A Literature Review of Agile Development Methods in the Past Decade: Evolutionary Paths, Core Controversies, and Future Trends

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Abstract:

Nowadays, agile methodology has emerged as a core and indispensable framework for project execution across diverse industries. Beyond mere process optimization, it is a people-centric, adaptive approach that relies on continuous feedback loops and incremental delivery cycles to enable teams to respond swiftly and effectively to evolving market demands. It also consistently delivers high-quality software products that create tangible value for customers. Through systematic literature analysis and in-depth comparative research, this study systematically delineates the evolutionary trajectory of agile methodology over the past decade. It traces the methodology's expansion from initial cross-role collaboration within small teams to enterprise-wide adoption across entire organizational ecosystems. The study further identifies core controversies in its practical implementation, clarifies context-specific applicable scenarios, and offers forward-looking projections of its future development trends. This study reveals that agile methodology has undergone a distinct evolution over the past decade—shifting from cross-role collaboration (2014–2018) to enterprise-wide extension (2019–2024)—with core controversies centered on cross-scenario adaptability, integration with emerging technologies, and ethical risks, while its future will move toward in-depth AI integration and cross-industry full-domain adaptability, and enterprises need to balance agility and structure for effective agile transformation.

Keywords: Agile Methodology, Enterprise Transformation, Evolution Trend, Practical Guidance

1. Introduction

Over the past decade, agile methodology has transitioned from widespread adoption to in-depth implementation, breaking down domain barriers and finding applications in enterprises across various fields. However, practical challenges, such as contradictions in technological integration, have become increasingly prominent. Existing research remains fragmented and lacks a comprehensive overview of agile's evolutionary trajectory. By examining its evolutionary path, core controversies, and future trends, this paper analyzes the characteristics and risks of agile methodology, aiming to provide a systematic reference for subsequent research. This paper adopts literature analysis and comparative methods to explore the evolutionary path of agile methodology. It examines agile's advantages, characteristics, and impacts of agile, identifies core controversies and adaptive scenarios, and finally proposes solutions and future trends. By contextualizing agile's evolution from technical collaboration to organizational penetration over the past decade, this paper integrates cross-domain controversial perspectives and technological integration paths to form a systematic analytical framework. To address key pain points in agile transformation, such as "difficulty in scenario adaptation" and "hindered technological integration", the study extracts reusable adaptation strategies by integrating practical cases across multiple industries, providing clear actionable guidances for enterprises in different fields. Meanwhile, by projecting future trends, it helps enterprises proactively mitigate risks in intelligent iteration, build organizational-level agile capabilities, and effectively enhance their responsiveness and competitive advantages in dynamic markets.

2. The Evolution Path of Agile Methodology in the Past Decade

2.1 The Division of Agile Methodology into Two Phases in the Past Decade

In contrast to the Waterfall Model, characterized by "linear progression, fixed phases, and upfront locking of requirements", agile development has gradually evolved into the mainstream paradigm for global software development. Its core advantages of rapid delivery, high user engagement, and efficient output drive this status. Moreover, a growing number of cross - industry enterprises (such as automobile manufacturers, banks, and game companies) have adopted it within their teams. The development of agile development can be divided into the Agile 2.0 and Agile 3.0 phases. This version numbers is concise and clear, and aligned with software engineering principles.

2.2 The Agile 2.0 Phase

The Agile 2.0 phase (2014–2018) marked an expansion period, during which agile development evolved from single-team practice to cross-role collaboration. As the complexity of software delivery increased, the limitations of traditional agile, focusing solely on development, became prominent, and the DevOps concept gained rapid traction. DevOps integrates concepts and practices of software development and operations. It establishes an automated pipeline from code submission to production deployment, further optimizing the software delivery process [1]. Meanwhile, agile was combined with Lean Startup thinking. This integration uses a "Minimum Viable Product (MVP)" to validate requirements and reduce waste. The core goal is to address "agile delivery efficiency" through technology and process collaboration, Outcomes of this phase were widely adopted in the Internet and technology industries.

2.3 The 3.0 Phase of Agile Development

Agile 3.0 (2019–2024) is a phase where agile extends beyond technical teams to encompass entire enterprise. Driven by the digital transformation needs in large enterprises and traditional industries, large-scale agile frameworks (e.g., SAFe and LeSS) have become increasingly mature. These frameworks facilitate agile adoption across enterprises in various fields and enable cross-departmental collaboration. In 2019, Xiaomi established an HR project team and initiated the practice of agile development. The team adopted a 4-week iteration cycle and advanced work through daily standups, kanban boards, iteration demos, and retrospective meetings. This approach not only enabled deep business stakeholder participation and timely feedback but also significantly improved R&D efficiency[2]. Delivered products thus became more aligned with customer needs. In collaborative process, agile coaches serve as key roles in agile transformation. They act as a mirror for teams, responsible for identifying internal issues, fostering members' agile thinking and capabilities, and supporting the development of the team's agile culture [3].

3. Core Controversies of Agile Methodology

3.1 Adaptability in Cross-scenario Applications

3.1.1 Uncertainty Arising from Requirement Objectives

To clarify the popularity and core application scenarios of agile methodology, this paper refers to the authoritative

ten-year agile status report released by Atlassian, an industry leader. The report covers agile maturity, trends and transformation benchmarks. It also offers new insights into collaboration among people, processes, and technology and compares data from recent literatures based on "industry application proportion".The report indicates that in recent years, the adoption rate of agile's core frameworks has risen sharply from 58% to 87%. A total of 81% of organizations have adopted Scrum or the hybrid model of "Scrum + Kanban", while the adoption rate of the SAFe scaling framework has reached 35%. Essentially, its characteristics of short iterations and high-frequency feedback enable dynamic responses to requirement fluctuations. However, its drawbacks are equally notable. When applied to scenarios with highly uncertain requirement objectives, agile methodology is prone to "frequent changes". As many as 32% of organizations have reported resource waste resulting from frequent iteration plan adjustment. Another 28% of teams have experienced uncontrolled delivery scope due to ambiguous requirement boundaries. Additionally, non-technical departments confront greater constrains from policies and industry regulations regarding requirement objectives, with rigid restrictions underlying such uncertainties. These organizations report that agile's principle of "embracing changes" conflicts with compliance requirements, leading to suboptimal practical outcomes.

