

Review

Digital leadership competencies and skills for agile and innovative public sector governance

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Abstract: Digital transformation is fundamentally reshaping public sector governance, placing new and complex demands on leadership. Yet existing research on public sector digital leadership remains fragmented, with competency elements dispersed across studies, theoretical perspectives lacking integration, and practical guidance remaining inconsistent. This study addresses these gaps through a systematic literature review guided by PRISMA 2020, searching Web of Science, Scopus, and IEEE Xplore for peer-reviewed literature published between 2015 and 2025. A total of 47 studies were included and analysed using a ten-dimensional digital leadership competency framework as a coding lens. Findings show strong empirical support for strategic vision, change management, communication, and digital literacy (87-96% coverage), while Cultural and Intercultural Competence and Talent Development / Digital-First Culture remain critically underexplored (2.1% and 10.6%). These gaps matter because public sector leaders increasingly govern digital transformation across culturally diverse communities and must institutionalise digital capability beyond individual champions. Five systematic implementation barriers were also identified with consistently high coverage (85-96%). Theoretical analysis revealed pronounced fragmentation: 40 studies drew on over 60 distinct theoretical perspectives. The study contributes by mapping evidence for the ten-dimensional framework, diagnosing theoretical fragmentation, and providing evidence-stratified guidance for public sector capability development in agile and innovative governance contexts.

Keywords: Digital Leadership; Public Sector; Systematic Literature Review; Digital Transformation; Leadership Competencies

1. Introduction

Digital technology has become a central driver of governance transformation, fundamentally reshaping how public sector organizations deliver services, engage citizens, and manage internal operations. Yet the digital transformation of the public sector is not a straightforward process of technology adoption or system upgrading. It is a complex, systemic change embedded within institutional environments, organisational structures, and public value orientations that differ markedly from those of the private sector [2, 30]. Public sector organizations operate under stricter institutional constraints, including legal regulation, political accountability, multi-level governance arrangements, and organizational path dependence. These characteristics collectively shape governance tensions and reform challenges that have no direct equivalent in market-driven contexts [5, 44].

Empirical evidence consistently demonstrates that investment in digital infrastructure alone does not guarantee improved governance capacity or the creation

of public value. Many digital projects fail to achieve their intended transformation goals due to insufficient strategic integration, weak cross-departmental collaboration, and limited organisational change capabilities [1, 43]. A growing scholarly consensus holds that the core challenges of public sector digital transformation extend well beyond the technical domain, involving the deeper reconstruction of governance logics, organisational capabilities, and leadership mechanisms [12].

This recognition has placed leadership at the centre of the debate. The role of public sector leaders in digital transformation has evolved beyond traditional administrative management or technical decision-making, encompassing an organisational guidance function that must respond to institutional complexity and uncertainty. This involves integrating digital technologies within existing policy objectives, organisational missions, and public value frameworks [13, 16]. Where clear leadership direction and coordination are absent, digital reform tends to advance in a fragmented manner, undermining the cross-departmental and cross-level synergy that transformation requires [24]. In this context, the concept of Digital Leadership has emerged as an important analytical lens for understanding how leaders guide, coordinate, and sustain digital change within the particular constraints of public governance.

Despite growing scholarly interest, the field of public sector Digital Leadership remains characterised by pronounced fragmentation. Conceptually, Digital Leadership is frequently conflated with adjacent notions such as e-leadership, IT leadership, and general public leadership, resulting in blurred definitional boundaries and inconsistent usage across studies. Theoretically, existing research draws on a wide range of perspectives, encompassing leadership theory, organisational change, digital governance, and public administration, without converging on a shared analytical foundation. Empirically, key topics including competency composition, implementation barriers, framework models, and development strategies tend to be examined in isolation, with few studies attempting an integrative view of the field. This fragmented research landscape restricts knowledge accumulation and limits the practical utility of existing findings for policymakers and public organisations seeking actionable guidance.

To address these limitations, a systematic and structured approach to knowledge integration is needed. The Systematic Literature Review (SLR) method is particularly well suited to this task. Compared with traditional narrative reviews, SLR emphasises transparency, reproducibility, and methodological rigour in the processes of literature identification, screening, and synthesis [32, 40]. It is therefore an appropriate vehicle for mapping the state of knowledge on Digital Leadership in the public sector, identifying areas of convergence and divergence, and providing a structured basis for subsequent theoretical development and practical application.

Guided by this rationale, the present study conducts a systematic review of studies on Digital Leadership in the public sector. The study is organised around four research questions:

RQ1: What are the core competencies and key skills required for Digital Leadership in the public sector?

RQ2: What conceptual frameworks and theoretical models have been proposed to explain Digital Leadership in the public sector?

RQ3: What are the main challenges and barriers faced in developing Digital Leadership capabilities in the public sector?

RQ4: What practices and strategies have been proposed for building and

strengthening Digital Leadership in the public sector?

To systematically address these questions, the study employs a ten-dimensional analytical framework synthesised from the existing literature as a coding and analytical lens [2, 9, 25, 41]. This framework consolidates capability elements dispersed across prior studies into ten interrelated dimensions and enables systematic assessment of which dimensions have received sufficient empirical attention and which remain underexplored. In particular, the review foregrounds Cultural and Intercultural Competence and Talent Development / Digital-First Culture as two consequential blind spots. Highlighting these gaps early is important because both dimensions are central to contemporary public sector digital transformation: leaders increasingly govern across culturally diverse populations, cross-border digital partnerships, and organisations that must build durable digital capability rather than depend on individual digital champions. The framework is described in full in Section 2.

The remainder of this article is structured as follows. Section 2 presents the methodology, including the review design, search strategy, eligibility criteria, and analytical approach. Section 3 reports the descriptive characteristics of the included studies. Section 4 presents the thematic analysis findings organised around the four research questions. Section 5 discusses the findings in relation to the competency framework, theoretical landscape, implementation barriers, and development practices. Section 6 presents conclusions, contributions, implications, and directions for future research.

2. Methodology

This study employed a qualitative Systematic Literature Review (SLR) guided by the PRISMA 2020 framework (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) to synthesise existing research on Digital Leadership in the public sector. Given the significant heterogeneity of this field across research contexts, methodological approaches, and theoretical foundations, a qualitative interpretive synthesis was adopted in preference to statistical meta-analysis. This design enables horizontal comparison across diverse studies while maintaining the transparency and reproducibility that structured review methodology requires.

2.1 Review Design and Search Strategy

Literature retrieval was conducted across three core academic databases: Scopus, Web of Science (WoS), and IEEE Xplore. These databases provide broad coverage of the relevant disciplines, including public administration, information systems, and digital governance. The search was restricted to English-language peer-reviewed journal articles published between 2015 and 2025, capturing the period during which Digital Leadership in the public sector emerged and developed as a distinct research focus.

Search strings were constructed around three core concept clusters: (1) Digital Leadership and related expressions, including e-leadership and technology leadership; (2) public sector context terms, including government, public administration, and public governance; and (3) competency-related expressions, including competency, capability, skill, and framework. Boolean operators were applied across all three clusters, with searches limited to title, abstract, and keyword fields to maximise relevance while minimising noise. Search strings were refined iteratively across multiple rounds until no further substantively new literature emerged.

