Agile Project Management in Government Software Development: Addressing Challenges in Education Public Policy

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Abstract: This article explores adopting Agile project management practices in developing government software solutions, specifically focusing on Brazil's National Textbook Program (PNLD). The PNLD is a cornerstone public policy initiative that ensures the distribution of millions of educational resources to public schools, addressing dynamic requirements and engaging diverse stakeholders. This study identifies the complexities of managing public policy-driven software projects through comprehensive case study research involving document analysis and interviews with project managers and stakeholders. Key challenges include aligning functionalities with user needs, improving communication between developers and users, and fostering iterative feedback processes. The findings reveal that while Agile practices have positively influenced the project's efficiency and adaptability, critical gaps remain in addressing requirements and stakeholder collaboration volatility. Based on these insights, the article proposes a set of good practices tailored to enhance Agile project management in similar contexts. These practices aim to improve responsiveness, stakeholder engagement, and process scalability, contributing to successfully implementing dynamic and multifaceted government policies.

1 INTRODUCTION

Government policies shape society by providing services, ensuring equity, and fostering development (Mehr et al., 2024; Nayyar and Malhotra, 2023; Achmad, 2024). Effective computational solutions are essential for managing, monitoring, and optimizing these policies (Maksimova et al., 2022; Lima and Ciasca, 2020), enabling efficient resource allocation and data-driven decision-making.

Public policy implementation is complex due to multiple stakeholders (Balane et al., 2020; Silva et al., 2024a). Government agencies administer policies, beneficiaries receive services, and oversight bodies ensure compliance. This ecosystem demands coordination, transparency, and accountability, posing challenges for software development (Bose et al., 2020).

Public education policies present unique challenges. Their business rules are intricate, frequently changing, and must address diverse stakeholder needs (Silva et al., 2024a; de Fatima Silva et al., 2024). Developing software for these policies requires adaptability to volatile requirements while maintaining compliance with regulations.

Project management is crucial in software development, ensuring structured planning, resource allocation, and stakeholder communication (Alqahtani et al., 2024; Silva et al., 2024b). It minimizes risks, aligns efforts with objectives, and enhances product quality (Zada et al., 2023). Iterative feedback fosters continuous improvement, refining processes and outcomes to meet stakeholder expectations.

This article examines how Agile project management supports government software for public education policies, focusing on a case study of the National Textbook Program (PNLD). It explores challenges, solutions, and Agile's impact on project efficiency and adaptability. Additionally, it proposes good practices for handling volatile requirements, diverse stakeholders, and operational complexities.

The article is structured as follows: Section 2 reviews Agile project management in government software. Section 3 presents the PNLD case study. Section 4 details the methodology, findings, and challenges. Section 5 proposes good practices. Section

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6 concludes with future research directions.

2 RELATED WORK

This section analyzes the state of the art regarding the use of Agile project management in developing government solutions, exploring how Agile practices have been adopted to address the challenges of public sector projects.

2.1 State of the Art Analysis

This section reviews ten state-of-the-art articles on project management in public policy and agile development in software engineering, highlighting their contributions. These studies explore agile methodologies in various contexts, including the public sector, assessing their impacts at individual, organizational, and social levels. The comparative analysis identifies key convergences and divergences that enhance understanding of the topic.

A central theme is the structure of agile methodologies, particularly Scrum. The (Ciancarini et al., 2024) study proposes adapting public administration, introducing new roles and a sector-specific model to address its complexities.

Challenges in agile implementation, especially requirement volatility (RV), are also discussed. The (Mohammad and Kollamana, 2024) study identifies six causes of RV and three mitigating agile practices, emphasizing communication, stakeholder involvement, and requirement clarity. Similarly, (Dingsøyr, 2024) highlights stakeholder participation, functional breakdown, and continuous communication as essential to managing RV effectively. These studies reveal that agile methodology extends beyond tools and practices, requiring institutional and human considerations for project success.

The impact of agility on organizations is also analyzed, particularly in culture, collaboration, efficiency, and value creation. The (Baxter et al., 2023) study examines agile practices' interaction with institutional orders, revealing tensions, transformations, and improved collaboration. Corroborating this, (Firdaus and Mulia, 2024) explores how agility is shaped by institutional dynamics, showing its adaptation is non-linear and culturally influenced.

