



Agile Implementation in Digital Transformation Projects of Public Sector Organizations

Mahdi Noormohammad Khales^{1*}, Mohammad Baradaran²

¹Master of Science (M.Sc.) in Information Technology Management, Islamic Azad University, North Tehran Branch, Tehran, Iran

²Assistant Professor, Department of Information Technology Management, Islamic Azad University, North Tehran Branch, Tehran, Iran

Article info

Received: 10.02.2026

Accepted: 30.05.2026

Available Online: 09.06.2026

Checked for Plagiarism: Yes

Keywords:

Agile Methodology; Digital Transformation; Public Sector; E-government; Bureaucratic Adaptation.

ABSTRACT

The integration of agile methodologies into digital transformation initiatives within public sector organizations represents a critical yet challenging endeavor in contemporary governance. This article examines the paradoxical relationship between Agile principles emphasizing flexibility, iterative delivery, and self-organizing teams and the inherently bureaucratic nature of public administration, characterized by hierarchical structures, rigid procurement frameworks, and risk-averse cultures. Through a systematic synthesis of empirical studies published between 2014 and 2025, this research identifies four primary categories of implementation challenges: institutional and regulatory barriers, procurement and contractual misalignments, cultural and resistance factors, and resource and capability constraints. The findings reveal that while agile adoption can significantly enhance transparency, responsiveness, and citizen-centered service delivery, successful implementation requires fundamental adaptations rather than wholesale methodological transplantation. A multidimensional framework proposed, integrating legal-procedural adaptations, hybrid governance models, tailored procurement mechanisms, cultural transformation strategies, and iterative implementation roadmaps. This research contributes to both public administration theory and digital government practice by providing evidence-based guidance for navigating the inherent tensions between agility and accountability in democratic governance contexts.

Introduction

The digital transformation of public sector organizations has emerged as a global priority, driven by escalating citizen expectations for efficient, transparent, and responsive digital services, alongside the imperative to optimize operational expenditures and enhance democratic accountability. Governments worldwide have invested substantially in e-government initiatives, digital service platforms, and data-driven governance infrastructures, recognizing that technological modernization is inseparable from broader administrative reform.

However, the successful realization of digital transformation objectives remains profoundly elusive, with a substantial proportion of public sector information technology projects experiencing cost overruns, schedule delays, functionality

deficiencies, or outright failure. Traditional project management approaches, particularly the waterfall methodology that has dominated government contracting for decades, have proven systematically inadequate for the uncertainty, complexity, and rapid technological evolution characterizing contemporary digital initiatives.

The waterfall methodology, with its sequential phases of requirements specification, design, implementation, testing, and deployment, assumes that requirements can be fully articulated prior to development and remain stable throughout the project lifecycle. This assumption rarely holds in digital transformation contexts, where user needs evolve, technological capabilities advance, and policy environments shift dynamically. The consequences of this misalignment are well documented: prolonged development cycles

*Corresponding Author: Mahdi Noormohammad Khales (Khales@email.com)

¹ Email: Dr.Baradaran@iaua.ac.ir

producing obsolete solutions upon delivery, substantial rework costs when requirement changes inevitably occur, limited opportunities for stakeholder feedback, and minimal transparency regarding project progress until final stages.

In response to these limitations, Agile software development methodologies grounded in the 2001 Agile Manifesto's values of individuals and interactions over processes and tools, working software over comprehensive documentation, customer collaboration over contract negotiation, and responding to change over following a plan have gained substantial traction in private sector contexts. Frameworks including Scrum, Kanban, and Extreme Programming emphasize iterative development cycles (sprints), cross-functional and self-organizing teams, continuous stakeholder engagement, and adaptive planning responsive to emergent requirements. Empirical evidence from commercial and non-governmental settings demonstrates that agile adoption correlates with improved software quality, accelerated time-to-market, enhanced user satisfaction, and reduced rework costs.

Nevertheless, the translation of agile success from private to public sector contexts has proven neither straightforward nor uniformly successful. Public sector organizations possess distinctive characteristics that fundamentally challenge agile assumptions. Hierarchical authority structures, codified in administrative law and civil service regulations, constrain the delegation of decision-making authority to team levels. Procurement frameworks, designed to ensure fairness, transparency, and accountability through competitive bidding and fixed-price contracts, typically mandate comprehensive upfront specifications that preclude iterative requirement evolution. Budgeting cycles, aligned with fiscal year appropriations, resist the flexible resource allocation that agile methodologies presuppose.

Furthermore, public sector organizational culture shaped by values of procedural regularity, risk aversion, equitable treatment, and documented accountability often conflicts with Agile emphases on experimentation, rapid iteration, and tolerance of failure as a learning mechanism. Civil service personnel systems, emphasizing seniority-based advancement and specialized functional roles, diverge sharply from Agile's preference for cross-functional generalizing specialists and team-based performance assessment. External oversight mechanisms, including legislative scrutiny, audit requirements, and freedom of information regimes, impose documentation and transparency demands that challenge Agile's "working software over comprehensive documentation" principle.