2.2 Study Selection and Eligibility

Study selection followed the three-stage screening process recommended by

PRISMA 2020: identification, title and abstract screening, and full-text assessment. The initial search retrieved 265 records. After merging results across databases and removing duplicates, 181 records proceeded to title and abstract screening. At this stage, studies were excluded if they did not clearly focus on Digital Leadership as a distinct construct, addressed digitalisation solely from a technical systems or platform perspective, or lacked a public sector context. This yielded 80 records for full-text assessment.

Full-text screening then applied three additional eligibility considerations. First, Digital Leadership had to constitute the core analytical focus of the study rather than appearing only as background context. Second, the study had to engage with leadership at the organisational or institutional level, rather than solely as an individual psychological trait. Third, purely opinion-based commentaries or conceptual discussions lacking a systematic analytical framework were excluded. Screening and inclusion decisions were completed independently by two researchers, with disagreements resolved through discussion. A total of 47 studies were ultimately included for descriptive analysis and thematic synthesis. The complete screening process is presented in **Figure 1**.

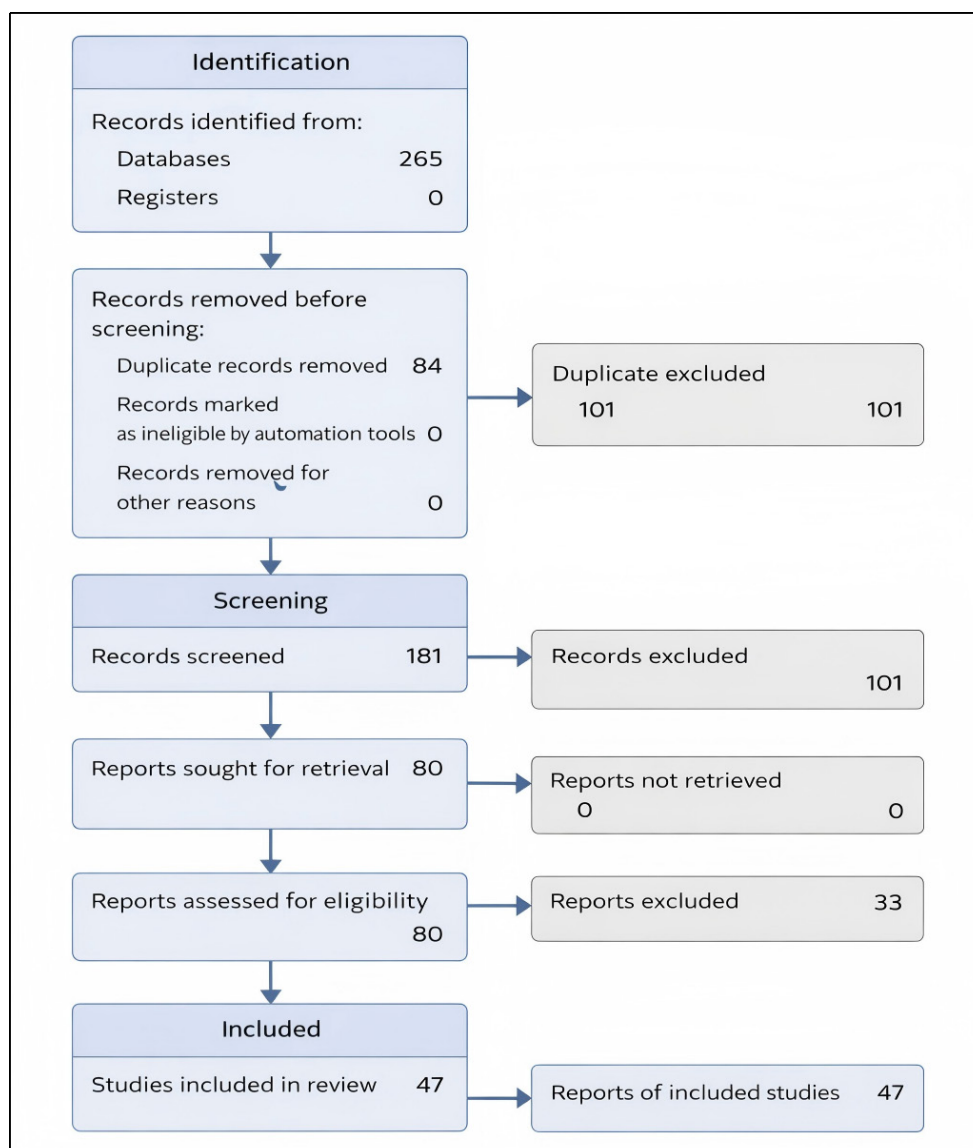


Figure 1. PRISMA Flow Diagram

2.3 Data Extraction and Thematic Analysis

Data extraction was guided by the four research questions (RQ1–RQ4) and captured two categories of information: (1) bibliographic and study characteristics, including publication year, geographical context, research method, and data type; and (2) substantive content related to Digital Leadership, covering competency definitions, analytical frameworks, implementation barriers, and development strategies. Information was recorded using a pre-designed extraction form to ensure consistency and comparability across studies.

Thematic analysis followed a combined deductive–inductive approach. Deductively, the four research questions provided the initial organisational framework for coding and classification. Inductively, repeated cross-study comparison allowed recurring themes and conceptual patterns to emerge from the literature, including those not yet explicitly theorised in prior work. This iterative process produced a thematic structure that responds systematically to the research questions while reflecting the breadth of perspectives in the included studies.

To enable systematic mapping between the emergent themes and existing conceptualisations, the ten-dimensional analytical framework introduced in Section 1 was applied as a coding lens. Each study was coded against the ten dimensions using a three-level scale: 0 (dimension not addressed), 1 (dimension mentioned but not substantively discussed), and 2 (substantive discussion with supporting evidence). Coding was conducted in two stages. First, descriptive and substantive information was extracted from each study into a structured matrix. Second, extracted evidence was matched to the ten framework dimensions using operational definitions developed from the framework literature. Ambiguous cases were not assigned solely on the basis of terminology; instead, the underlying construct, empirical focus, and evidence provided in the study were examined. For example, a study was coded under Talent Development and Digital-First Culture only when it addressed organisational mechanisms for developing digital capability in others, rather than merely reporting individual leaders' learning orientation. This coding approach supports both quantitative assessment of coverage across dimensions and qualitative interpretation of how each dimension is conceptualised in the literature.

To minimise single-researcher bias, thematic identification, classification, and boundary decisions were cross-checked by two researchers and confirmed through iterative discussion. Coding consistency was maintained through shared coding definitions, comparison of initial coding results, and explicit discussion of borderline cases until agreement was reached. Where studies addressed several competency dimensions simultaneously, the coding recorded all substantively evidenced dimensions rather than forcing assignment to a single category. These procedures were used to strengthen transparency and reproducibility while preserving the interpretive flexibility required for synthesising heterogeneous qualitative, quantitative, and mixed-methods studies. The extracted data formed the basis for the descriptive and thematic analyses.

2.4 Quality Appraisal

Quality appraisal was conducted to describe the methodological characteristics of the included studies, not to rank studies or determine inclusion. The 2018 version of the Mixed Methods Appraisal Tool (MMAT) was applied to empirical studies, given its compatibility with quantitative, qualitative, and mixed-methods research designs [19]. Non-empirical studies were not subject to MMAT assessment, as the tool is designed for empirical research designs.

