studies, this research focuses on hybrid approach by phase. Our numerical experiments reveal that hybrid approach should be effective in projects with higher change probability and bigger size, but also indicate that the effective area of plan-driven methods should be wider in high-criticality projects. Chapter 5 validates our models with the statistical analysis via survey responses and case study with interviews. The results support our numerical experiments of effective areas of agile and hybrid presented in Chapter 3 and 4. The case study of agile method indicates that the IT system development platform and the collaboration with outsourced development partners should enhance the reduction rate of the rework probability, and that The hybrid approach is expected to provide bigger cost benefit (less work effort)as compared with the plan-driven method in larger-scale projects with uncertain requirements. Chapter 6 discusses a model use case and limitations. In initiating projects, project managers input the Likert 5 scales and numerical parameters, then analyze the agile or other methods are appropriate or not. Our model limitation is that Rework likelihood, criticality and rework attenuation rate has been calculated from the average of several Likert 5 scale inputs. Finally, Chapter 7 summarizes the conclusion in response to our research goals. It also provides the future research direction: (1) our model enhancement, (2) implementation of the model calculation tool, and (3) global comparison analysis.

Key Words
IT project, Agile, Plan-riven, Hybrid approach, Project management methodology