The (Adeyinka et al., 2023) study quantitatively assesses agility's impact on IT teams' well-being, linking agile practices to job satisfaction, stress, psychological safety, and engagement. In this regard, (I Kennedyd et al., 2024) further investigates how these elements influence project success.

Value creation is another key topic, distinguishing between functional, personal, relational, and ideological values. The (Neumann et al., 2024) study examines agility's impact on public administration efficiency, work quality, motivation, and well-being, stressing the alignment of agile practices with organizational and individual needs.

Adapting agile methodologies is crucial. While some articles focus on frameworks like SAFe, others emphasize customization to organizational needs (Sánchez and Macías, 2019; van Wessel et al., 2023), recognizing flexibility as vital for success.

Overall, agile methodologies can benefit both public and private organizations if properly implemented. Effective management involves addressing requirement volatility, adapting methods to context, balancing institutional tensions, and prioritizing communication and collaboration. The next section will further analyze these studies, highlighting recurring themes.

2.2 Discussion

The comparative analysis of the related works highlights distinct contributions across three dimensions: Agile Methods Application, Focus Area, and Article Proposal, as illustrated in Table 1.

In Agile Methods Application, most articles focus on project management and software development, emphasizing Agile's role in improving coordination, flexibility, and delivery. However, fewer studies explore Agile in the public sector, revealing a research gap in adapting these methodologies to governmental challenges, including bureaucracy, regulations, and stakeholder complexities.

The Focus Area dimension covers diverse priorities, notably requirements engineering, agile scaling, and IT team well-being. Requirements engineering is central, ensuring Agile projects meet evolving needs and stakeholder expectations. Agile scaling addresses challenges in large, distributed teams, while IT team well-being is recognized as crucial for project success, emphasizing psychological safety and support. These varied themes underscore Agile's broad impact.

The Article Proposal dimension highlights innovative contributions. Some studies adapt Agile practices to different contexts, while others examine its organizational impact on value creation and team well-being. Additionally, best practices for requirements engineering and Agile processes offer actionable strategies for improving project outcomes. These insights reflect Agile research's evolving nature and relevance across public policy and software engineer-

Table 1: Comparative Analysis of Related Works.

Related Work		[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]
Agile Methods Application	Project Management	●	●	●	●	●	●	●	●	●	●
	Agile Development Method	●	○	●	●	○	●	●	○	●	●
Focus Area	Agile in the Public Sector	●	●	●	●	●	○	○	○	○	○
	IT Team Well-Being	○	○	○	○	○	●	○	○	○	●
	Requirements Engineering	○	○	○	○	○	○	●	●	○	○
	Agile Scaling	○	○	○	○	○	○	○	○	●	○
Article Proposal	Definition and Adaptation	●	○	●	●	●	●	○	○	●	○
	Implementation Challenges	○	○	○	○	○	○	●	●	○	○
	Impact on Organizations	●	●	●	○	●	○	○	○	●	○
	Value and Well-being	○	●	○	○	●	●	○	○	○	○
	Requirements Engineering	○	○	○	○	○	○	●	●	○	●
	Best Practices Proposal	○	○	○	○	○	○	○	●	○	○

Note: [1] = (Baxter et al., 2023); [2] = (Neumann et al., 2024); [3] = (Ciancarini et al., 2024); [4] = (Dingsøyr, 2024); [5] = (Firdaus and Mulia, 2024); [6] = (I Kennedyd et al., 2024); [7] = (Mohammad and Kollamana, 2024); [8] = (Sánchez and Macías, 2019); [9] = (van Wessel et al., 2023); and [10] = (Adeyinka et al., 2023).

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3 CASE STUDY OF A GOVERNMENT SOFTWARE PROJECT

Educational public policies drive socioeconomic development by ensuring equitable access to quality education and fostering citizenship. These policies comprise government-led guidelines, programs, and actions that address educational needs inclusively, recognizing education as a fundamental right and a catalyst for sustainable growth.

In Brazil, education is a constitutional right, with policies like the National Education Plan (PNE) guiding actions to expand access, enhance quality, support educators, and reduce inequalities. Among these, the National Program for Textbooks and Teaching Materials (PNLD) is a key initiative providing millions of public school students with high-quality educational resources. Managed by the Ministry of Education (MEC) and the National Fund for Educational Development (FNDE), the PNLD oversees the acquisition, evaluation, distribution, and monitoring of textbooks, requiring coordination among multiple stakeholders.