Assessment followed the two-stage MMAT procedure: initial screening against two threshold questions, followed by design-specific appraisal against the relevant MMAT criteria. In line with MMAT guidance, results were not numerically scored or weighted but described in terms of overall methodological distribution. Assessment results were cross-checked by two researchers, with disagreements resolved through discussion. Quality appraisal results are reported descriptively in Section 3.5 and were not used as a basis for interpreting or comparing substantive findings.

3. Descriptive Results

This section presents the descriptive profile of the 47 included studies across five dimensions: publication period, geographical and public sector context, research methods, theoretical use, and quality appraisal. The analysis is factual and does not involve theoretical interpretation, which is addressed in Section 5. **Table 1** provides a full summary of the descriptive statistics.

Table 1. Overview of Included Studies on Digital Leadership in the Public Sector (N = 47)

Dimension	Categories	Distribution (N)
Publication Period	2015–2018	9
	2019–2021	18
	2022–2025	20
Country / Region	Europe	17
	Asia	12
	North America	9
	Oceania	5
	Cross-regional / Global	4
	Central / Federal government	14
	Local government / Municipality	15
Public Sector Type	Public service organizations (e.g. health, education, agencies)	13
	Multi-level / cross-sector public systems	5
	Qualitative	24
Research Method	Quantitative	13
	Mixed methods	10
	RQ1: Digital leadership competencies & skills	45
Main RQ Focus	RQ2: Conceptual frameworks / models	22
	RQ3: Challenges & barriers	18
	RQ4: Practices, strategies & outcomes	24

3.1 Publication Year Distribution

The 47 included studies were published between 2015 and 2025. Publication

volume was modest in the early period (2015–2018, $n = 9$), increased between 2019 and 2021 ($n = 18$), and remained relatively high in the most recent period (2022–2025, $n = 20$). The annual distribution, shown in **Figure 2**, indicates growing scholarly attention to Digital Leadership in public sector digital transformation.

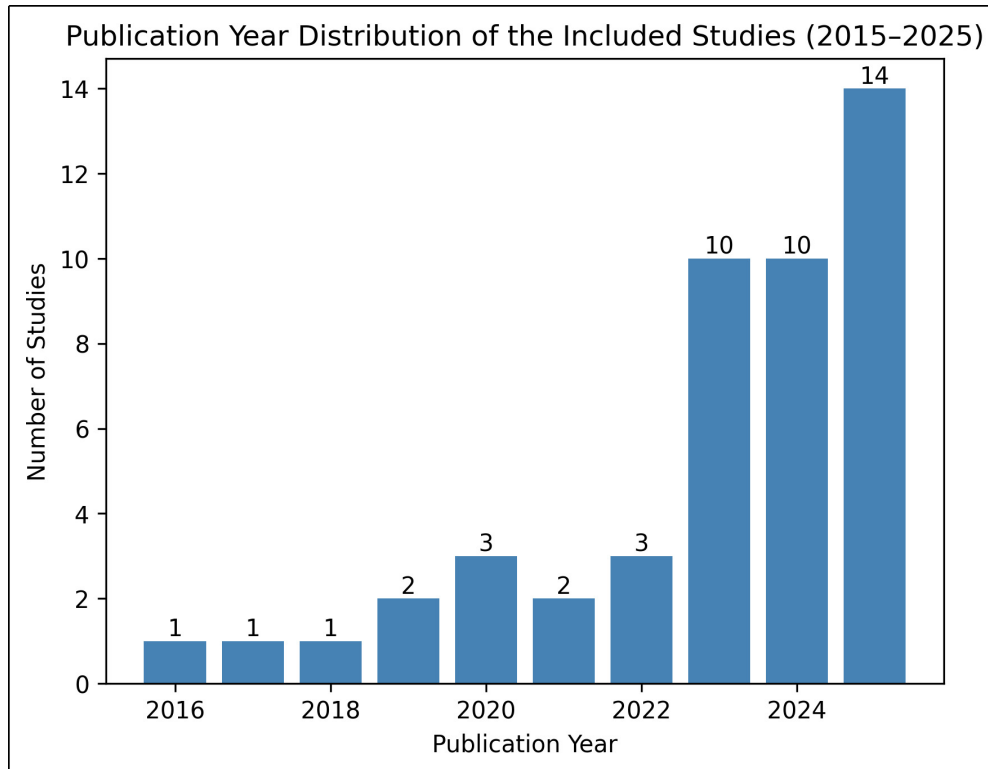


Figure 2. Publication Year Distribution of the Included Studies

3.2 Geographical and Public Sector Contexts

The included studies span multiple world regions, with Europe contributing the largest share ($n = 17$), followed by Asia ($n = 12$), North America ($n = 9$), Oceania ($n = 5$), and cross-regional or global studies ($n = 4$). Public sector contexts are similarly diverse, covering central and federal government agencies ($n = 14$), local government and municipal organisations ($n = 15$), public service organisations such as health and education ($n = 13$), and multi-level or cross-sector systems ($n = 5$). Research scenarios include digital government, e-government, and smart city governance.

3.3 Research Methods

Qualitative designs were most common ($n = 24$), followed by quantitative ($n = 13$) and mixed-methods approaches ($n = 10$). Data sources included questionnaire surveys, interviews, policy documents, and organisational texts. Qualitative studies predominantly employed thematic or content analysis, while quantitative studies mainly used descriptive statistics and regression analysis. The limited use of mixed-methods designs suggests that this approach remains underutilised in the field.

3.4 Theoretical Use

Of the 47 included studies, 40 (85.1%) explicitly employed a theoretical framework or conceptual lens. However, these studies drew on more than 60 distinct theoretical perspectives, with most theories cited by only one or two studies. Theories appearing across multiple studies include Transformational Leadership

Theory, Dynamic Capabilities, and the Technology-Organisation-Environment (TOE) Framework, but none has emerged as a dominant theoretical foundation. This pattern of theoretical dispersion is discussed further in Section 5.3.

3.5 Quality Appraisal

Quality appraisal using MMAT was applied to 43 empirical studies; 4 non-empirical studies were not assessed because MMAT is designed for empirical research designs. Of the 43 appraised studies, 22 were classified as high-quality and 21 as medium-quality. High- and medium-quality studies were distributed across qualitative, quantitative, and mixed-methods designs. No studies were excluded on the basis of quality assessment. Appraisal results are used solely for descriptive purposes and do not influence the interpretation of substantive findings.

4. Results of the Thematic Analysis

Thematic analysis of the 47 included studies identified four interrelated thematic areas corresponding to the four research questions: (1) core competencies and skills of Digital Leadership (RQ1); (2) conceptual definitions and framework models (RQ2); (3) challenges and barriers to capability development (RQ3); and (4) practices and strategies for building Digital Leadership (RQ4). **Figure 3** presents the thematic synthesis framework, and **Figure 4** shows the distribution of coverage across the four research questions. RQ1 received the greatest scholarly attention, addressed by 45 studies (95.7%), followed by RQ4 (24 studies, 51.1%), RQ2 (22 studies, 46.8%), and RQ3 (18 studies, 38.3%). RQ3 received the least coverage, reflecting that implementation barriers are more often identified as contextual findings within broader studies than as primary analytical foci. The findings in this section are reported descriptively; theoretical interpretation is addressed in Section 5.