These tensions have generated a growing body of scholarly inquiry examining how agile methodologies can be effectively adapted for public sector digital transformation. Early research focused

primarily on identifying barriers to adoption, documenting challenges related to procurement misalignment, cultural resistance, and regulatory constraints. Subsequent studies have explored hybrid approaches, combining agile development with stage-gate governance frameworks to satisfy both flexibility requirements and accountability mandates. More recently, attention has shifted to understanding how Agile implementation varies across multiple levels of analysis macro (policy and regulatory environment), meso (organizational structures and processes), and micro (team dynamics and individual practices).

This article addresses three interrelated research questions. First, what are the primary categories of challenges that impede agile implementation in public sector digital transformation projects? Second, what empirical evidence exists regarding the benefits and outcomes of agile adoption in government contexts? Third, what strategies and frameworks have been proposed or validated for adapting agile methodologies to public sector constraints while preserving core agile benefits?

The theoretical significance of this inquiry extends beyond practical implementation guidance. The Agile-public sector interface provides a valuable lens for examining fundamental questions in public administration theory, including the tension between bureaucratic rationality and organizational agility, the possibilities for administrative reform within constitutional constraints, and the conditions under which private sector management innovations productively translated to governmental contexts. By synthesizing empirical findings from diverse national and institutional settings, this article contributes to the development of a contextualized theory of public sector agility.

The structure of this article proceeds as follows. Section 2 reviews the existing literature on agile implementation in public sector contexts, organizing findings across macro, meso, and micro levels of analysis. Section 3 describes the systematic literature review methodology employed. Section 4 presents results organized into four analytical tables examining challenges, benefits, adaptation strategies, and contextual factors. Section 5 discusses the theoretical and practical implications of these findings, including the proposal of an integrated implementation framework. Section 6 concludes with implications for policy, practice, and future research.

Literature Review

Macro-Level Analysis: Institutional and Regulatory Contexts

The macro-level encompasses the policy, legal, and regulatory environment within which public sector digital transformation occurs. Research consistently identifies procurement frameworks as a primary barrier to agile adoption. Traditional government

procurement, predicated on the Federal Acquisition Regulation model and its international variants, requires detailed statements of work, fixed-price contracts, and milestone-based payments tied to deliverable completion. This contracting model fundamentally conflicts with Agile's iterative requirement evolution and reprioritization. Binamungu and Mahundi examined software development guidelines across three East African nations, finding that "excessive micromanagement of the development process" and "assumption of uniformity across development projects" systematically undermined the four agile values.

Legal and regulatory constraints extend beyond procurement to encompass data protection, records management, and accessibility requirements. Public sector organizations must comply with privacy legislation that mandates specified data handling procedures, complicating the iterative user feedback cycles central to Agile design. Records retention laws requiring comprehensive documentation of decision processes conflict with Agile's preference for face-to-face communication over written artifacts. Accessibility requirements for digital services, while fundamentally aligned with user-centered design principles, impose specific technical standards that may constrain implementation approaches.

Budgeting and appropriations processes present additional macro-level challenges. Annual or biennial budget cycles, with line-item appropriations for specific activities and deliverables, resist the flexible resource allocation that agile methodologies presuppose. Mergel documented how fiscal year constraints force public sector agile teams to commit to multi-month work plans that contradict sprint-based planning. Similarly, Kautz and Winter identified "insufficient resources" and "no shared vision" among transformation obstacles, noting that political leadership changes frequently disrupt multi-year agile transformation initiatives.

Despite these constraints, macro-level innovations are emerging. Several jurisdictions have developed Agile-friendly procurement mechanisms, including modular contracting (awarding contracts for individual sprints or minimal viable products), agile delivery contracts (structured around iterative deliverables), and outcomes-based agreements (compensating vendors for achieved outcomes rather than completed activities). Ciancarini et al. proposed Scrum@PA, a tailored framework for public administration Scrum adoption, demonstrating how Barcelona's Scrum@IMI method successfully adapted agile principles within legal constraints.

Meso-Level Analysis: Organizational Structures and Processes

The meso-level encompasses organizational structures, processes, and culture within public

sector entities. Hierarchical authority structures represent a fundamental meso-level challenge. Weberian bureaucracy, characterized by clear hierarchical reporting lines, specialized functional roles, and rule-bound decision-making, directly contradicts Agile's emphasis on self-organizing teams and delegated authority. Nuottila, Aaltonen, and Kujala identified "resistance to change among project stakeholders" and "loose commitment from the government agency" as primary adoption barriers in a large governmental office case study.

Performance management systems present additional meso-level tensions. Traditional public sector performance measurement emphasizes compliance with procedures, efficient resource utilization, and avoidance of errors or failures. Agile methodologies, conversely, embrace experimentation, iterative learning, and rapid failure recovery as mechanisms for innovation. Djaenudin identified "rigid bureaucracy, digital inertia, and resistance to change" as major barriers to workforce agility, while finding that "transformational/empowering leadership, goal clarity, trust in leadership, collaborative culture, psychological empowerment, and knowledge sharing" functioned as key enablers.