The PNLD follows structured phases: public notice and bidding, pedagogical evaluation, acquisition and production, distribution, and monitoring. The pedagogical evaluation phase ensures that submitted materials align with national curricular standards, emphasizing quality, cultural relevance, and inclusivity. Committees of experts assess materials, provide feedback for revision, and approve final selections for school adoption.

Since 2020, the pedagogical evaluation has undergone digital transformation to enhance efficiency, transparency, and adaptability. This shift involves software integration, process redefinition, and cultural adjustments to meet evolving policy demands. Given the program's complexity, involving government bodies, educators, and publishers, digital tools aim to improve collaboration and expedite evaluations without compromising quality.

Managing large-scale public policy projects like the PNLD presents challenges due to fluctuating requirements, regulatory constraints, and stakeholder diversity. Effective management requires technical expertise, strategic methodologies, and adaptability to dynamic conditions. Agile project management emerges as a viable approach, facilitating iterative processes, risk mitigation, and stakeholder alignment.

This study examines Agile project management's impact on the PNLD, proposing good practices for government projects facing similar complexities. These strategies address changing requirements, multistakeholder collaboration, and the need for iterative development, offering a framework for successful public policy implementation.

4 EXAMINING PROJECT MANAGEMENT IN THE PNLD

This section outlines the methodology used to investigate the application of Agile project management in the PNLD case study and presents the key challenges

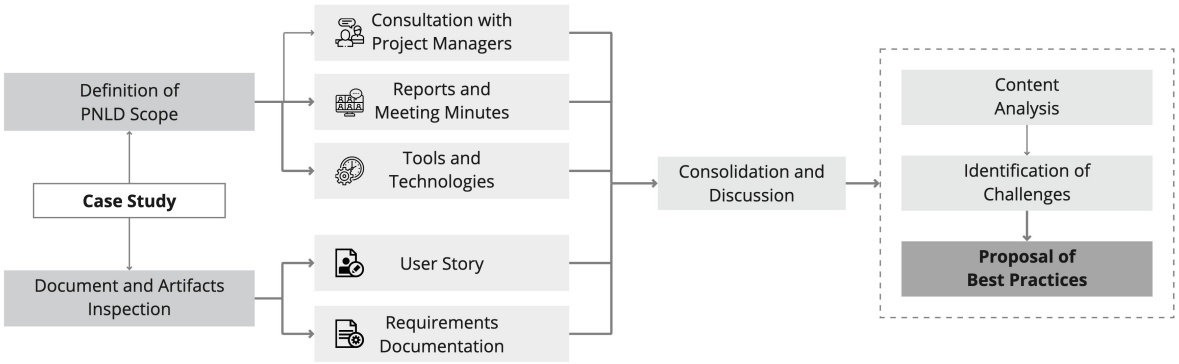

Figure 1: Methodological Approach.

identified in managing such a complex public policy-driven initiative.

4.1 Investigation Methodology

The methodology adopted in this study, as shown in Figure 1, considered a detailed and structured analysis of the scenario described in Section 3. The first step was to define the scope of the PNLD to understand the organizational structure, processes and activities surrounding the project. It was also possible to list the management tools used, identify stakeholders and team structure, and the practices surrounding planning and execution.

This was followed by inspecting documents and artifacts generated throughout the software life cycle. This activity provided a solid base of data and information, including formal records such as meeting minutes, reports, user stories, requirements documentation, and an assessment of the tools and technologies employed in the study context. Data collection is therefore divided into different sources and perspectives:

- **Reports and Minutes of Meetings:** Extraction of information documented in official reports and records of meetings related to the PNLD process.
- **Tools and Technologies:** Identification of tools and technologies used in the PNLD context to support operations and activities.
- **User Stories:** Collection of narratives that express the needs, expectations and challenges faced by users of the system.
- **Requirements Documentation:** Compilation of functional and non-functional requirements identified during the document analysis and scope study.

