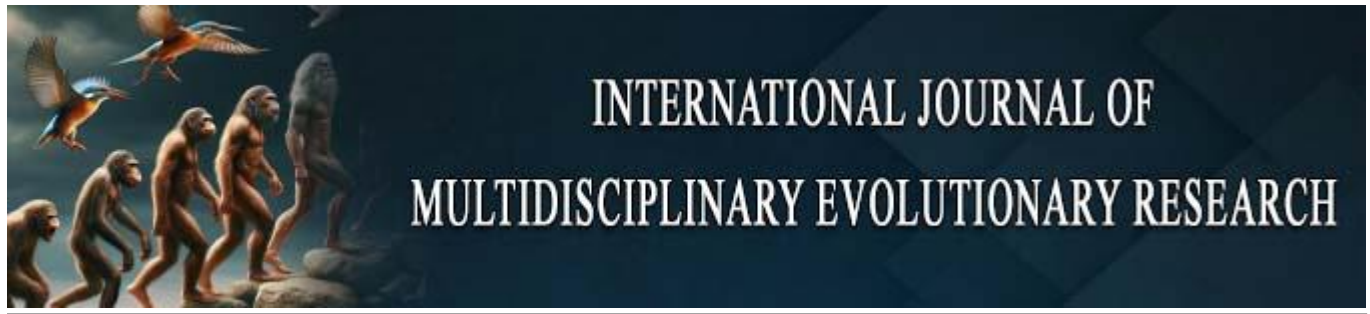




Building Digital Public Services for the Next Decade: The Convergence of AI, Cloud, and Human-Centred Design

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Article Info

P-ISSN: 3051-3502

E-ISSN: 3051-3510

Volume: 07

Issue: 01

Received: 06-12-2025

Accepted: 08-01-2026

Published: 10-02-2026

Page No: 33-42

Abstract

As digital transformation accelerates across public sectors globally, governments face the critical challenge of delivering services that are simultaneously technologically advanced, scalable, and genuinely responsive to citizen needs. This paper introduces the Integrated Digital Service Framework (IDSF), a comprehensive model that synthesizes artificial intelligence capabilities, cloud computing infrastructure, and human-centred design principles into a cohesive architecture for next-generation public services. Through systematic analysis of implementations across Singapore, Estonia, Denmark, and the United Kingdom, we demonstrate how the strategic convergence of these three elements creates digital services that surpass what each component achieves independently. Our framework addresses critical gaps by establishing clear integration pathways between AI-enabled personalization, cloud-based scalability, and user-centric design, while maintaining democratic accountability and service equity. Key findings reveal that successful implementations require balanced investment across technological capabilities and human-centred design competencies, with particular attention to ethical AI governance, cloud sovereignty considerations, and inclusive design practices. The framework demonstrates that convergence maturity not isolated technological sophistication determines service effectiveness, with implications for strategic planning and resource allocation in public sector digital transformation.

Keywords: Digital Public Services, Artificial Intelligence, Cloud Computing, Human-Centred Design, Service Design, Digital Transformation, E-Government, Citizen Experience, Public Sector Innovation, Digital Inclusion

1. Introduction

The landscape of public service delivery stands at a transformative inflection point. Over the next decade, governments worldwide must navigate the convergence of three powerful technological and methodological forces: artificial intelligence systems capable of unprecedented personalization and automation, cloud computing platforms enabling massive scale and flexibility, and human-centred design approaches that fundamentally reorient service delivery around citizen needs (Lindgren *et al.*, 2019; Mergel *et al.*, 2023; Veenstra & Kotterink, 2024) ^[16, 19, 28].

Traditional approaches to digital government have typically treated technological infrastructure, intelligent systems, and user experience as parallel modernization streams managed by distinct organizational units with separate governance frameworks (Brown *et al.*, 2021) ^[4]. This fragmentation creates critical vulnerabilities: AI capabilities deployed without cloud-scale infrastructure cannot reach all citizens; cloud platforms built without human-centred design principles create technically sophisticated but unusable services; and user-focused designs without intelligent automation fail to deliver personalized experiences citizens expect.

Recent developments in foundation models and generative AI fundamentally reshape this landscape (Korzynski *et al.*, 2023; Sun & Medaglia, 2019) ^[14, 24]. These advanced AI systems enable natural language interactions, content generation, and complex problem-solving. Simultaneously, cloud-native architectures and edge computing create infrastructure paradigms supporting

real-time, personalized service delivery at population scale (Charalabidis *et al.*, 2018) ^[7]. This paper introduces the Integrated Digital Service Framework (IDSF), a comprehensive model for conceptualizing and implementing the convergence of AI, cloud, and human-centred design in public service contexts. Unlike approaches treating these as independent initiatives, IDSF positions them as interdependent dimensions of a unified service architecture.

1.1. Research Questions and Contributions

This research addresses three interconnected questions:

RQ1: How do AI capabilities, cloud infrastructure, and human-centred design principles interact to create effective digital public services, and what specific integration mechanisms enable or constrain this convergence?