Organizational culture represents perhaps the most entrenched meso-level barrier. Public sector organizations typically exhibit risk-averse cultures, shaped by accountability regimes that punish visible failures while offering limited rewards for innovation successes. Agile methodologies, conversely, require psychological safety for team members to propose experimental approaches, acknowledge mistakes, and adjust direction based on feedback. Payomrat, Senapathi, and Madanian identified "bureaucratic and cultural barriers" and "difficulties with adaptability and change management" among primary challenges.

However, evidence of successful meso-level adaptation is accumulating. Monageng and Esiefarienrhe developed an integrated risk assessment framework combining Scrum methodology with computer-aided software engineering tools for Botswana's e-government initiatives, finding that 81.25% of surveyed project management specialists supported the framework. The success attributed to proactive, iterative risk management tailored to local socioeconomic circumstances. Johannessen documented how Norwegian public sector teams achieved "agile bureaucracy" through ethnographic methods for user needs analysis, demonstrating that cultural change is possible through sustained leadership commitment and pilot project success (Figure 1).



Figure 1. Meso-Level Analysis: Organizational Structures and Processes

Micro-Level Analysis: Team Dynamics and Individual Practices

The micro-level focuses on team composition, practices, and individual competencies. Cross-functional team formation represents a foundational micro-level challenge. Public sector IT teams are often organized by functional specialty (developers, testers, business analysts, project managers), with established reporting lines and performance assessment systems that discourage cross-functional flexibility. Agile methodologies require team members capable of contributing across multiple functional areas and willingness to assume varied responsibilities as sprint requirements evolve. Stakeholder engagement practices differ substantially between public and private sector contexts. Private sector agile projects typically designate a product owner a single individual with authority to prioritize requirements and accept or reject completed work. Public sector projects often involve multiple stakeholders with overlapping and sometimes conflicting mandates: legislative oversight committees, inspector general offices, citizen advisory groups, and multiple agency divisions whose cooperation is required for system implementation. Mergel documented how this "stakeholder engagement and collaboration" challenge manifests as delayed decision-making, requirement conflicts, and difficulty achieving user consensus. Documentation practices present persistent micro-level tensions. The Agile principle of "working software over comprehensive documentation" conflicts with public sector accountability requirements, including audit trails, procurement

records, and accessibility compliance documentation. Tai and Awasthi found that public sector agile teams spend substantially more time on documentation activities than private sector counterparts, reducing capacity for development work do. Binamungu and Mahundi documented how guidelines specifying "specific activities and deliverables for each stage of software development" left "little or no room for innovation and creativity."

Despite these challenges, micro-level adaptations are emerging. Successful public sector agile teams have developed "documentation as code" practices, generating required artifacts through automated processes rather than separate manual activities. Others have implemented "dual-track Agile," maintaining separate but coordinated processes for compliance documentation and development work. Training and coaching interventions addressing public sector-specific Agile applications have demonstrated effectiveness, particularly when tailored to civil service contexts and delivered by practitioners with government experience.

Synthesis and Research Gaps

The literature reviewed reveals consistent findings across diverse national and institutional contexts. Procurement and regulatory constraints, hierarchical structures, risk-averse cultures, and documentation requirements represent universal implementation challenges. Successful adaptations share common elements: leadership commitment, pilot project strategies, hybrid governance models, and sustained investment in training and coaching.

Several significant research gaps remain. Longitudinal studies tracking Agile adoption outcomes over extended timeframes are scarce, limiting understanding of sustainability and institutionalization processes. Comparative studies examining variations across different types of public sector organizations (central versus local government, regulatory versus service delivery agencies) needed to develop contingent implementation guidance. The relationship between Agile adoption and public value outcomes citizen satisfaction, service accessibility, administrative burden reduction remains under-investigated. Finally, research examining how Artificial Intelligence and emerging technologies interact with agile methods in public sector contexts is nascent but rapidly developing.

Methodology

This study employed a systematic literature review methodology guided by PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) standards. The review protocol was designed to comprehensively identify, evaluate, and synthesize empirical research examining Agile methodology implementation in public sector digital transformation projects published between January 2014 and December 2025.

The search strategy targeted six electronic databases: Scopus, Web of Science, Google Scholar, IEEE Xplore, ACM Digital Library, and PAIS Index. Search strings combined terms related to Agile methodologies ("agile," "scrum," "kanban," "iterative development," "lean software") with public sector contexts ("public sector," "government," "e-government," "public administration," "civil service," "government agency") and digital transformation ("digital transformation," "digitalization," "e-government," "digital service," "IT modernization").

✓ Inclusion criteria were:
peer-reviewed journal articles, conference proceedings, or book chapters.

- ✓ Empirical research (quantitative, qualitative, or mixed methods).
- ✓ Focused on Agile methodology implementation in public sector contexts.
- ✓ Addressing digital transformation initiatives.

- ✓ published in English.
- ✓ Between January 2014 and December 2025. Exclusion criteria were:
 - conceptual or theoretical papers without empirical data.
 - case studies of private sector organizations.
 - non-digital transformation contexts.
 - Editorials, commentaries, or book reviews.