To further enrich the results obtained, we consulted directly with project managers and area leaders to answer questions and get a perspective from the professionals who work directly in the planning and execution of the PNLD. After collection, all the data gathered was integrated and discussed to identify patterns, gaps and points for improvement in the PNLD process and scope. In order to consider the data obtained from managers and leaders, a content analysis was adopted to structure and relate them to the perceptions obtained in the previous phases and thus identify the problems and challenges that hinder the achievement of the objectives defined in the scope.

Finally, considering all the analysis results, a set of recommendations was proposed to be adopted at the project management level to mitigate the challenges identified and improve processes and activities throughout the life cycle.

4.2 Results and Discussion

Since 2020, the pedagogical assessment phase has undergone digital transformation to enhance efficiency and adaptability. This shift involves software integration, process redefinition, and cultural adjustments to meet evolving policy demands. Agile project management practices have been adopted to streamline operations, but challenges remain in achieving program objectives.

A key complexity in pedagogical evaluation is the dynamic nature of each program cycle, requiring interaction with external systems and multiple stakeholders. Each evaluation demands specific configurations outlined in the calls for proposals, making software development highly intricate. This process involves complex architecture, extensive requirements, and ongoing stakeholder collaboration.

Given the fluid nature of the evaluation process, specifications must be continuously revised to accommodate changes in program guidelines. However, discrepancies arise between end-user needs and development team interpretations. To address this, the project

follows a structured routine of periodic meetings, ensuring an organized and adaptable workflow. Table 2 details the meeting types, participants, and objectives.

Table 2: Periodic Meetings.

Meetings	Stakeholders
Internal Alignment	Project Managers
Checkpoint	Project Managers, Requirements Engineers, Client, Project Coordinators and UX Designer
Demand Tracking	Project Managers, Developers, Database Administrators, Requirements Engineers, and UX Designer
Integration	Project Managers, External Partner, Client and Project Coordinators
Business	Project Managers, Requirements Engineers, UX Designer, Coordination
Requirements	Project Managers, Requirements Engineers, UX Designer

- **Internal Alignment Meeting:** Brings project managers together to organize internal activities, ensuring that teams know priorities and challenges.
- **Checkpoint Meeting:** Involves a broader team - including managers, requirements engineers, clients, coordination, and UX designer - to update the client on the progress of the demands under development and welcome their feedback, promoting transparency and engagement.
- **Demand Monitoring Meeting:** It focuses on technical progress, with the participation of developers, database administrators, and other technical team members, allowing the identification of obstacles and necessary adjustments.
- **Integration Meeting:** Enlarges collaboration by including external partners and coordination, fostering the inclusion and alignment of all parties involved in the PNLD Evaluation project.
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- **Requirements Meeting:** It is a space dedicated to analyzing and defining system functionalities, always focusing on the client's needs and the project's objectives.

Weekly meetings, sometimes held more frequently, ensure continuous communication, rapid issue resolution, and efficient decision-making—key principles of agile projects. This structured approach enhances development success and stakeholder satisfaction.

To better understand team interactions, project managers were consulted, revealing critical insights. Initially, a traditional management approach with rigid processes and long deadlines hindered adaptability, limited communication, and caused role ambiguity, reducing efficiency.

With the shift to Scrum-based agile methods, the project adopted flexible, iterative cycles focused on incremental deliveries and continuous improvement. Regular meetings and feedback improved alignment and problem-solving, while short Sprints enabled quick adjustments and added immediate value.

Technological tools further supported workflow management. Monday.com streamlined task tracking, and GitLab facilitated version control, enhancing collaboration and ensuring timely, high-quality deliveries.

Based on these issues, the main challenges faced in software development have been identified, which are detailed and analyzed in the following section.

4.2.1 Challenges Identified

Through discussions with project managers, various challenges were identified, encompassing technical, functional, and organizational aspects of system development. These challenges highlighted issues such as aligning functionalities with users' real needs, the system's efficiency and impact on daily operations, technological and functional constraints, and difficulties related to communication, collaboration, and adopting Agile practices. These challenges were thoroughly analyzed from the managers' perspectives, providing detailed insights into the primary obstacles encountered. This analysis served as the foundation for proposing a set of best practices aimed at enhancing project management effectiveness.