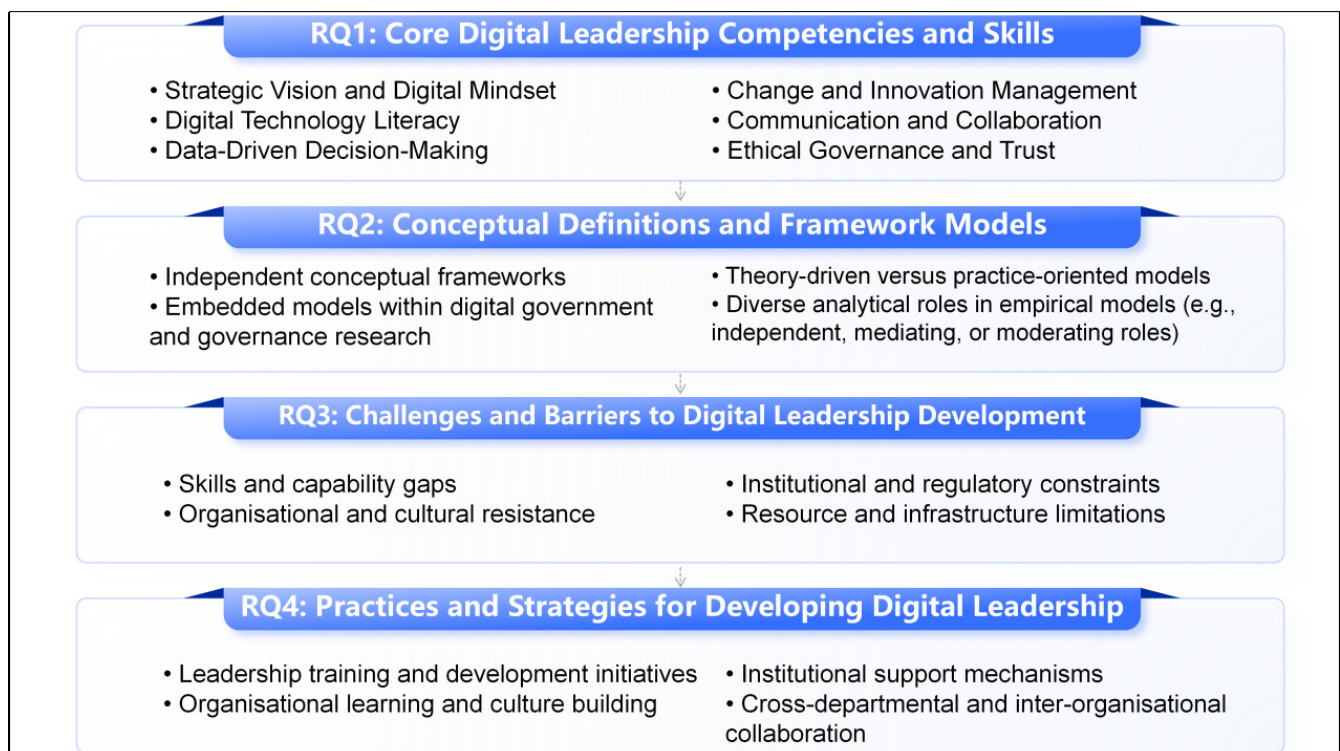


Figure 3. Thematic Synthesis Framework of Digital Leadership in the Public Sector

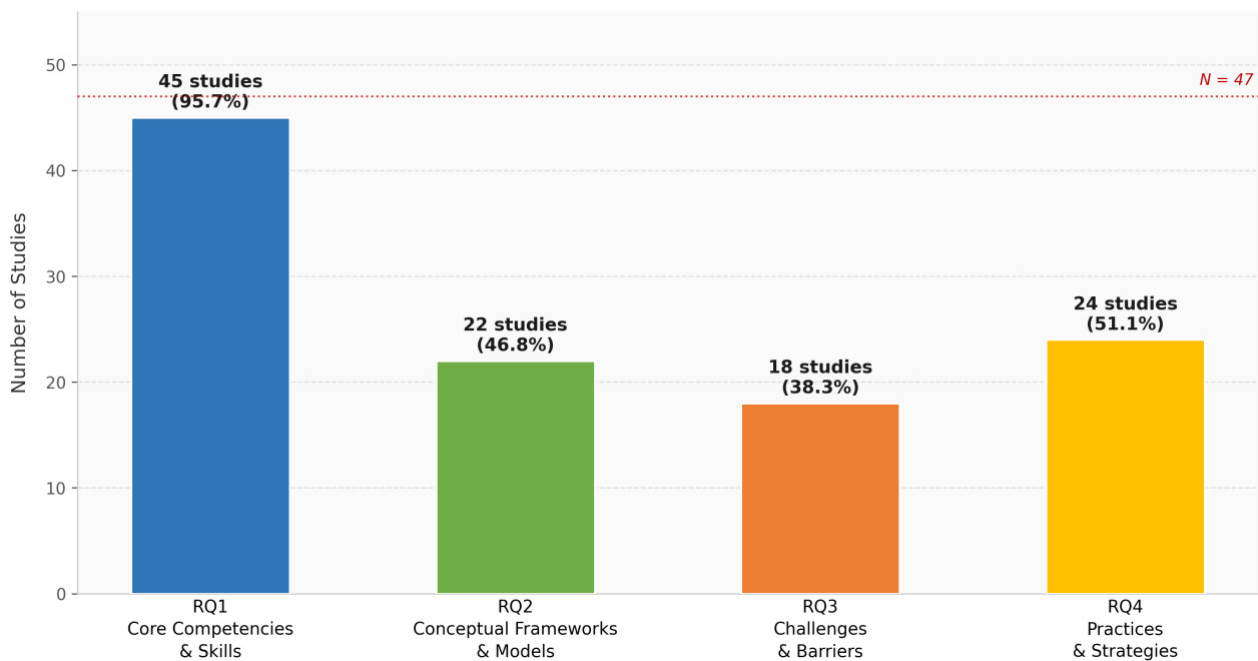


Figure 4. Distribution of thematic coverage across research questions (RQ1–RQ4)

4.1 Core Digital Leadership Competencies and Skills in the Public Sector (RQ1)

The reviewed studies consistently characterise Digital Leadership in the public sector as a multi-dimensional capability set rather than a single skill or trait. Six inductively derived competency themes were identified across the included studies.

Strategic Vision and Digital Mindset emerged as the most frequently discussed theme, with studies describing leaders' ability to align digital technology development with organisational goals and position digital transformation within broader public governance objectives. Digital Technology Literacy was widely referenced as a foundational capability, encompassing leaders' understanding of digital tools, platforms, and their implications for public service delivery, although most studies treated it descriptively rather than as a primary analytical focus. Change and Innovation Management also featured prominently, with studies emphasising leaders' capacity to guide organisational change, manage resistance, and create conditions for experimentation within institutional constraints.

Communication and Collaboration was highlighted in studies addressing cross-departmental coordination, stakeholder engagement, and multi-party governance, often in conjunction with digital platform use. Data-Driven Decision-Making was identified in studies focused on digital government and smart governance contexts, describing leaders' ability to draw on data resources to support policy and operational decisions. Ethical Governance and Trust received more limited but consistent attention, with studies addressing data ethics, privacy, and the maintenance of public value and accountability during digital transformation.

Overall, the reviewed studies present these competency themes mainly at a descriptive or conceptual level, with uneven depth of evidence across dimensions.