The screening process proceeded in three stages. First, duplicate records removed. Second, titles and abstracts screened against inclusion criteria. Third, full texts of remaining articles assessed for eligibility. Two reviewers independently conducted screening with inter-rater reliability of 0.87 (Cohen's kappa). Disagreements were resolved through discussion and third-reviewer adjudication.

Data extraction captured author(s), publication year, country/institutional context, research design, agile methodology examined, sector/agency type, key findings (challenges, benefits, adaptation strategies), theoretical frameworks employed, and limitations. Quality assessment used the Critical Appraisal Skills Programme (CASP) checklist for qualitative studies and appropriate instruments for quantitative and mixed-methods research.

The initial search yielded 847 records. After duplicate removal (n=214), title and abstract screening eliminated 498 records not meeting inclusion criteria. Full-text assessment of 135 articles resulted in 45 studies meeting all inclusion criteria. The final sample comprised 28 journal articles, 12 conference proceedings, and 5 book chapters. Geographic distribution showed 42% from Europe, 31% from North America, 16% from Asia-Pacific, 8% from Africa, and 3% from South America.

Data synthesis employed thematic analysis, with initial open coding identifying emergent categories, followed by axial coding organizing categories into higher-level themes, and selective coding integrating themes into a coherent framework. Member checking with public sector Agile practitioners (n=8) enhanced interpretive validity (Figure 2).



Figure 2. Organizational structure and processes

Results

Table 1. Primary Implementation Challenges in Public Sector Agile Adoption

Challenge Category	Specific Challenges	Frequency (%)	Representative Studies
Institutional & Regulatory	Procurement misalignment; rigid budgeting cycles; compliance requirements	84.4	-
Organizational Structural	Hierarchical authority; functional silos; performance management misalignment	77.8	-
Cultural & Resistance	Risk aversion; resistance to change; documentation culture	73.3	-
Resource & Capability	Insufficient training; skill gaps; limited tooling	66.7	-

Table 1 synthesizes implementation challenges across 45 empirical studies, revealing four dominant categories with varying prevalence. Institutional and regulatory challenges, reported in 84.4% of studies, represent the most frequently cited barrier category. This finding reflects fundamental incompatibilities between agile principles and public sector governance frameworks. Procurement misalignment is particularly consequential, as traditional contracting mechanisms designed for predictable, well-specified deliverables cannot accommodate Agile's iterative requirement evolution. Fixed-price contracts requiring detailed statements of work before development commences create perverse incentives: vendors must either violate Agile principles by rigidly adhering to initial specifications or breach contract terms by adapting to emergent requirements. Similarly, annual budgeting cycles conflict with sprint-based planning, forcing premature commitment to multi-month work plans.

Organizational structural challenges, reported in 77.8% of studies, reflect tensions between hierarchical bureaucracy and Agile's decentralized decision-making. Weberian bureaucracy's clear reporting lines and specialized roles, designed to ensure accountability and expertise development, impede cross-functional team formation and delegated authority. Performance management systems measuring individual functional contributions rather than team outcomes discourage the collective ownership and shared responsibility essential to Agile success. Mid-level managers, whose organizational influence often derives from controlling information flow and decision authority, may resist Agile practices that empower teams directly. Cultural and resistance challenges, reported in 73.3% of studies, deeply embedded in public sector institutional logics. Risk aversion rational in accountability environments where failures receive scrutiny while successes receive limited recognition

directly conflicts with Agile's experimental, learn-from-failure orientation. Documentation requirements, essential for audit trails and legal accountability, create path dependencies that resist Agile's emphasis on working software over comprehensive documentation. Resistance to change, while present in any organizational transformation, particularly pronounced in public sectors where civil service protections limit performance-based consequences for resistance. Resource and capability challenges, reported in 66.7% of studies, represent necessary but insufficient conditions for successful

implementation. While training and coaching are essential, their absence compounds other challenges rather than independently determining outcomes. Notably, resource challenges less frequently cited than institutional or cultural barriers, suggesting that financial investments alone cannot overcome fundamental governance and cultural incompatibilities. Effective interventions must address structural and cultural dimensions simultaneously rather than focusing narrowly on capacity building.

Table 2. Reported Benefits of Agile Implementation in Public Sector Contexts

Benefit Category	Specific Benefits	Frequency (%)	Evidence Strength
Process & Efficiency	Reduced time-to-market; lower rework costs; improved quality	71.1	Strong
Transparency & Accountability	Enhanced progress visibility; stakeholder feedback integration	64.4	Moderate
Adaptability & Responsiveness	Requirement change accommodation; policy alignment	60.0	Strong
Citizen Centricity	User-centered design; improved satisfaction	55.6	Moderate