RQ2: What organizational capabilities, governance frameworks, and technical architectures are required to successfully implement integrated digital services that balance technological sophistication with genuine citizen value?

RQ3: How can public sector organizations strategically navigate the tensions between innovation imperatives, equity requirements, and democratic accountability when deploying AI-enabled, cloud-based services designed around citizen needs?

Our contributions are threefold. First, we bridge previously disconnected research domains. Second, we provide an empirically-grounded maturity model. Third, we identify specific integration mechanisms and governance approaches that enable successful convergence while maintaining democratic values.

1.2. Policy and Societal Significance

Beyond its theoretical contributions, this study addresses pressing policy and societal challenges confronting governments as digital service delivery becomes the primary interface between state and citizen. Public services increasingly shape citizens' perceptions of government legitimacy, trust, and fairness, particularly as automated decision-making and data-driven personalization become embedded in everyday administrative processes. The convergence of AI, cloud infrastructure, and human-centred design therefore represents not merely a technical modernization agenda, but a fundamental reconfiguration of how public value is created and experienced.

Fragmented digital transformation efforts risk exacerbating inequalities, undermining transparency, and eroding public trust. AI-enabled services deployed without inclusive design may systematically disadvantage vulnerable populations, while cloud infrastructures adopted without clear sovereignty and governance frameworks may compromise democratic accountability. Conversely, human-centred services that lack scalable infrastructure or intelligent automation struggle to meet rising citizen expectations for responsiveness and personalization. The policy significance of convergence lies in its capacity to mitigate these risks by aligning technological capability with societal values.

By articulating a unified framework for convergence, the Integrated Digital Service Framework (IDSF) provides policymakers with a structured approach for aligning national

digital strategies, regulatory frameworks, and investment decisions. The framework supports evidence-informed policymaking by clarifying where coordination, capability development, and governance reform are most critical, thereby contributing to more resilient, equitable, and trustworthy digital public services.

2. Theoretical Foundations and Literature Review

2.1. Artificial Intelligence in Public Service Delivery

The application of AI technologies in government contexts has evolved from early expert systems to contemporary implementations featuring machine learning, natural language processing, and generative AI capabilities (van Noordt & Misuraca, 2022; Wirtz *et al.*, 2019) ^[26, 29]. Research identifies three primary value propositions: operational efficiency through automation, enhanced decision-making through analytics, and improved citizen experience through personalization (Mergel *et al.*, 2023) ^[19].

However, AI adoption in public sectors faces distinct challenges. Issues of algorithmic accountability, transparency, fairness, and democratic legitimacy assume heightened importance when AI systems influence access to public services (Veale & Brass, 2019; Young *et al.*, 2019) ^[27, 30]. The 'black box' nature of many machine learning systems creates tensions with requirements for explainability and contestability (Burrell, 2016) ^[6].

Recent scholarship emphasizes 'responsible AI' frameworks that embed ethical considerations throughout the AI lifecycle (Floridi *et al.*, 2018; Jobin *et al.*, 2019) ^[9, 13]. For public services, this encompasses technical measures for fairness and transparency plus institutional arrangements maintaining human oversight and democratic accountability (Bullock, 2019) ^[5].

2.2. Cloud Computing Infrastructure for Government Services

Cloud computing has fundamentally transformed government IT infrastructure, moving from capital-intensive on-premises data centers to flexible, scalable cloud platforms (Charalabidis *et al.*, 2018) ^[7]. This shift enables governments to rapidly deploy new services, scale resources based on demand, and reduce infrastructure costs (Marston *et al.*, 2011) ^[18].

However, cloud adoption in government raises critical questions of data sovereignty, security, and vendor lock-in (Kshetri, 2013) ^[15]. Many jurisdictions require citizen data to be stored within national boundaries, creating tensions with global cloud platforms (Irion, 2012) ^[12]. Hybrid cloud strategies have emerged as a pragmatic approach, balancing cloud benefits with sovereignty requirements (Garrison *et al.*, 2012) ^[10].

Cloud-native architectures based on microservices, containers, and serverless computing enable more agile development and deployment of government services (Pahl & Jamshidi, 2016) ^[20]. These approaches support continuous integration and delivery, allowing rapid iteration based on citizen feedback (Lwakatare *et al.*, 2019) ^[17].

2.3. Human-Centred Design in Public Services

Human-centred design (HCD) approaches emphasize understanding citizen needs, contexts, and experiences as the foundation for service design (Bason, 2010) ^[2]. This represents a fundamental shift from technology-first or process-first approaches to genuinely citizen-centric service

delivery (Simonofski *et al.*, 2021) [23]. Service design methodologies including user journey mapping, persona development, and co-creation workshops enable governments to understand and address real citizen needs (Scholta *et al.*, 2019) [22]. These approaches reveal pain points, opportunities, and unmet needs that may not be apparent through traditional requirements gathering (Blomkamp, 2018) [3]. Digital inclusion remains a critical consideration in HCD for public services. Services designed primarily for digitally literate citizens risk excluding vulnerable populations (Reddick *et al.*, 2020) [21]. Inclusive design practices emphasize accessibility, multi-channel delivery, and assisted digital support (Helsper, 2021) [11].