4.2 Conceptual and Framework Models of Digital Leadership in the Public Sector (RQ2)

Studies addressing RQ2 show considerable diversity in how Digital Leadership is conceptualised and positioned within analytical frameworks. Three broad patterns

are identifiable across the included studies.

First, a subset of studies explicitly propose conceptual or analytical frameworks in which Digital Leadership occupies a central connecting role between digital technology adoption and organisational or governance outcomes. However, these frameworks vary considerably in structure, constituent elements, and the way relationships between variables are expressed, with no consistent model emerging across studies.

Second, many studies do not construct a standalone Digital Leadership framework but instead embed it as one component within broader research models addressing digital government, e-government, or smart city governance. In these cases, Digital Leadership functions as a contextual or enabling factor within a larger institutional, technological, or organisational analytical structure.

Third, studies differ in the functional role assigned to Digital Leadership within their models. Some treat it as the primary explanatory variable, examining its relationship with organisational performance or governance outcomes. Others position it as a mediating or moderating variable within more complex analytical structures. Theoretical grounding also varies: some studies draw explicitly on leadership theory, organisational change theory, or digital governance frameworks, while others adopt a practice-oriented approach with limited theoretical scaffolding.

Overall, the literature addressing RQ2 reflects a field in which conceptual frameworks are diverse and largely non-cumulative, with limited convergence around shared definitional boundaries or model structures.

4.3 Challenges and Barriers to Developing Digital Leadership Capabilities in the Public Sector (RQ3)

Studies addressing RQ3 identify five main categories of barriers to developing Digital Leadership capabilities in the public sector: skills and capability gaps, cultural and organisational resistance, institutional and regulatory constraints, resource constraints, and infrastructure or data limitations. Across these studies, Digital Leadership development is presented not only as a matter of improving individual leaders' skills, but also as a process shaped by organisational, institutional, and resource conditions.

Skills and capability gaps were repeatedly identified as a major barrier. Reviewed studies commonly reported insufficient understanding among public sector leaders of digital technologies, data use, and innovation management. Cultural and organisational resistance also emerged as a recurring obstacle, particularly where established working practices, hierarchical structures, and risk-averse cultures limited experimentation and slowed the adoption of new digital practices.

Institutional and regulatory constraints formed another important barrier. Studies described how legal requirements, administrative procedures, accountability obligations, and compliance responsibilities can restrict leaders' room for manoeuvre when promoting digital governance and innovation. Resource constraints were also frequently reported, including shortages of financial support, human resources, time, and training opportunities needed to sustain Digital Leadership development.

Finally, infrastructure and data limitations were identified in studies focusing on the technical conditions that support Digital Leadership practices. These limitations included inadequate information systems, poor data quality, fragmented data-sharing mechanisms, and insufficient digital infrastructure. Overall, the findings suggest that barriers to Digital Leadership development are multi-level and context-dependent, combining individual capability issues with broader organisational and institutional

constraints.

4.4 Practices and Strategies for Developing Digital Leadership Capabilities (RQ4)

The reviewed studies addressing RQ4 describe a diverse range of practices for developing Digital Leadership in the public sector, with no single standardised development path emerging across studies. Three practice categories were identified.

Leadership Training and Development was the most commonly reported category, with studies describing formal training programmes, on-the-job learning, and targeted capacity development initiatives focused on areas such as digital technology understanding, data application, and change management. Organisational Learning and Culture featured in studies emphasising the importance of organisational-level conditions for Digital Leadership development, including the creation of learning-supportive environments, experimentation cultures, and internal knowledge-sharing mechanisms. Capability-Building Practices encompassed a broader set of institutional and structural arrangements, including cross-departmental collaboration mechanisms, institutional support for digital projects, and the mobilisation of external resources and partnerships to address internal capacity gaps.

Across the included studies, these three categories are not mutually exclusive and are often discussed in combination. However, most practices are reported descriptively, and evidence of their effectiveness remains limited. The evidence strength of these practice categories is discussed further in Section 5.

Table 2. Summary of Research Questions and Key Findings

Research	Question/Focus	Key Findings	Thematic Coverage
RQ1: What are the core competencies and skills required for Digital Leadership in the public sector?	Capability dimensions	Six inductively derived capability themes identified, subsequently mapped onto the ten-dimensional analytical framework in section 5 (see Section 5.2): Strategic Vision & Digital Mindset, Digital Technology Literacy, Data-Driven Decision-Making, Change & Innovation Management, Communication & Collaboration, and Ethical Governance & Trust	45 studies (95.7%)
RQ2: What conceptual and framework models have been developed to understand Digital Leadership in the public sector?	Theoretical foundations	High theoretical fragmentation observed: 65 different theories scattered across 40 studies (85.1%); Four main theoretical orientations identified: technology-organization, strategic capability, leadership behavior, and institutional governance	22 studies (46.8%)
RQ3: What are the main challenges and barriers to developing Digital Leadership capabilities in the public sector?	Implementation obstacles	Five systematic barriers identified: Cultural & Organizational Resistance (95.7%), Skills & Capability Gaps (93.6%), Institutional & Regulatory Constraints (91.5%), Resource Constraints (91.5%), and Infrastructure & Data Limitations (85.1%)	18 studies (38.3%)

Continuation Table :			
Research	Question/Focus	Key Findings	Thematic Coverage
RQ4: What practices and strategies have been proposed for developing Digital Leadership capabilities in the public sector?	Development approaches	Three practice categories identified: Leadership Training & Development (89.4%), Organizational Learning & Culture (91.5%), and Capability-Building Practices (89.4%); Evidence strength remains at “promising but not fully verified” stage	24 studies (51.1%)

Table 2 maps the four research questions to their key findings. RQ1 received the broadest coverage across the included studies, reflecting the centrality of competency identification to the field. RQ4 and RQ2 occupied intermediate positions, while RQ3 received the least coverage as a primary analytical focus, though barriers were frequently identified as contextual findings within studies addressing other research questions. The findings summarised here are discussed further in Section 5.

5. Discussion

Building on the descriptive and thematic findings reported in Sections 3 and 4, this section interprets the significance of those findings for understanding Digital Leadership in the public sector. Rather than restating the thematic categories, the discussion synthesises the findings at a higher analytical level, addressing the nature of Digital Leadership as a capability system, the unevenness of evidence across dimensions, theoretical fragmentation, systemic barriers, development practices, and key directions for future research.

5.1 Digital Leadership as an Integrated Competency System: Discussion of RQ1

The findings of this review confirm that Digital Leadership in the public sector cannot be adequately understood as a single technical skill or a leadership style. Across the 47 included studies, competency-related evidence consistently points to an integrated, multi-dimensional, and trainable capability system that is deeply shaped by the institutional and governance contexts of the public sector. This section synthesises the ten dimensions of the analytical framework not as discrete categories but as interrelated components of a coherent capability architecture, with discussion organised around three groupings that reflect differentiated patterns of empirical coverage.

The most empirically robust dimensions are those concerned with strategic vision, change management, digital and technical competence, innovation and risk-taking, communication and empathy, and collaboration and partnerships (hereafter D1–D6; see **Table 3** for full dimension labels), each achieving coverage rates between 87% and 96% across the included studies. These dimensions collectively form the operational core of public sector Digital Leadership. Strategic and visionary leadership is not simply about articulating a digital future; in public sector contexts it requires integrating technological potential with public value goals, accountability requirements, and cross-organisational governance priorities [27, 41]. Leaders who demonstrate this capability coordinate dispersed digital initiatives into a coherent transformation trajectory, prioritise investment at the resource and policy level, and communicate strategic direction effectively across organisational and political

boundaries [2, 31]. The literature consistently treats this capacity as trainable through digital strategy courses, scenario planning, and systematic exposure to international digital government exemplars rather than as a product of individual intuition or positional authority.