Although agile methodology is currently a mainstream development method, it still confronts challenges in cross-scenario applications. For instance, when applied to embedded system development, it often proves difficult to achieve user-intensive participation in testing [4]. Another example is AI-related projects, which feature vague requirements that need adjustment according to user data feedback.

3.1.2 Excessively Long Project Cycles

The completion cycle of some projects can span months, significantly longer than agile's iteration cycle. Moreover, delivering a "Minimum Viable Product (MVP)", a core practice in traditional agile, may not be feasible. Agile methods may thus not be an optimal choice. For example, infrastructure projects, such as the construction of large data centers or large-scale network deployment typically involve clear planning and long-term implementation cycles. Such projects require extensive preliminary planning and resource preparation, involving close collaboration among multiple departments and professionals. Due to their large scale and high complexity, frequent requirement changes and iterative development are impractical. Similarly, AI model training projects often have development cycles spanning months. These projects require extensive data preparation, large-scale training, and repeated

parameter tuning. Such processes conflict with agile's core logic of short iterations. Additionally, AI model training is susceptible to interruptions from issues such as insufficient computing power and system failures, requiring long-term stability guarantees. It therefore cannot adapt to agile's model of rapid delivery and flexible adjustment.

3.2 Contradictions between Technological Integration and Ethics

3.2.1 Integration Contradictions

Beyond the aforementioned incompatibility between AI and agile methodology, hardware delivery in software-hardware integration scenarios may also conflict with agile's short cycles. Hardware production must comply with strict regulatory standards, yet iterative changes in agile methodology may violate these requirements.

3.2.2 Security Issues Caused by Overly Short Iteration Cycles

Agile's focus on rapid delivery may prompt teams to reduce testing time, overlook code refactoring, and prioritize iterations over code quality. While this can meet delivery goals in the short term, it increases long-term maintenance costs and product risks. Although automated testing and continuous integration can balance rapid delivery and code quality, ethical conflicts remain unavoidable in practical implementation.

4. Future Trends of Agile Methodology

4.1 In-depth Integration of Agile and AI

Agile is upgrading its iterative logic with AI technology support. In requirement management, Tencent's CodeBuddy IDE enables the application prototypes generation through natural language. Agile teams can quickly verify the feasibility of the "Minimum Viable Product (MVP)" during Sprint planning phase, avoiding iterative rework from ambiguous requirements. In the implementation phase of development, AI tools like GitHub can automatically generate code snippets. With AI handling this work, teams can focus on business logic design. This aligns with agile's essence of focusing on value delivery. For risk control, AI modules can analyze code changes in real time, issue early warnings about technical debt risks, assist teams in timely iterative adjustments, and reduce delivery failures.

4.2 Breaking Down Barriers and Achieving Full-domain Adaptability

Agile will no longer be confined to software teams. It will evolve into a cross-industry and organizational-wide

working mode. For example, In the automotive sector, by virtue of the in-depth integration of agile development methodologies and artificial intelligence, Marelli can transform a concept into a Minimum Viable Product (MVP) in just 90 days. It launches up to 20 "MVPs" annually for market validation, using physical components to quickly test ideas and concepts, evaluate user experience, and rapidly assess the scalability potential of solutions [5]. McDonald's China Co., Ltd. has adopted the PPSS agile methodology. It conducts Program Increment (PI) planning every three months to align with its overall strategy and then achieves rapid delivery through two-week Sprints. More than 40 Scrum teams have collaborated to implement this methodology collaboratively, achieving large-scale agile transformation. These cases provides strong evidence of agile's adaptability across industries and fields.

5. Conclusion

This study systematically concludes that agile methodology has undergone a distinct evolution over the past decade, evolving from "cross-role collaboration (2014-2018)" to "enterprise-wide extension (2019-2024)". Since 2019, driven by large enterprises' digital transformation demands, agile has transcended team boundaries, expanding into cross-departmental, cross-business-unit, and organizational-wide ecosystems to enable unified agile governance and collaborative innovation.

Currently, core controversies surrounding agile center on three key aspects. Cross-scenario adaptation: how to tailor agile principles to fields with distinct regulatory and business characteristics; integration with emerging technologies: effectively integrating agile with cloud computing, big data, and other technologies while preserving its flexibility; ethical risks: including data privacy protection, responsible AI application, and labor intensity distribution during iterations.

Looking ahead, agile will advacne toward in-depth AI integration and cross-industry full-scale adaptation. AI is expected to optimize key stages in agile processes, improving decision-making efficiency. Meanwhile, agile will

break down industry barriers to develop specialized, customized implementation frameworks.

It is crucial to emphasize that agile is not a universl "one-size-fits-all solution". For large-scale software projects with complex requirements, long cycles, and strict quality standards, mechanical application of traditional agile is impractical. Enterprises should strike a balance between agility and structure, retaining its advantages in rapid customer response, efficiency improvement, and market competitiveness, while integrating standardized processes to effectively control risks and ensure stable product quality throughout the lifecycle.

This study's systematic analysis of agile's evolution, core controversies, trends, and proposed strategies provides practical reference for enterprises' agile transformation and lays a theoretical foundation for subsequent research.

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