2.4. Fragmentation and the Limits of Siloed Digital Transformation

Despite substantial advances in digital government scholarship, much of the existing literature continues to examine artificial intelligence, cloud computing, and human-centred design as distinct domains of inquiry. AI research has focused primarily on automation, decision-making, and ethical governance; cloud computing scholarship has emphasized infrastructure modernization, scalability, and cost efficiency; while human-centred design literature has foregrounded usability, co-creation, and inclusion. Although each stream offers valuable insights, their separation limits explanatory power in contemporary service environments where these elements increasingly operate in combination. Siloed approaches to digital transformation have tangible consequences in practice. AI systems developed independently of service design processes may optimize efficiency while failing to reflect real citizen needs or contextual constraints. Cloud platforms implemented as infrastructure upgrades often lack integration with frontline service delivery, resulting in technically robust systems that do not translate into improved user experience. Similarly, human-centred design initiatives that are not embedded

within scalable, data-enabled architectures struggle to move beyond pilot projects or isolated successes. Existing digital government maturity models frequently reinforce this fragmentation by emphasizing linear progression within individual domains rather than relational integration across them. As a result, governments may achieve high levels of sophistication in one dimension while remaining constrained by weaknesses in others. This literature gap underscores the need for an integrative framework that conceptualizes digital public services as sociotechnical systems whose effectiveness depends on coordinated development across AI capabilities, cloud infrastructure, and human-centred design principles. The IDSF responds directly to this gap by foregrounding convergence as the central driver of service effectiveness.

3. The Integrated Digital Service Framework (IDSF)

The Integrated Digital Service Framework (IDSF) conceptualizes digital public service transformation through three interdependent dimensions: Artificial Intelligence capabilities, Cloud infrastructure, and Human-Centred Design principles. Unlike models treating these as parallel initiatives, IDSF positions them as mutually reinforcing elements of a unified architecture. Each dimension contributes distinct capabilities. AI enables personalization, prediction, and automation. Cloud provides scalability, flexibility, and cost-efficiency. Human-centred design ensures accessibility, usability, and genuine value creation. The framework demonstrates that effectiveness emerges not from excellence in individual dimensions but from strategic integration across all three. Integration mechanisms operate at multiple levels: technical (APIs, data flows, service orchestration), organizational (cross-functional teams, shared governance), and strategic (aligned objectives, balanced investment). Successful implementations establish clear ownership of each dimension while creating structured interfaces enabling convergence.

Table 1: Evolution of Digital Service Paradigms

Era	Primary Focus	Key Technologies	Service Characteristics	Limitations
E-Government 1.0 (1990s-2000s)	Information Provision	Static websites, Email	One-way communication, Basic forms	Limited interaction, Manual processing
E-Government 2.0 (2000s-2010s)	Transaction Services	Databases, Portals	Online transactions, Account management	Siloed systems, Poor integration
Digital Government (2010s-2015)	Platform Integration	APIs, Cloud basics	Cross-agency services, Mobile apps	Limited personalization, Generic UX
Smart Government (2015-2020)	Data-Driven	Big Data, Basic AI	Predictive services, IoT integration	Privacy concerns, Technical complexity
Convergent Services (2020-Present)	AI-Cloud-HCD Integration	Generative AI, Cloud-native, Design systems	Personalized, Scalable, Citizen-centric	Governance challenges, Equity risks

3.1. IDSF Dimensions and Integration Mechanisms

The IDSF framework operationalizes through five key integration mechanisms:

Data Integration: Unified data architectures enabling AI models to access cloud-stored citizen data while maintaining privacy and security requirements established through HCD research.

Service Orchestration: Cloud-based service layers coordinating AI-powered capabilities across multiple touchpoints designed using citizen journey mapping.

Feedback Loops: Continuous learning cycles where citizen interactions inform AI model improvement, cloud resource allocation, and service design refinement.

Governance Alignment: Integrated frameworks ensuring AI ethics, cloud sovereignty, and accessibility standards are consistently applied across all services.

Capability Development: Cross-functional teams combining data science, cloud engineering, and service design expertise.

Table 2: IDSF Component Analysis Matrix

Dimension	Core Capabilities	Key Technologies	Critical Success Factors
AI Capabilities	Personalization, Prediction, Automation, Natural interaction	Machine Learning, NLP, Computer Vision, Generative AI	Data quality, Model governance, Ethical frameworks, Explainability
Cloud Infrastructure	Scalability, Flexibility, Cost-efficiency, Resilience	IaaS, PaaS, SaaS, Containerization, Serverless	Security, Sovereignty, Interoperability, Vendor management
Human-Centred Design	Accessibility, Usability, Value creation, Inclusion	Journey mapping, Personas, Co-creation, Testing	Citizen engagement, Design capacity, Iterative development, Equity focus