Change management and agility address a distinct leadership challenge: how to implement reform within institutions that are structurally resistant to disruption. Empirical studies show that effective digital leaders adopt iterative, phased approaches rather than wholesale restructuring, monitoring organisational carrying capacity and employees' adaptive readiness throughout the transformation process [15, 18]. Unlike the private sector, the public sector demands that change occurs within accountability mechanisms and service continuity requirements, making the capacity to balance adaptive momentum with institutional stability a defining feature of this competency [14, 27]. The literature emphasises that relevant training should move beyond agile project management certification to include design thinking, adaptive leadership coaching, and practice-based learning that develops the reflective capacity to navigate change under multiple competing constraints. This disposition toward controlled adaptation connects directly to innovation and risk-taking (D4), where the literature does not call for bold risk-seeking behaviour but for the deliberate creation of testable space: pilot projects, innovation laboratories, and digital sandboxes that allow experimentation without exposing core services to failure [9, 26, 35]. Leaders with this capability actively protect innovation projects from premature closure, manage stakeholder expectations around bounded experimentation, and treat failure as a source of organisational learning rather than an accountability violation.

Digital and technical competence (D3) is consistently framed in the literature as strategic literacy rather than operational proficiency. The key capability is not knowing how to build or operate a system but rather understanding what technologies can and cannot do, formulating the right questions in complex technical environments, and making judgements that align with public value and governance requirements [41, 42]. This framing distinguishes public sector digital leaders from technical specialists and reinforces that technological understanding serves governance judgement rather than replacing it. Relevant training needs centre on e-government platforms, data analytics and AI fundamentals, and cybersecurity awareness, with emphasis on conceptual understanding and strategic application rather than technical implementation detail [4, 28].

The interpersonal dimensions (D5 and D6) are nearly universal in the reviewed literature, each appearing in 93.6% of studies. Communication and empathy in digital transformation contexts involves translating complex technological concepts for non-technical audiences, responding to employees' concerns about role change and skill displacement, and building public trust through transparent and empathetic engagement [3, 36, 39]. Effective digital leaders adopt two-way communication practices, actively acknowledge limitations and uncertainties, and adapt their communication style to audiences ranging from politicians and technical experts to front-line staff and citizens. Training in this domain should integrate emotional intelligence, change communication, and inclusive communication strategies, combined with practice through scenario simulation and leadership coaching rather than one-way lecture formats. Collaboration and partnerships (D6) extends these relational capabilities outward to cross-departmental coordination, public-private partnerships, and multi-stakeholder co-creation. Research consistently shows that public sector digital reforms exceed the capacity of any single department or function,

making leaders' ability to break down silos, negotiate shared ownership, and manage complex collaborative networks a critical operational competency [2, 21, 33]. Relevant training encompasses collaborative governance, stakeholder management, and the operational mechanics of partnership arrangements.

Data-driven and analytical thinking (D7, 61.7% coverage) and human-centred and ethical leadership (D8, 57.4% coverage) occupy an intermediate position in the empirical landscape. The analytical dimension encompasses not data science expertise but the governance capacity to evaluate evidence quality, identify data limitations and potential biases, and prevent the formalisation of data-driven processes from displacing substantive judgement [11, 37]. Leaders must also promote data literacy across their organisations and ensure that data usage practices align with transparency and privacy requirements. The ethical dimension is increasingly recognised as central to the legitimacy of digital governance: leaders who fail to address algorithmic fairness, digital inclusion, and the unintended consequences of technology adoption risk eroding the public trust on which the sustainability of digital services depends [8, 22]. While coverage rates for D7 and D8 remain below those of the core dimensions, the trajectory in recent studies suggests that both are moving toward greater centrality in research on public sector Digital Leadership, particularly as AI-related governance challenges attract growing policy attention. The limited but increasing coverage of D8 also reflects a broader maturation of the field: early studies in this domain focused primarily on what technologies leaders should adopt; more recent work has begun to ask how leaders should govern technology use in ways that are equitable, transparent, and accountable to citizens. This normative turn in the literature, visible in discussions of algorithmic fairness, data privacy, and digital inclusion, signals that ethical and human-centred leadership is no longer a peripheral concern but a constitutive dimension of what it means to lead effectively in a digital public sector.

Two dimensions remain markedly underexplored. Cultural and intercultural competence (D9) appears meaningfully in only one study (2.1%), which treated national culture as a moderating condition on e-leadership effectiveness rather than examining cultural intelligence as a trainable capability [25]. No study in this review systematically examined the CQ framework - encompassing CQ drive, knowledge, strategy, and action - in relation to Digital Leadership, despite the increasing prevalence of multicultural governance environments, cross-border digital collaboration, and diverse citizen populations with varying levels of digital literacy and divergent service expectations. Talent development and digital-first culture (D10) appears substantively in five studies (10.6%). The literature pays extensive attention to individual learning and professional development, but the systemic dimension of how leaders build digital capability across their organisations - through mentoring structures, skills gap assessment, succession planning, and the institutionalisation of a digital-first organisational culture, remains largely unaddressed as a distinct leadership function [6, 7]. The few studies that do address this dimension reveal its importance: Susilawati et al. (2021) identify mentoring as a core digital leadership role, and Bandara et al. (2018) demonstrate that shadow training and organisation-wide capability investment were decisive in sustaining transformation outcomes beyond the tenure of a single digital champion. These examples suggest that the gap in D10 research is not a reflection of the dimension's marginal relevance but rather of the methodological challenges involved in studying long-term, system-level capability development processes.

Across all ten dimensions, a consistent conclusion recurs: Digital Leadership is trainable. The literature does not treat these capabilities as fixed personal traits but

locates their development in institutionalised learning mechanisms, organisational support structures, and sustained practice-based engagement. This consensus holds across contexts as diverse as European municipal management, South-East Asian smart city governance, and national e-government reform programmes, suggesting that trainability is a robust characteristic of the capability system rather than a context-specific finding. At the same time, the literature cautions that training effectiveness depends on conditions that go beyond the content of any individual programme: organisational culture, role design, incentive structures, and sustained leadership support all shape whether capability investments translate into changed behaviour. This interdependence between individual skill development and systemic organisational conditions is one of the central themes that the alignment analysis and subsequent sections examine in greater depth.