Table 2 presents benefits reported across the reviewed studies, demonstrating that despite substantial implementation challenges; agile adoption yields meaningful positive outcomes when successfully implemented. Process and efficiency benefits, reported in 71.1% of studies, represent the most consistently documented outcome category. Reduced time-to-market reflects Agile's iterative delivery mechanism, which produces potentially shippable functionality each sprint rather than delaying all value until final project completion. Lower rework costs emerge from continuous stakeholder feedback, which identifies requirement misinterpretations early when correction costs remain low. Improved quality results from integrated testing practices and the technical discipline of practices such as test-driven development and continuous integration. Transparency and accountability benefits, reported in 64.4% of studies, address traditional public sector concerns about project visibility and oversight. Daily stand-up meetings, sprint reviews, and information radiators provide continuous visibility into project progress, challenges, and adjustments. For public sector stakeholders including legislative oversight committees, inspector general offices, and citizen advocates this transparency enables timely intervention rather than discovering problems only at project completion. Sprint reviews provide structured opportunities for stakeholder feedback, transforming accountability from retrospective blame assignment to collaborative problem solving.

Adaptability and responsiveness benefits, reported in 60.0% of studies, are particularly valuable in policy environments characterized by frequent change. Traditional waterfall projects struggle when policy shifts occur mid-development, often requiring contract renegotiation, substantial rework, or acceptance of obsolete functionality. Agile's iterative reprioritization mechanisms accommodate policy changes without contractual disruption, as product owners can redirect team focus toward new requirements at each sprint planning session. This adaptability extends to technological changes, enabling teams to incorporate emerging capabilities rather than locked into initial technical decisions. Citizen centricity benefits, reported in 55.6% of studies, align agile adoption with broader public sector reform movements emphasizing user-centered service delivery. User story practices force teams to articulate requirements from citizen perspectives ("as a citizen, I want... so that..."). Regular usability testing with citizen users provides empirical feedback rather than relying on organizational assumptions about user needs. Demonstrated improvements in citizen satisfaction, while reported less frequently than other benefit categories, may reflect measurement challenges rather than actual outcome differences public sector citizen satisfaction is influenced by many factors beyond software quality, including policy satisfaction and prior service experiences.

Table 3. Adaptation Strategies for Public Sector Agile Implementation

Strategy Category	Specific Strategies	Implementation Frequency	Success Indicators
Hybrid Governance	Stage-gate with Agile sprints; compliance documentation integration	48.9	Moderate
Procurement Reform	Modular contracting; agile delivery contracts; outcomes-based agreements	37.8	Emerging
Cultural Transformation	Leadership commitment; pilot projects; psychological safety	64.4	Strong
Capability Building	Tailored training; embedded coaching; communities of practice	71.1	Strong

Table 3 synthesizes adaptation strategies documented in studies reporting successful implementations. Hybrid governance approaches, implemented in 48.9% of successful cases, represent pragmatic recognition that wholesale Agile adoption is neither feasible nor desirable in public sector contexts. Stage-gate with Agile sprints combines top-level phase gates (requirements approval, design review, deployment authorization) with sprint-level Agile development within each phase. This approach satisfies legal requirements for milestone-based oversight while preserving team-level flexibility. Compliance documentation integration addresses the documentation tension by automating artifact generation or embedding documentation activities within sprint work rather than treating documentation as separate overhead. Procurement reform strategies, implemented in 37.8% of successful cases, demonstrate emerging but not yet widespread innovation. Modular contracting structures procurements as sequences of small contracts for individual sprints or minimal viable products, preserving competitive pressure while enabling iterative course correction. Agile delivery contracts specify iterative deliverables and acceptance criteria without fully specifying requirements upfront. Outcomes-based agreements compensate vendors for achieved outcomes (e.g., successful user transactions) rather than completed activities, aligning vendor incentives with citizen value creation. The lower implementation frequency reflects procurement reform difficulty given

statutory constraints, not ineffectiveness where implemented. Cultural transformation strategies, implemented in 64.4% of successful cases, emphasize that technical and procedural adaptations are insufficient without corresponding cultural change. Leadership commitment articulated visibly and consistently, reinforced through resource allocation and strategic messaging enables permission to experiment and fail productively. Pilot project strategies demonstrate Agile value in contained, low-risk contexts before organization-wide scaling, generating internal evidence that overcomes resistance arguments. Psychological safety, the shared belief that interpersonal risk-taking is safe, enables the experiment-fail-learn cycles essential to Agile innovation. Capability building strategies, implemented in 71.1% of successful cases, represent the most consistently adopted adaptation category. Tailored training addresses public sector-specific contexts rather than generic Agile training, incorporating procurement constraints, compliance requirements, and political environment realities. Embedded coaching, where experienced Agile practitioners work alongside teams for extended periods (typically 6-12 months), proves more effective than episodic training in developing sustainable capabilities. Communities of practice enable knowledge sharing across organizational boundaries, accelerating learning and reducing reinvention.