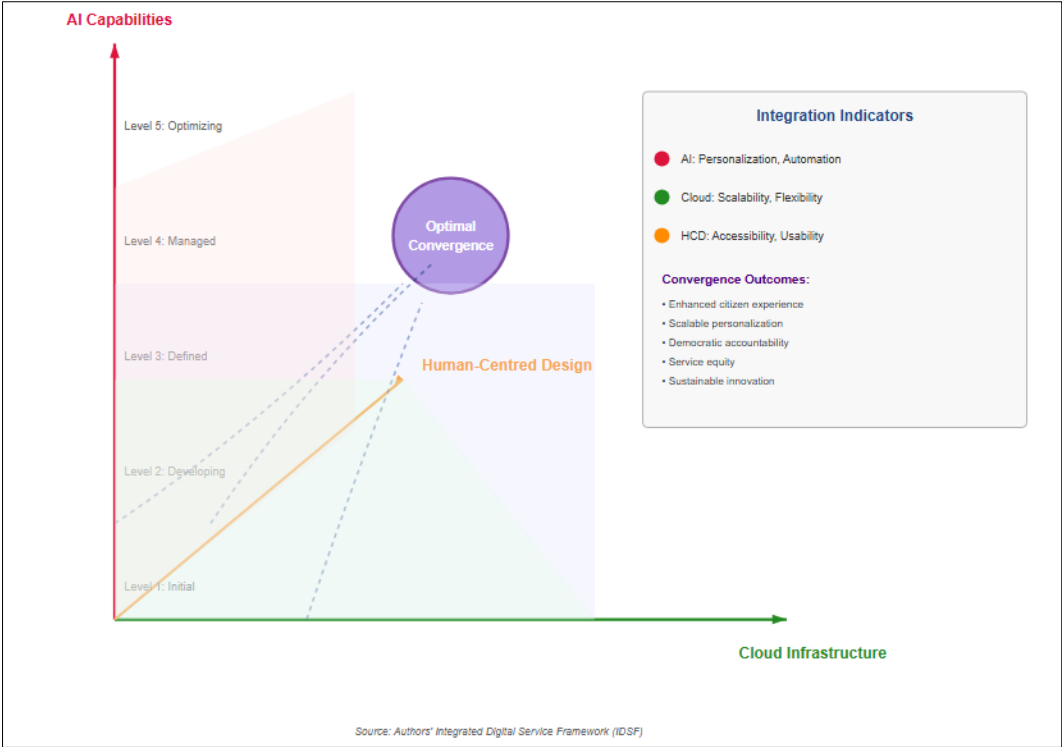


Fig 1: IDSF Three-Dimensional Framework

A three-dimensional visualization showing AI (vertical axis), Cloud (horizontal axis), and HCD (depth axis) as intersecting planes. The convergence point represents optimal integration.

Color coding indicates maturity levels across each dimension. Arrows show integration pathways and feedback loops.

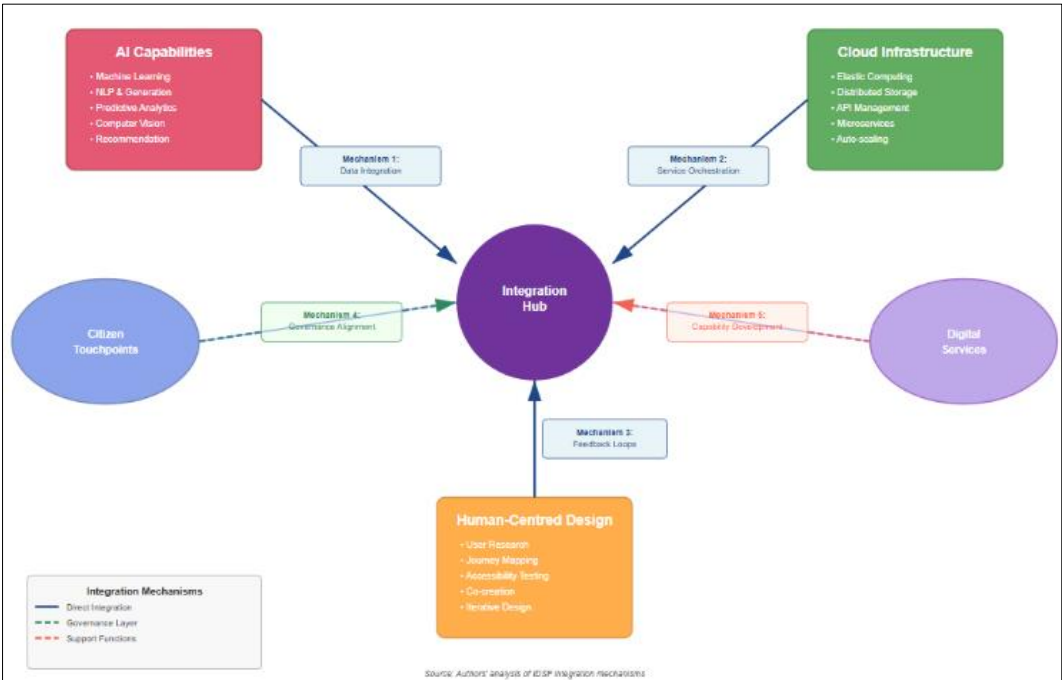


Fig 2: AI-Cloud-HCD Integration Mechanisms

A process flow diagram illustrating the five integration mechanisms. Shows data flows between citizen touchpoints, cloud infrastructure, AI processing, and service design feedback. Includes governance checkpoints and capability development cycles.