5.2 Alignment with the Digital Leadership Competency Framework

Table 3. Systematic Mapping Between Inductively Derived Competencies and Framework Dimensions

Framework Dimension	Empirical Theme(s)	Coverage (Studies)	Coverage (%)	Training Evidence
1. Strategic & Visionary Leadership	Strategic Vision and Digital Mindset	45/47	95.7%	Very Strong: Training mentioned in 42 studies (89.4%); includes strategy courses, scenario planning, case studies
2. Change Management & Agility	Change and Innovation Management (Change subset)	45/47	95.7%	Very Strong: Learning & culture mentioned in 43 studies (91.5%); agile methods, design thinking emphasized
3. Digital & Technical Competence	Digital Technology Literacy	41/47	87.2%	Very Strong: Digital skills training mentioned in 42 studies (89.4%); e-gov platforms, AI, data analytics courses
4. Innovation & Risk-Taking	Change and Innovation Management (Innovation subset)	45/47	95.7%	Very Strong: Capability building mentioned in 42 studies (89.4%); innovation labs, experimentation emphasized
5. Communication & Empathy	Communication and Collaboration (Communication subset)	44/47	93.6%	Very Strong: Leadership training (89.4%) and learning culture (91.5%) include empathy, stakeholder communication
6. Collaboration & Partnerships	Communication and Collaboration (Collaboration subset)	44/47	93.6%	Very Strong: Partnership models, co-design, network governance discussed in training contexts
7. Data-Driven & Analytical Thinking	Data-Driven Decision Making	29/47	61.7%	Strong: Analytics, data governance, evidence-based practices emphasized in training discussions
8. Human-Centred & Ethical Leadership	Ethical Governance and Trust	27/47	57.4%	Moderate: AI ethics, privacy, inclusive design mentioned but less systematically than technical dimensions

Continuation Table:

Framework Dimension	Empirical Theme(s)	Coverage (Studies)	Coverage (%)	Training Evidence
9. Cultural & Intercultural Competence	[No direct empirical theme identified]	1/47	2.1%	Minimal: No systematic training discussion; single study treats culture as moderator variable
10. Talent Development & Digital-First Culture	Organizational Learning and Culture (partial overlap)	5/47	10.6%	Limited: Individual learning well-covered (91.5%), but org-level talent systems rarely discussed

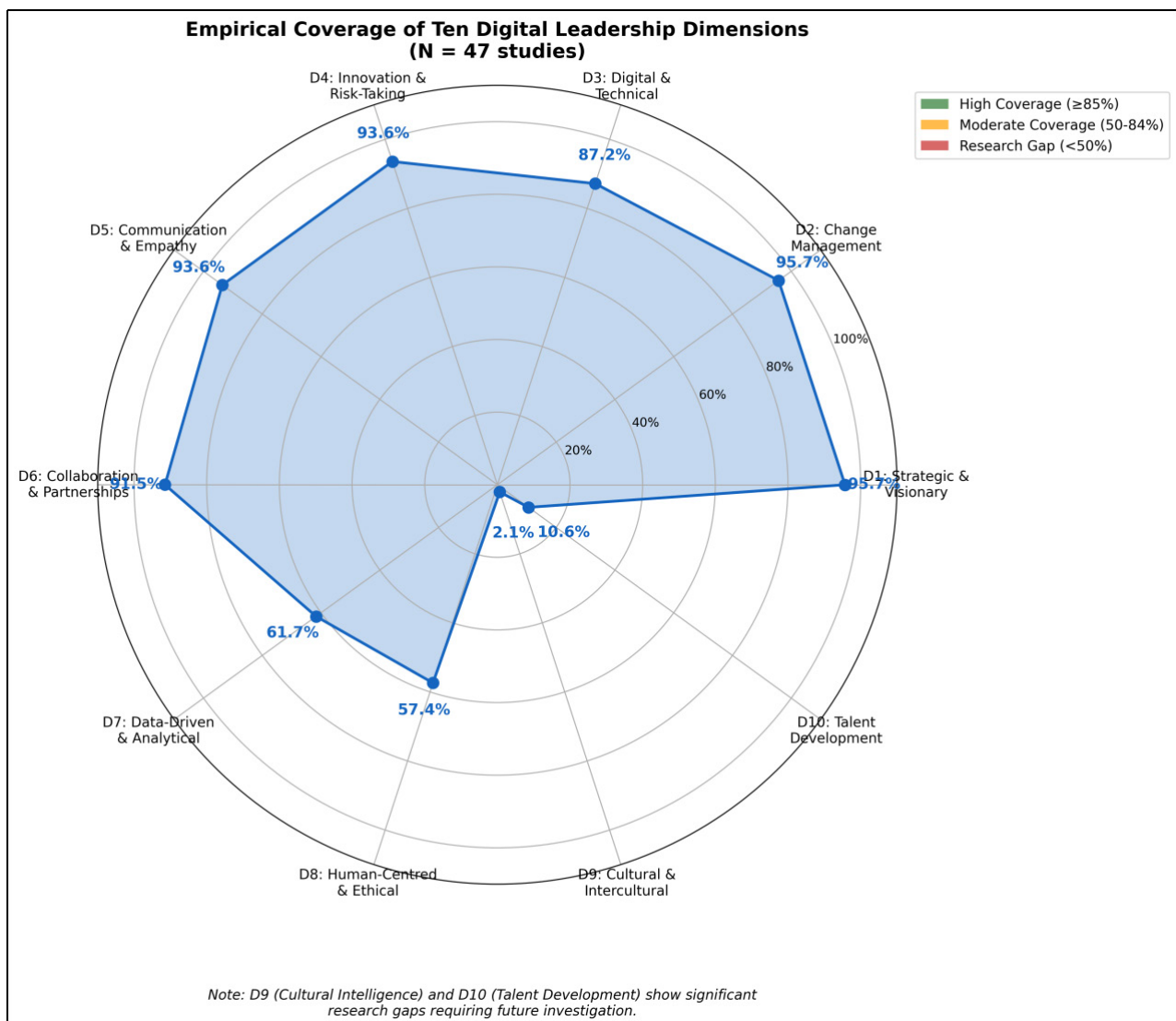
**Figure 5.** Evidence Coverage of Ten Digital Leadership Dimensions (N = 47 studies)

Table 3 and **Figure 5** present the systematic mapping between the six inductively derived competency themes and the ten dimensions of the analytical framework, quantifying empirical coverage for each dimension and the extent to which training evidence supports each. This analysis serves three purposes: to assess conceptual alignment between inductively generated themes and the framework's deductive structure; to distinguish well-evidenced from underexplored dimensions; and to evaluate how consistently the literature supports the assumption that Digital

Leadership capabilities are developable through systematic intervention.

The mapping reveals strong convergence for dimensions D1 to D6. Several empirical themes subsume more than one framework dimension, reflecting the broader classificatory conventions of existing research. The inductively derived theme of Change and Innovation Management encompasses both Change Management and Agility (D2) and Innovation and Risk-Taking (D4); the theme of Communication and Collaboration spans both Communication and Empathy (D5) and Collaboration and Partnerships (D6). The framework's subdivision of these themes carries real analytical value: D2 centres on adaptive implementation within institutional constraints, while D4 concerns the deliberate creation of experimental space; D5 emphasises internal trust-building and empathetic communication, while D6 concerns multi-stakeholder network governance. Disaggregating these pairings enables more precise identification of distinct leadership behaviours, training needs, and development pathways that combined categorisation tends to obscure.

The contribution of the ten-dimensional framework therefore lies not only in naming competency categories but in providing a public-sector-sensitive analytical architecture. Compared with more generic digital competency models, the framework connects individual leadership behaviours with the institutional, collaborative, ethical, and capability-building conditions of public governance. It also enables evidence coverage analysis: by mapping each included study against the same dimensional structure, the review can distinguish mature areas of knowledge from neglected but strategically important dimensions. This dual function gives the framework both theoretical value, by supporting cumulative concept development, and practical value, by helping public organisations prioritise capability development investment.