- **Matching Functionalities to Needs:** The managers stressed that, due to the dynamism of the project, although the system used meets professional needs, with relevant functionalities aligned with daily work, there is still a considerable frequency in which functionalities become insufficient, obsolete or do not fully meet expectations.
- **Communication and Collaboration:** Communication failures between developers and users were highlighted, resulting in functionalities that do not meet real demands.

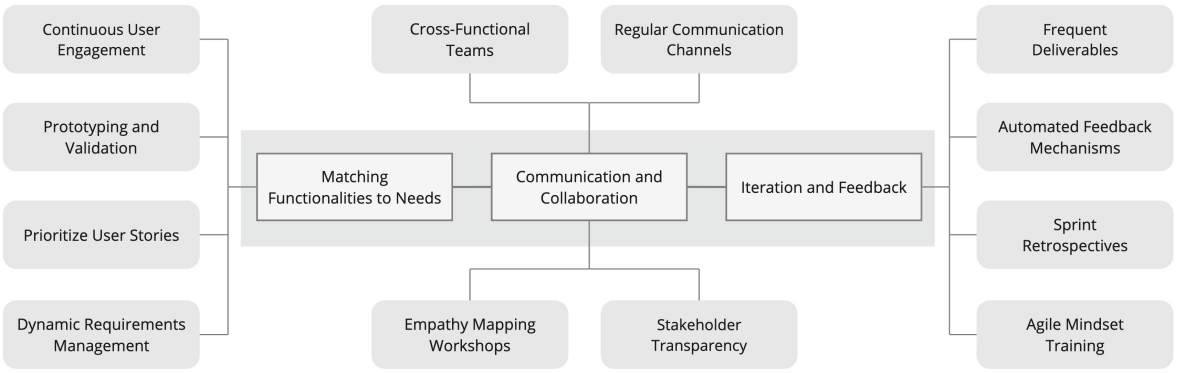

Figure 2: Good Practices Proposal.

- **Iteration and Feedback:** They pointed out that, although agile practices are adopted, development still seems to follow a traditional model, with little room for changes based on continuous feedback.

5 GOOD PRACTICES PROPOSAL

The good practices proposal builds on case study research, including stakeholder interviews and process analyses. The study identified strengths, challenges, and impacts of current methodologies, revealing areas for improvement.

Government projects supporting public policies are inherently complex, requiring adaptable management to handle evolving requirements, regulations, and diverse stakeholders. While agile methods have improved processes, gaps remain in managing volatility, enhancing collaboration, and scaling practices.

To address these issues, we propose a set of good practices (Figure 2) aimed at optimizing project management in dynamic, multi-stakeholder public policy initiatives.

- **Matching Functionalities to Needs**

Continuous User Engagement: Establish regular check-ins with end-users to ensure functionalities align with their evolving needs. This can include biweekly review meetings or user surveys.

In the PNLD context, maintaining proximity to diverse end-users is essential. Regular check-ins via usability surveys, workshops, and online consultations ensure continuous engagement, even with remote users, and help minimize obsolete functionalities.

Prioritize User Stories: Use a well-maintained backlog where user stories are detailed, prioritized, and refined with direct input from stakeholders.

The PNLD evaluation platform's backlog should efficiently manage requirements, balancing tasks based on dynamics, changes, urgency, and stakeholder perspectives. Involving stakeholders ensures collaborative refinement, focusing updates on the most relevant needs.

Prototyping and Validation: Develop prototypes or Minimum Viable Products (MVPs) for critical functionalities, allowing users to validate features early in development.

Although the PNLD uses agile practices, it still follows traditional methods that make users reactive. Prototypes or MVPs for critical features, like the publisher submission interface, should be tested and validated before release. Defining testing phases for functionality and usability is key to improving efficiency and reducing errors.

Dynamic Requirements Management: Incorporate tools like Kanban boards or backlog grooming sessions to handle changes effectively and keep functionalities relevant.

The PNLD operates in a dynamic context with frequent changes. Kanban boards can be used for real-time task monitoring and priority adjustments. Regular backlog refinement sessions can incorporate feedback, ensuring agile adaptation to new demands and mitigating requirement volatility.

- **Communication and Collaboration**

Cross-Functional Teams: Foster collaboration by involving developers, users, and stakeholders in sprint planning and review meetings.