3.2. Convergence Trade-offs and Tensions

While the IDSF emphasizes the synergistic potential of AI, cloud, and human-centred design, convergence is neither frictionless nor value-neutral. Integrated digital services introduce a series of structural trade-offs that must be actively managed rather than resolved through technical optimization alone. Recognizing these tensions is essential for realistic implementation and effective governance.

One central tension arises between personalization and equity. AI-driven personalization can significantly enhance service relevance and efficiency, yet it risks reinforcing existing inequalities if training data reflects historical bias or if differentiated services are not transparently governed. Similarly, cloud-based scalability and automation may improve responsiveness but can reduce opportunities for human discretion in complex or sensitive cases, raising concerns about fairness and contestability.

Data sovereignty and security present another area of tension. Cloud-native architectures enable flexibility and rapid innovation, but reliance on external providers raises questions regarding control, jurisdiction, and long-term dependency. These concerns intersect with human-centred design requirements for trust, transparency, and accountability, particularly in contexts involving sensitive personal data.

Finally, convergence introduces organizational tensions between speed and deliberation. Agile development and continuous deployment practices enable rapid iteration, yet democratic governance requires time for consultation, oversight, and public scrutiny. Effective convergence therefore depends not on eliminating these tensions, but on establishing governance mechanisms that make them explicit, manageable, and subject to ongoing review.

4. Case Study Analysis: Learning from Implementation Leaders

This section examines how four jurisdictions Singapore, Estonia, Denmark, and the United Kingdom have approached the convergence of AI, cloud, and human-centred design in their digital service transformations. Each case reveals distinct integration pathways and implementation lessons.

4.1. Singapore: Centralized Strategic Integration

Singapore's Smart Nation initiative exemplifies systematic integration through centralized coordination. The Government Technology Agency (GovTech) serves as both technology provider and capability builder, ensuring alignment across all three IDSF dimensions (Tan *et al.*, 2024) [25]. AI capabilities are deployed through centralized platforms including the National AI Strategy and Moments of Life services that use machine learning to anticipate citizen needs. Cloud infrastructure leverages the Government Commercial Cloud and Singapore Government Tech Stack

(SGTS) providing standardized microservices. Human-centred design is embedded through dedicated service design teams and mandatory user research requirements.

Integration strengths include strong strategic governance, substantial technical capability within government, and systematic approach to service standards. Challenges involve balancing centralization with agency autonomy and ensuring inclusive design reaches all population segments.

4.2. Estonia: Distributed Infrastructure Excellence

Estonia's X-Road ecosystem demonstrates how distributed technical architecture can enable service innovation while maintaining citizen-centric design (Anthes, 2015) [1]. The 'data embassy' concept and 'once-only' principle exemplify integration of technical capability with citizen value.

AI applications include automated tax filing, intelligent case routing in e-courts, and predictive analytics for employment services. Cloud infrastructure emphasizes data sovereignty through distributed architecture. Human-centred design manifests in the Personal State concept customizing services based on individual circumstances.

Estonia's approach shows that technical excellence can enable service innovation even with limited resources. The 'no legacy' philosophy enables continuous modernization. However, small population size limits generalizability to larger, more diverse jurisdictions.

4.3. Denmark: Design-Led Transformation

Denmark's approach prioritizes human-centred design as the organizing principle, with technology serving design-identified needs (Scholta *et al.*, 2019) [22]. Extensive user journey mapping and citizen co-creation inform both technical architecture and service delivery.

AI deployments focus on citizen-facing improvements rather than back-office automation. Cloud adoption emphasizes hybrid models balancing sovereignty with capability. Service design excellence manifests in high user satisfaction scores and digital literacy initiatives.

Denmark demonstrates that design-led approaches can drive technology adoption. However, this requires substantial investment in design capacity and may result in slower deployment of cutting-edge technologies.

4.4. United Kingdom: Addressing Historical Fragmentation

The UK's digital transformation journey reflects both innovation and challenges of fragmented development (DSIT & GDS, 2025) [8]. Strong service design capabilities through GOV.UK contrast with fragmented infrastructure and inconsistent AI governance.

Service layer innovations include user-centric design systems and reusable components (GOV.UK Notify, Pay). However, the 2025 review identifies significant infrastructure fragmentation and data interoperability challenges. Recent consolidation of digital functions aims to address these gaps. The UK case illustrates risks of unbalanced development across IDSF dimensions. Excellent service design cannot fully compensate for infrastructure limitations. Recent reforms suggest recognition of integration imperative.