Table 4. Contextual Factors Influencing Agile Implementation Success

Contextual Factor	High Success Conditions	Low Success Conditions	Moderating Influence
Organizational Size	Small agency; independent status	Large ministry; centralized control	Strong
Leadership Stability	Consistent support over 2+ years	Frequent political/leadership changes	Very Strong
Regulatory Flexibility	Waiver authority; pilot exemptions	Statutory requirements; no flexibility	Strong
Technical Maturity	Modern systems; API availability	Legacy systems; technical debt	Moderate
Team Autonomy	Delegated authority; self-directed	Centralized control; micromanagement	Strong

Table 4 examines contextual factors moderating Agile implementation success, addressing why similar strategies produce divergent outcomes across settings. Organizational size demonstrates strong moderating influence, with smaller agencies and independent units substantially more likely to achieve successful adoption than large ministries or centralized departments. This finding likely reflects multiple mechanisms: smaller organizations have fewer hierarchical layers, enabling faster decision making and cultural change; independent status may include procurement and personnel authorities unavailable to line departments; and visibility constraints mean failures in small organizations attract less scrutiny than failures in flagship initiatives.

Leadership stability exhibits very strong moderating influence, emerging as perhaps the single most consequential contextual factor. Consistent leadership support over two or more years enables sustained transformation despite inevitable implementation difficulties and resistance. Conversely, frequent political or career executive leadership changes common in many public sector contexts disrupt transformation initiatives as new leaders bring different priorities, terminate predecessor initiatives to signal change, or lack institutional memory about adaptation rationales. This finding has profound implications for transformation timing relative to electoral and appointment cycles.

Regulatory flexibility demonstrates strong moderating influence, with waiver authority or pilot exemptions substantially increasing success likelihood. Statutory requirements, however well-intentioned, often preclude the procedural adaptations necessary for Agile success. Jurisdictions with authority to grant time-limited, scope-limited waivers from standard procurement, budgeting, or documentation requirements enable controlled experimentation. Pilot exemptions allow specific teams or projects to operate under modified rules while generating evidence for broader rule changes. Without such flexibility, organizations face impossible choices between agile principles and legal compliance.

Technical maturity exhibits moderate moderating influence, with modern systems and API availability facilitating agile adoption while legacy systems and technical debt impede it. The moderate strength of this influence weaker than organizational or leadership factors suggests that technical challenges, while real, are more surmountable than cultural or structural barriers. Teams can implement strangler patterns (gradually replacing legacy systems) or facade patterns (wrapping legacy systems with modern interfaces) as technical accommodations, whereas leadership instability or statutory constraints lack comparable workarounds.

Team autonomy demonstrates strong moderating influence, with delegated authority and self-direction enabling the rapid decision-making and local adaptation essential to agile methods. Micromanagement whether from hierarchical superiors, inspector general oversight, or legislative intervention destroys the psychological safety and decision velocity necessary for iterative development. Notably, autonomy does not imply absence of accountability; successful implementations feature clear performance metrics and reporting requirements that do not prescribe methods. The distinction between outcome accountability (what is achieved) and method prescription (how it is achieved) is crucial for designing oversight mechanisms compatible with Agile principles.

Discussion

The findings of this systematic review reveal that Agile implementation in public sector digital transformation occupies a contested space between methodological promise and institutional constraint. Four major themes emerge from the synthesis: the primacy of institutional context in shaping implementation possibilities, the necessity of hybrid adaptation over wholesale transplantation, the centrality of leadership and cultural factors relative to technical capabilities, and the potential for virtuous cycles wherein successful implementations generate momentum for broader transformation.

The primacy of institutional context suggests that public sector organizations cannot simply adopt private sector Agile practices without fundamental adaptation. Weberian bureaucracy's core features hierarchical authority, rule-based decision making, specialized roles, and documented procedures are not accidental pathologies but deliberate design choices embodying values of procedural regularity, equitable treatment, and democratic accountability. Attempts to simply override or ignore these features invite implementation failure and may generate backlash that forecloses future transformation possibilities. This finding aligns with institutional theory perspectives emphasizing how organizations' embeddedness in broader institutional environments shapes the feasibility and form of change initiatives. The necessity of hybrid adaptation, rather than pure Agile implementation, represents a mature recognition that fidelity to Agile principles must be balanced with compliance to public sector requirements. Hybrid governance models combining stage-gate oversight with sprint-level flexibility preserve accountability while enabling adaptability. Documentation strategies that automate artifact generation or embed documentation within development workflows address compliance needs without sacrificing delivery velocity. Procurement innovations including modular contracting and outcomes-based

agreements create space for iteration within statutory frameworks. The diversity of documented adaptation strategies suggests that local innovation and contextual tailoring are essential, as no single template fits all public sector contexts.

The centrality of leadership and cultural factors relative to technical capabilities challenges technocentric assumptions that digital transformation success depends primarily on technology selection or infrastructure investment. While technical factors matter, the evidence indicates that leadership commitment, cultural change, and psychological safety are consequential determinants of agile adoption success. This finding has significant practical implications, suggesting that transformation initiatives emphasizing tool adoption or training while neglecting cultural and structural barriers are likely to underperform. Leadership stability over multi-year timeframes emerges as particularly critical, implying that transformation timing relative to political cycles and executive tenure deserves explicit strategic consideration.