The PNLD lifecycle's complexity affects the public policy and its supporting systems. Collaboration in sprint planning and review meetings is essential to incorporate diverse perspectives. Enhancing teamwork with cross-functional teams is key to optimizing processes and improving deliverables.

Regular Communication Channels: Set up structured yet flexible communication tools like Slack

or Microsoft Teams for instant feedback and issue tracking.

Establishing structured communication channels is crucial for managing the dynamic nature of the PNLD and its diverse stakeholders. Tools like Slack or Microsoft Teams can enhance the flow of information between teams and end-users, enabling quick feedback, issue tracking, and real-time discussions on adjustments.

Empathy Mapping Workshops: Conduct sessions to better understand user pain points and expectations, helping developers align their work with user demands.

Understanding operational and end-user perspectives is key to identifying challenges with the evaluation platform. Workshops can help uncover difficulties and disengagement, ensuring the platform aligns with users' needs. For the PNLD, listening networks are essential to align user demands with developer priorities.

Stakeholder Transparency: Maintain visible dashboards to share progress and decisions with all stakeholders, reducing miscommunication.

Maintaining visible dashboards that share progress and key decisions with PNLD stakeholders promotes transparency, optimizes decision-making, and adds value to project management. For example, a dashboard showing update statuses ensures stakeholders know what to expect and when, reducing communication issues.

- **Iteration and Feedback**

Frequent Deliverables: Break down deliverables into smaller increments with shorter iteration cycles (e.g., 1-2 week sprints) to enable frequent reviews and feedback.

Adopting strategies that keep pace with the PNLD's dynamic needs helps reduce errors and ensures the system adapts quickly to real-world usage. This approach aligns functionalities with educators' expectations, minimizes outdated features, and enhances stakeholder trust through consistent progress and short-cycle value delivery.

Automated Feedback Mechanisms: Use tools to collect user feedback continuously, such as feedback widgets integrated into the system or surveys post-deployment.

Integrating automated feedback mechanisms in PNLD Evaluation can provide insights into how users interact with the platform. Features like a feedback widget and post-implementation surveys allow users to express satisfaction and highlight areas for improvement.

Automated usage analysis can reveal patterns, such as difficulty finding information or long wait times, helping the development team identify issues. This data-driven approach fosters continuous improvement, ensuring the platform meets user needs effectively.

Sprint Retrospectives: Conduct thorough sprint retrospectives, focusing on lessons learned and improvements for the next cycle, to enhance the quality of feedback.

Sprint retrospectives in PNLD Evaluation help improve software features by aligning solutions with user needs and program objectives. They provide opportunities to discuss usability, plan enhancements, and incorporate feedback, ensuring efficient, intuitive, and user-aligned development.

Agile Mindset Training: Educate teams on adopting an iterative mindset, emphasizing adaptability and openness to feedback-based change.

Building an agile organizational culture is crucial for optimizing the development cycle of the evaluation platform. It helps adapt to dynamic needs and promotes solutions that focus on stakeholders. Continuous team training, collaborative problem-solving, and emphasis on user value are key to this mindset.

In the PNLD Evaluation context, this approach boosts team collaboration, improves development efficiency, and enhances the program's responsiveness to user demands, leading to a better experience aligned with educational goals.

6 CONCLUSIONS

This study investigated the application of Agile project management practices in developing and managing government software solutions, using the National Textbook Program (PNLD) as a case study. PNLD exemplifies the complexity of public policy-driven projects, where dynamic requirements, diverse stakeholders, and large-scale operations demand adaptable and efficient methodologies. We identified significant challenges through detailed analyses and interviews, including aligning system functionalities with user needs, addressing communication gaps, and fostering a truly iterative feedback process.

While evidence demonstrates that adopting Agile practices has brought improvements, particularly in process efficiency and adaptability, persistent gaps highlight the need for more focused interventions. These gaps underscore the importance of continuous user engagement, transparent communication, and iterative feedback mechanisms to ensure that the solutions developed remain relevant and impactful.

To address these issues, this article proposed a set of good practices designed to mitigate the identified

challenges and enhance Agile project management in similar contexts. By adopting these practices, government projects can better navigate the inherent complexities of public policy initiatives, improving outcomes and delivering value to stakeholders. Future research should explore the longitudinal impacts of these practices to refine methodologies further and contribute to the broader discourse on Agile practices in government software projects.

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