Table 3: Convergence Maturity Model

Maturity Level	AI Integration	Cloud Integration	HCD Integration
Level 1: Initial	Pilot projects, No governance	Basic hosting, Legacy dominance	Ad hoc user testing
Level 2: Developing	Department-specific AI, Basic ethics	Hybrid cloud, Some APIs	Dedicated design teams
Level 3: Defined	Enterprise AI platform, Clear governance	Cloud-first policy, Standardized APIs	Service design standards
Level 4: Managed	AI integrated across services, Active governance	Cloud-native architecture, Full automation	Co-creation embedded
Level 5: Optimizing	Continuous AI innovation, Adaptive governance	Edge computing, Full sovereignty	Inclusive design excellence

Table 4: Comparative Case Study Analysis

Jurisdiction	AI Maturity	Cloud Maturity	HCD Maturity	Integration Approach
Singapore	Level 4	Level 4	Level 4	Centralized strategic coordination
Estonia	Level 3	Level 4	Level 4	Distributed technical excellence
Denmark	Level 3	Level 3	Level 5	Design-led transformation
UK	Level 3	Level 2-3	Level 4	Service-first with infrastructure gaps

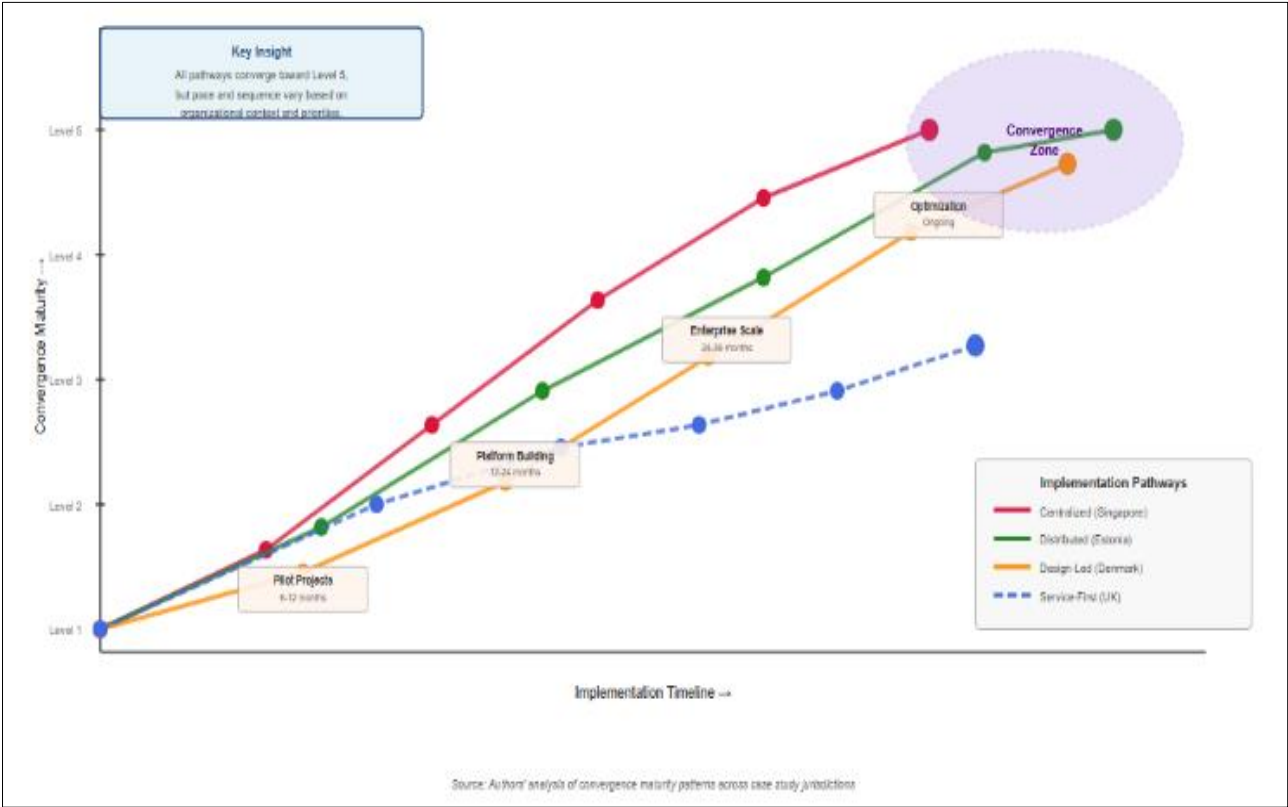


Fig 3: Service Convergence Maturity Pathway

A progression chart showing the five maturity levels across a timeline. Uses color gradients to show advancement across AI, Cloud, and HCD dimensions. Includes milestone markers and critical decision points. Shows different pathways (centralized, distributed, design-led) converging toward Level 5.