The potential for virtuous cycles wherein successful implementations generate momentum for broader transformation offers a hopeful counterpoint to narratives emphasizing barriers and constraints. Pilot project strategies, documented in multiple successful cases, demonstrate that contained successes can build internal evidence, develop change agent capabilities, and create political support for wider adoption. Each successful sprint review builds trust with oversight stakeholders, each on-time delivery within budget challenges skepticism about Agile feasibility, and each positive citizen satisfaction metric provides performance evidence for skeptical decision-makers. The implication is that transformation strategies should sequence implementation to generate early, visible, and credible successes in contexts with favorable conditions (small scale, supportive leadership, and regulatory flexibility) before attempting challenging implementations.

These findings have significant implications for public administration theory. The Agile-public sector interface illuminates tensions between bureaucratic and post-bureaucratic organizing principles, suggesting that rather than simple displacement of bureaucracy by agility, effective public sector digital transformation requires hybrid institutional logics incorporating elements of both. This perspective challenges both "new public management" assumptions that private sector practices transplant straightforwardly and "public administration orthodox" assumptions that bureaucratic forms are immutable. Instead, the evidence suggests possibility of "agile bureaucracy" institutional forms that maintain necessary accountability and regularity while incorporating

flexibility and responsiveness in bounded, controlled ways.

Practical implications span multiple stakeholder groups. For public sector executives and managers, the findings emphasize that successful Agile adoption requires sustained leadership attention to cultural and structural dimensions, not merely methodology training or tool investment. For procurement officials, the evidence supports experimentation with modular contracting and outcomes-based agreements within statutory authority, building experience that may inform future regulatory reform. For legislative and oversight bodies, the findings suggest value in creating waiver or pilot authorities that enable controlled experimentation with alternative approaches while maintaining accountability through reporting and evaluation requirements. For Agile practitioners and consultants, the findings indicate necessity of public sector-specific adaptation rather than generic methodology application.

Limitations of this review warrant acknowledgement. Publication bias may over represent successful implementations; as negative findings face higher publication barriers. Geographic distribution skews toward Western developed country contexts, limiting generalizability to developing country settings with different institutional infrastructures. The 2014-2025 timeframe, while appropriate for contemporary relevance, excludes earlier foundational work. Most included studies examine implementation over relatively short timeframes (typically 12-24 months), limiting understanding of long-term sustainability and institutionalization processes.

Conclusion

This systematic review examined agile methodology implementation in public sector digital transformation projects across 45 empirical studies published between 2014 and 2025. The findings demonstrate that while Agile adoption presents substantial challenges in public sector contexts including procurement misalignment, hierarchical structures, risk-averse cultures, and documentation requirements successful implementation is achievable through tailored adaptation rather than wholesale transplantation. Four categories of challenges were identified: institutional and regulatory barriers (84.4% of studies), organizational structural constraints (77.8%), cultural and resistance factors (73.3%), and resource and capability limitations (66.7%). Despite these challenges, successful implementations yield meaningful benefits including improved efficiency, enhanced transparency, increased adaptability, and greater citizen centrality.

Theoretically, this research contributes to public administration scholarship by articulating how

"agile bureaucracy" achieved through hybrid governance models that preserve accountability while enabling flexibility. The findings challenge both naive optimism about private sector practice transplanted and pessimistic assumptions about bureaucratic immutability, instead supporting a contingent, context-sensitive approach to public sector digital transformation. The multidimensional framework proposed integrating legal-procedural adaptations, hybrid governance, procurement reform, cultural transformation, and iterative implementation—provides analytical and practical guidance for navigating tensions between agility and accountability.

For practice, the evidence supports several actionable recommendations. Public sector organizations should prioritize leadership commitment and cultural transformation alongside technical capacity building. Pilot project strategies enabling controlled experimentation should precede organization-wide scaling. Procurement reform, while challenging, merits systematic attention including exploration of modular contracting and outcomes-based agreements within statutory authority. Hybrid governance models combining appropriate oversight with team-level flexibility represent the most promising implementation approach given current institutional constraints.

Several directions for future research emerge. Longitudinal studies examining Agile adoption outcomes over extended timeframes (5+ years) are needed to understand sustainability and institutionalization processes. Comparative research across diverse public sector organization types (central versus local government, regulatory versus service agencies) would enable development of contingent guidance. Investigation of how emerging technologies particularly artificial intelligence and machine learning interact with Agile methods in public sector contexts represents a high-priority frontier. Finally, research examining citizen outcomes directly, including service accessibility, administrative burden, and satisfaction, would strengthen evidence for public value creation.

The digital transformation of public sector organizations, while challenging, is essential for democratic governance in the twenty-first century. Citizen expectations for digital services will not diminish, and governmental legitimacy increasingly depends on demonstrated capacity for efficient, responsive, and transparent service delivery. Agile methodologies, appropriately adapted to public sector constraints and contexts, offer a valuable approach for achieving these objectives while maintaining the accountability, equity, and procedural regularity that distinguish democratic governance from private sector management.

Disclosure Statement

No potential conflict of interest reported by the authors.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Authors' Contributions

All authors contributed to data analysis, drafting, and revising of the paper and agreed to be responsible for all the aspects of this work.

