Project Management: Planning, Risk Management, and Agile Methodologies

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ABSTRACT

This paper introduces the history of project management. This paper introduces the changes from planning and management methods since ancient times to Agile and hybrid methods. This paper introduces some important tools, such as Work Breakdown Structure, Critical Path Method, Earned Value Management, and discusses how Agile and Scrum are used in various projects. The paper will also check the major steps of project risk management. Including discovering risks, evaluating, making response plans and paying attention to risks. The traditional method is that the project with clear content is easy to manage and predict. On the other hand, Agile's method is more suitable for uncertain and changing environment. Therefore, hybrid project management can coordinate mechanism and flexibility well. As artificial intelligence is more and more used in risk prediction, schedule optimization and resource allocation, the way of project management and the role of project manager may change again.

Keywords: Project Management; Gantt Chart; Critical Path; Risk Management; Agile; Scrum; Earned Value; PMI; PMBOK

1. INTRODUCTION

Project management refers to the application of knowledge, skills, tools and techniques in project activities to meet the requirements of the project within the prescribed scope, time, cost and quality rules. It has changed from a professional engineering field to a widely used management method. Because companies are increasingly promoting strategies through projects rather than long-term work. The Project Management Institute's (PMI) 'Guide to the Project Management Body of Knowledge' (PMBOK Guide) is now in its seventh edition. It is the most widely used project management guide in the world. About 1.4 million people in the world have the qualification of Project Management Professional (PMP). The increasing importance of project management indicates that modern companies are "projectification". That is to say, in the company's work, the proportion of work promoted not as regular repetitive work, but as temporary and scoped measures is increasing.

2. TRADITIONAL PROJECT PLANNING

2.1 Work Breakdown Structure and Critical Path

Work Breakdown Structure (WBS) is to shrink all the work of a project into a small work that can be assigned to one person, estimated time and managed. WBS, a basic planning tool for project management, includes schedule (determining work sequence and estimating time), cost estimate (adding up all the costs of each small work) and responsibility assignment (adding up all the costs of each work) of the project. Critical Path Method (CPM) was made by DuPont in 1957 for chemical plant maintenance plan. Pert (program evaluation and review technique) was introduced by US Navy Polaris in 1958. They will find a critical path to determine the project duration, or calculate a schedule float (the time when non-critical work can be delayed without delay in the whole project).

2.2 Earned Value Management

Earned Value Management (EVM) integrates the scope of work, schedule and cost results into a tracking system, which provides the strictest framework for checking and predicting the project status. EVM has three important indicators: Planned Value (PV: refers to the budgeted cost of the work planned to be completed before the situation date); Earned Value (EV: refers to the budgeted cost of the work actually completed before the date of the situation); And Actual Cost (AC: refers to the actual cost of finished work). Schedule Variance (SV = EV-PV) and Cost Variance (CV = EV-AC) measure plan and cost results; Schedule Performance Index (SPI = ev/PV) and cost performance index (CPI = ev/AC) tell

us the percentage of efficiency. In the research of Flemming and Koppelman (2010), it is found that the CPI at the end of 20% of the project is a reliable prediction value of the final project CPI. In this way, in the process of reorganization, we can find the problematic projects as soon as possible.

Table 1. Project management methodologies and their optimal contexts.

Methodology	Best Suited For	Core Principle
Waterfall/Traditional	Well-defined requirements; stable scope; regulatory compliance	Sequential phases; complete requirements before building
Agile (Scrum)	Software development; evolving requirements; fast feedback needed	Iterative sprints; customer collaboration; responding to change
PRINCE2	Large public sector projects; formal governance required	Controlled stages; product-based planning; defined roles
Kanban	Ongoing service delivery; maintenance; continuous flow work	Visualize workflow; limit WIP; pull-based prioritization
Hybrid	Complex projects with some defined and some emergent elements	Combine waterfall planning with agile execution flexibility

3. AGILE PROJECT MANAGEMENT

Agile project management originated from Agile Manifesto, which was used for software development in 2001, and was later used in various industries. More important than processes and tools are “interaction with individuals”, “software that works better than detailed documents”, “cooperation with customers is more important than negotiating contracts” and “responding to changes is more important than following plans”. As the most commonly used Agile framework, Scrum divides the work of a project into Sprints (usually 2-4 weeks). Also, Fixed activities such as Sprint Planning, Daily Standup, Sprint Review, Sprint Retrospective, Product Owner, Scrum Master, Development Team According to the 16th Annual State of Agile Report in 2022, 71% of the organizations have used Agile methods in at least some projects, and the main benefits are easier to cope with the change of priorities and faster delivery.

4. PROJECT RISK MANAGEMENT

It is said that “project risk management” is very important for successfully completing complex projects by discovering, investigating and responding to risks that may have a negative impact on project objectives. PMI’s risk management processes (risk discovery, quality assessment, quantitative analysis, response planning, monitoring) tell us a good mechanism to manage project instability. “Monte Carlo simulation” uses the probability of estimating the time required for work and simulating the schedule of the project for thousands of times. Through the probability, the completion date and cost can be predicted. Compared with critical path analysis, which only considers fixed numbers, this can better reflect the unstable situation of the project. Ways to deal with Risk include: avoiding (changing the project plan to eliminate Risk), reducing (reducing the probability and impact of occurrence), and transferring (transferring the results of Risk to other companies through insurance or contract, etc.)

5. CONCLUSION

Project management has developed a set of strict practices for planning, implementing and managing complex and temporary work in all walks of life. There is a difference in ideas between the traditional careful planning (clear project, which is easy to manage and predict) and Agile’s approach (when you don’t know much about the environment, you can respond to changes immediately). Now there are also ways to choose which approach to choose by mixing the two, which needs to be carefully considered after looking at the characteristics of the project. The restriction of “iron triangle”, that is, the scope, time and cost of the project are all related. If one is changed, the other two will be adjusted, which has always been a big topic in project management. In the future research, how to change the role of project manager by using AI project management platform (real-time risk prediction, automatic optimization plan, and resource allocation with brain)?

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