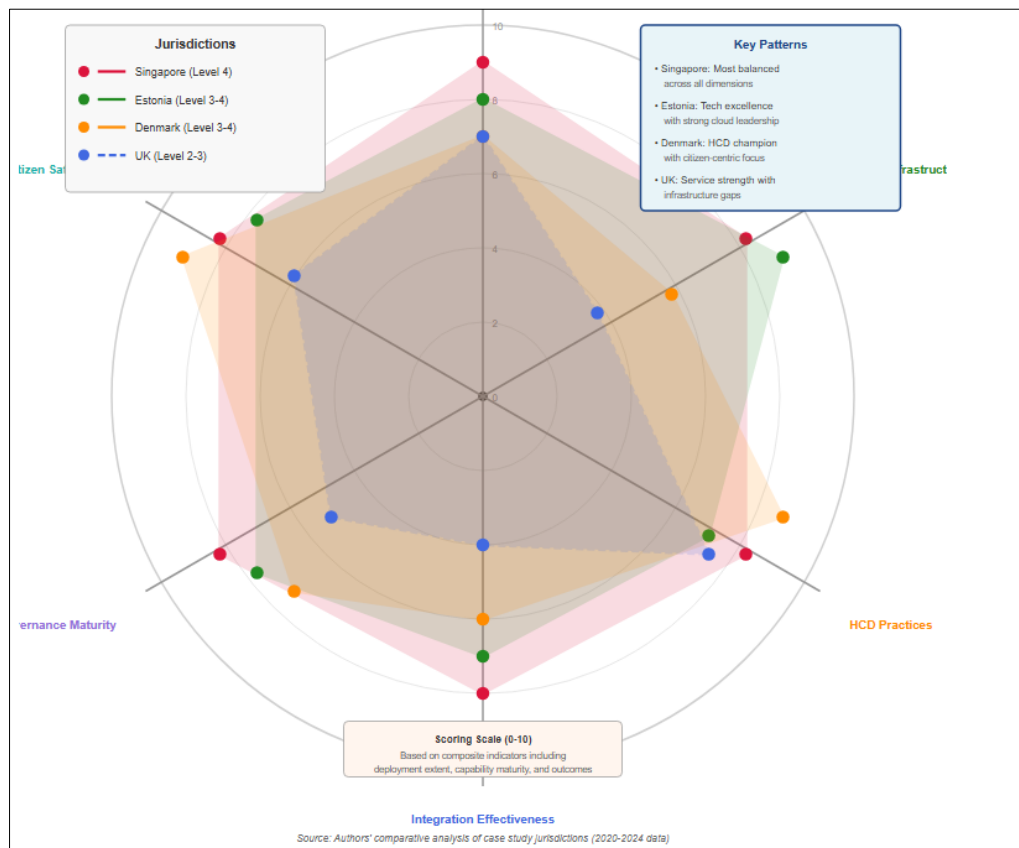


Fig 4: Cross-Jurisdictional Implementation Patterns

A radar/spider chart comparing the four case study jurisdictions across multiple dimensions: AI deployment, Cloud infrastructure, HCD practices, Integration effectiveness, Governance maturity, and Citizen satisfaction. Different colored lines for each jurisdiction show distinct patterns and strengths.

4.5. Cross-Case Synthesis: Patterns of Convergence

Comparative analysis of the four case studies reveals distinct yet convergent patterns in how jurisdictions operationalize the integration of AI, cloud infrastructure, and human-centred design. Despite differences in scale, governance traditions, and administrative capacity, all cases demonstrate that sustained service improvement depends on balanced development across these dimensions rather than isolated excellence.

Three dominant convergence pathways emerge. Singapore exemplifies centralized strategic coordination, where strong central governance aligns technical platforms, AI capabilities, and service design standards across government. Estonia represents a distributed technical excellence model, leveraging interoperable infrastructure and strong data governance to enable innovation with relatively limited resources. Denmark illustrates a design-led transformation pathway, where deep investment in human-centred design shapes both technological choices and service delivery priorities. The United Kingdom reflects a service-first approach constrained by legacy infrastructure and fragmented governance, highlighting the risks of unbalanced convergence.

Across cases, common enablers include shared platforms, cross-functional teams, standardized APIs, and explicit service design standards. Conversely, recurring constraints include legacy systems, skills shortages, and fragmented

accountability. These findings suggest that while convergence pathways may vary, successful implementation consistently requires deliberate coordination mechanisms, sustained investment in capabilities, and governance structures capable of spanning organizational and technological boundaries.

5. Discussion and Implications for Policy and Practice

The IDSF framework and case study analysis reveal several critical insights for digital public service transformation. First, convergence maturity not isolated technological sophistication determines service effectiveness. Jurisdictions excelling in one dimension while neglecting others achieve suboptimal outcomes.

Second, integration mechanisms require explicit design and governance. Ad hoc approaches result in fragmentation, duplicated efforts, and missed opportunities for synergy. Successful implementations establish clear organizational structures, shared platforms, and cross-functional teams enabling convergence.

Third, implementation pathways vary based on contextual factors including organizational capacity, political structures, and legacy constraints. No single path proves universally optimal. However, all successful approaches share commitment to balanced development across dimensions.

Fourth, governance frameworks must evolve to address convergent services. Traditional siloed approaches managing AI ethics, cloud security, and service design independently prove inadequate. Integrated governance ensuring alignment across dimensions becomes essential.