References

- [1] Payomrat, N., Senapathi, M., & Madanian, S. (2025). Digital transformation in the public sector: A systematic mapping study from an agile perspective. In N. Carroll (Ed.), *Research Handbook on Digital Transformation and Responsibility* (pp. 75-96). Edward Elgar Publishing.
- [2] Binamungu, L. P., & Mahundi, M. (2022). Investigating the support for agility in developing government software systems: A case of three East African countries. *Tanzania Journal of Engineering and Technology*, 41(3), 1-13.
- [3] Monageng, T., & Esiefarienrhe, B. M. (2025). Transforming e-government projects by developing a RAF using Scrum integrated with CASE tool in Botswana. *TELKOMNIKA (Telecommunication Computing Electronics and Control)*, 24(2).
- [4] Tai, K.-T., & Awasthi, P. (2025). An exploration of agile government in the public sector: A systematic literature review at macro, meso, and micro levels of analysis. *Government Information Quarterly*, 42(4), 102082.
- [5] Kautz, T., & Winter, R. (2024). Striving to become agile in the public sector: A context theory perspective. In A. Lazazzara, R. Reina, & S. Za (Eds.), *Towards Digital and Sustainable Organisations* (pp. 75-96). Springer.
- [6] Nuottila, J., Aaltonen, K., & Kujala, J. (2016). Challenges of adopting agile methods in a public organization. *International Journal of Information Systems and Project Management*, 4(3), 4-20.
- [7] Ciancarini, P., Giancarlo, R., & Grimaudo, G. (2024). Scrum@PA: Tailoring an agile methodology to the digital transformation in the public sector. *Information*, 15(2), 110.
- [8] Mergel, I. (2016). Agile innovation management in government: A research agenda. *Government Information Quarterly*, 33(3), 516-523.
- [9] Janssen, M., & van der Voort, H. (2016). Adaptive governance: Towards a stable,

- accountable and responsive government. *Government Information Quarterly*, 33(1), 1-5.
- [10][13] Lappi, T., & Aaltonen, K. (2017). Project governance in public sector agile software projects. *International Journal of Managing Projects in Business*, 10(2), 263-294.
- [11] Dikert, K., Paasivaara, M., & Lassenius, C. (2016). Challenges and success factors for large-scale agile transformations: A systematic literature review. *Journal of Systems and Software*, 119, 87-108.
- [12] Conforto, E. C., Salum, F., Amaral, D. C., da Silva, S. L., & de Almeida, L. F. M. (2014). Can agile project management adopted by industries other than software development? *Project Management Journal*, 45(3), 21-34.
- [13] Denning, S. (2016). How to make the whole organization "agile"? *Strategy & Leadership*, 44(4), 10-17.
- [14] Cockburn, A., & Highsmith, J. (2001). Agile software development: The people factor. *Computer*, 34(11), 131-133.
- [15] Lee, G., & Xia, W. (2010). Toward agile: An integrated analysis of quantitative and qualitative field data on software development agility. *MIS Quarterly*, 34(1), 87-114.
- [16] Dybå, T., & Dingsøy, T. (2008). Empirical studies of agile software development: A systematic review. *Information and Software Technology*, 50(9-10), 833-859.
- [17] Dingsøy, T., Nerur, S., Balijepally, V., & Moe, N. B. (2012). A decade of agile methodologies: Towards explaining agile software development. *Journal of Systems and Software*, 85(6), 1213-1221.
- [18] Hood, C. (1991). A public management for all seasons? *Public Administration*, 69(1), 3-19.
- [19] Luna-Reyes, L. F., & Gil-Garcia, J. R. (2011). Using institutional theory and dynamic simulation to understand complex e-government phenomena. *Government Information Quarterly*, 28(3), 329-345.
- [20] Janowski, T. (2015). Digital government evolution: From transformation to contextualization. *Government Information Quarterly*, 32(3), 221-236.
- [21] Layne, K., & Lee, J. (2001). Developing fully functional E-government: A four stage model. *Government Information Quarterly*, 18(2), 122-136.
- [22] Andersen, K. V., & Henriksen, H. Z. (2006). E-government maturity models: Extension of the Layne and Lee model. *Government Information Quarterly*, 23(2), 236-248.
- [23] Gil-Garcia, J. R., & Pardo, T. A. (2005). E-government success factors: Mapping practical tools to theoretical foundations. *Government Information Quarterly*, 22(2), 187-216.
- [24] Bertot, J. C., Jaeger, P. T., & Grimes, J. M. (2010). Using ICTs to create a culture of transparency: E-government and social media as openness and anti-corruption tools for societies. *Government Information Quarterly*, 27(3), 264-271.
- [25] Norris, D. F., & Reddick, C. G. (2013). Local e-government in the United States: Transformation or incremental change? *Public Administration Review*, 73(1), 165-175.
- [26] Bannister, F., & Connolly, R. (2011). The trouble with transparency: A critical review of openness in e-government. *Policy & Internet*, 3(1), 1-30.