5.1. Policy Recommendations

Based on framework analysis and case study findings, we offer policy recommendations organized by stakeholder:

Table 5: Implementation Challenges and Mitigation Strategies

Challenge Category	Specific Challenges	Mitigation Strategies
Technical Integration	Legacy system constraints, Data silos, API incompatibility	Incremental modernization, Data mesh architecture, API-first design
Organizational	Siloed structures, Skill gaps, Cultural resistance	Cross-functional teams, Capability building, Change management
Governance	Fragmented oversight, Unclear accountability, Regulatory uncertainty	Integrated frameworks, Clear roles, Regulatory sandboxes
Resource Constraints	Limited budgets, Competing priorities, Vendor dependencies	Phased implementation, Open standards, Multi-vendor strategies
Equity & Inclusion	Digital divide, Accessibility gaps, Algorithmic bias	Multi-channel services, Inclusive design, Bias testing



Fig 5: Strategic Implementation Roadmap

A comprehensive roadmap showing three parallel tracks (AI, Cloud, HCD) over a 36-month timeline. Includes key milestones, integration points, and decision gates. Shows resource allocation, capability development phases, and governance checkpoints. Color-coded risk indicators highlight critical dependencies.

5.2. Implications for Digital Government Theory

The IDSF framework contributes to digital government theory by challenging linear and technology-centric models of transformation. Traditional stage models of e-government conceptualize progress as sequential advancement through predefined technological phases. In contrast, IDSF advances a convergence-based perspective in which maturity is relational rather than linear, emerging from the interaction between technological capability, organizational practice, and citizen experience.

This perspective aligns digital government scholarship more closely with sociotechnical systems theory, emphasizing that public service outcomes are co-produced through the interplay of technology, institutions, and human behavior. By foregrounding integration mechanisms, IDSF extends public value theory, illustrating how value creation depends not only on service outcomes but also on governance processes, inclusivity, and legitimacy.

Furthermore, the framework reframes digital maturity as a dynamic capability rather than a fixed end state. Convergence maturity evolves as technologies, citizen expectations, and regulatory environments change, requiring continuous adaptation. This theoretical shift has implications for how

researchers conceptualize digital transformation success and how governments assess progress over time.

6. Conclusion and Future Research Directions

This paper has introduced the Integrated Digital Service Framework (IDSF) as a comprehensive model for conceptualizing and implementing the convergence of AI, cloud computing, and human-centred design in public service contexts. Through theoretical development and comparative case analysis, we have demonstrated that effective digital public services emerge from strategic integration across these three dimensions rather than excellence in isolated domains. Our key findings emphasize that convergence maturity the degree of effective integration across AI, cloud, and HCD dimensions determines service effectiveness more than technological sophistication in any single area. Case studies across Singapore, Estonia, Denmark, and the UK reveal diverse implementation pathways while confirming the importance of balanced development, explicit integration mechanisms, and integrated governance frameworks.

The IDSF framework makes several contributions to digital government scholarship and practice. Theoretically, it bridges previously disconnected research streams, revealing systematic relationships between AI, cloud, and HCD. Practically, it provides actionable guidance for organizations at different maturity levels, identifying specific integration mechanisms and governance approaches.

However, several limitations and future research directions warrant attention. First, the framework requires empirical validation through longitudinal studies tracking convergence

development over time. Second, sector-specific variations (health, education, social services) merit detailed examination. Third, the interplay between convergence approaches and different political systems requires investigation. Fourth, emerging technologies including quantum computing and extended reality may necessitate framework evolution.

As governments worldwide navigate accelerating digital transformation, the IDSF framework offers structured guidance for building services that are simultaneously technologically advanced, scalable, and genuinely responsive to citizen needs. The convergence imperative integrating AI capabilities, cloud infrastructure, and human-centred design into cohesive service architectures represents the defining challenge for digital public services in the decade ahead.

6.1. Implications for Global South and Emerging Economies

While the case studies examined in this paper focus on advanced digital governments, the IDSF framework has important implications for Global South and emerging economy contexts. Many such jurisdictions face constraints related to infrastructure, skills, and institutional capacity, yet they also possess opportunities for leapfrogging legacy systems through cloud-native architectures and modular service design.

In these contexts, convergence may offer a pathway to scalable and inclusive service delivery by prioritizing shared platforms, open standards, and design practices attuned to local needs. Human-centred design is particularly critical in environments characterized by digital divides, multilingual populations, and varying levels of digital literacy. At the same time, governance challenges related to data protection, vendor dependence, and algorithmic accountability are often amplified where regulatory frameworks remain underdeveloped.

Applying IDSF in emerging economies therefore requires contextual adaptation rather than direct replication. Incremental convergence, capacity-building partnerships, and regionally appropriate governance frameworks may enable governments to harness AI and cloud technologies while safeguarding equity, trust, and democratic accountability.

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How to Cite This Article

Ademulegun MF, Olaifa T. Building digital public services for the next decade: the convergence of AI, cloud, and human-centred design. *Int J Multidiscip Evol Res*. 2026;7(1):33-42.

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