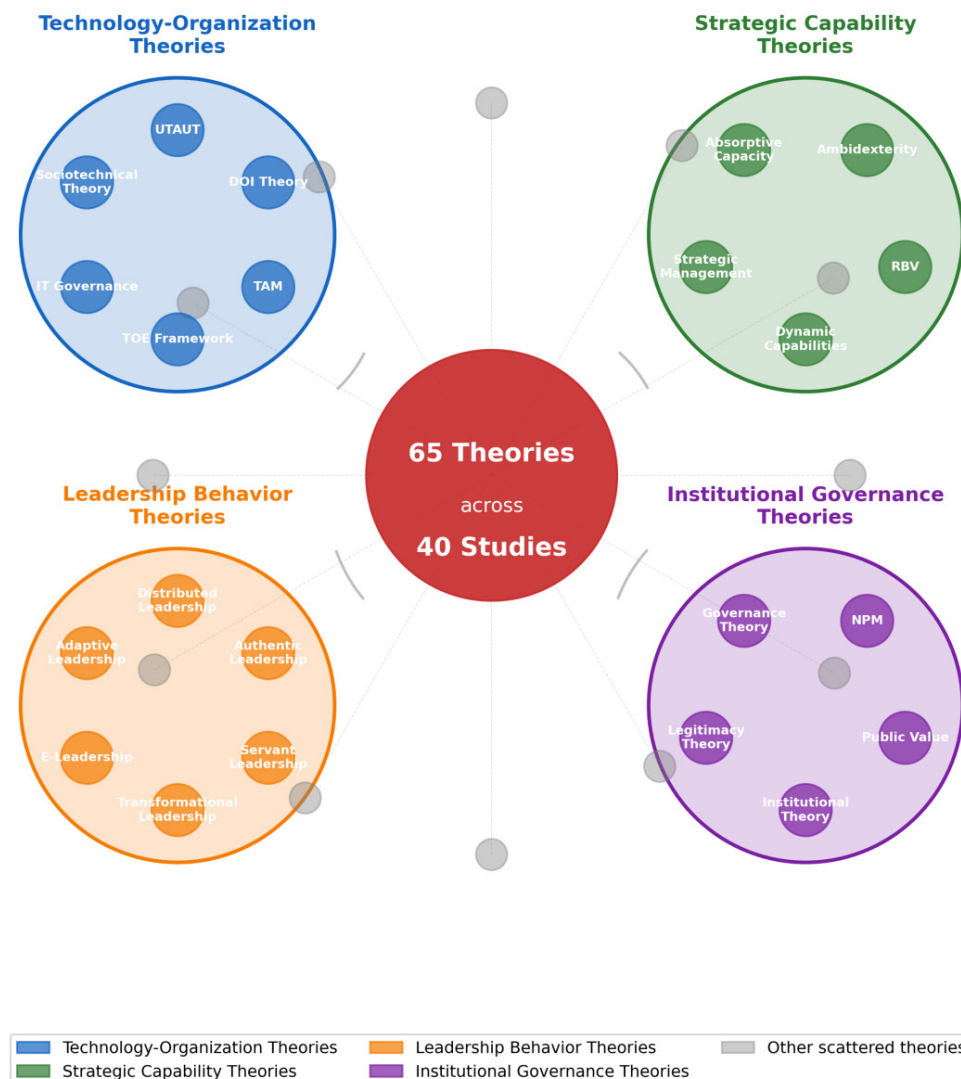
The training evidence column in **Table 3** confirms the framework's trainability assumption at a high level of consistency. Of the 47 included studies, 46 (97.9%) referenced at least one dimension of training, organisational learning, or capability development. The three training-related coding dimensions - Leadership Training and Development (42 studies, 89.4%), Organisational Learning and Culture (43 studies, 91.5%), and Capability Building Practices (42 studies, 89.4%) - show uniformly high coverage across D1 to D6. Coverage of training content diminishes for D7 and D8, where relevant discussions are present but less systematically developed, and becomes minimal for D9 and D10, where the absence of empirical attention means that training approaches have not been meaningfully discussed.

The two most consequential gaps concern the treatment of cultural intelligence and the boundary between individual learning and organisational talent development. For D9, the single relevant study offered a cross-national comparison using national culture as a contextual moderator rather than a competency construct to be cultivated [25]. The framework's proposition that cultural intelligence can be developed through structured CQ-oriented training programmes has no empirical referent in the current literature. For D10, the apparent strength of the Organisational Learning and Culture theme (91.5%) is misleading: its content overwhelmingly concerns individual leaders' learning orientations and adaptive capacities rather than the institutional mechanisms through which leaders develop digital capability in others. The framework's distinction between 'what leaders have learned' and 'how leaders develop the organisation's digital capability' has not yet been operationalised in empirical research, and addressing this distinction is among the most significant priorities for subsequent investigation. The mapping analysis thus reveals not only where the literature is strong but where its silences are most consequential: the very dimensions

most relevant to contemporary challenges in multicultural governance and long-term organisational resilience are precisely those with the weakest empirical foundations.

5.3 Conceptual Frameworks and Theoretical Lenses

Theoretical Fragmentation in Public Sector Digital Leadership Research (N = 40 studies with explicit theoretical frameworks)



Note: 65 different theories scattered across 40 studies, with most theories used only once, indicating significant theoretical fragmentation hindering knowledge accumulation.

Figure 6. Theoretical Fragmentation in Public Sector Digital Leadership Research (N = 40 studies)

Figure 6 illustrates the theoretical fragmentation that characterises the field: 65 different theoretical perspectives are distributed across 40 studies (85.1%) that employ explicit frameworks, with most theories appearing only once. This fragmentation reflects both the genuinely interdisciplinary nature of Digital Leadership and the absence of a consolidated theoretical paradigm.

Four main theoretical orientations are identifiable. The technology-organisation perspective, drawing on frameworks such as Media Richness Theory and Adaptive Structuration Theory, examines how leaders select and deploy digital communication media and how technological adoption reshapes organisational processes [33, 35, 42]. These frameworks illuminate the adaptive, interactive character of Digital Leadership but tend to focus on communication behaviour rather than broader governance capability. The strategic capability perspective, represented by Resource-Based View, Dynamic Capabilities Theory, and Upper Echelons Theory, treats Digital Leadership as a form of strategic organisational resource and examines how leaders' cognitive frameworks shape digital strategy and sustain innovation capacity under changing conditions [4, 8, 28]. The concept of antifragile capability developed within this orientation - suggesting that effective digital governance enables public organisations to benefit from disruption rather than merely surviving it - has been adopted in several recent studies [21, 23, 34, 45]. The leadership behaviour perspective encompasses Electronic Leadership Theory and elements of Transformational Leadership Theory, focusing on how leadership styles function in technology-mediated environments, including virtual team trust-building, remote performance monitoring, and managing organisational change against bureaucratic inertia [6, 25, 29, 39]. The institutional and governance perspective draws on IT governance frameworks and Institutional Theory to foreground the structural and regulatory conditions within which Digital Leadership operates [3, 17, 29].

These four orientations are not competing explanations but analytically complementary lenses: technology-organisation theories explain how technology is adopted, capability theories explain where leadership resources originate, behaviour theories explain how leaders act, and institutional theories explain the structural constraints on action. Their simultaneous presence reflects the genuine complexity of Digital Leadership, but the absence of integration across orientations prevents the accumulation of mutually reinforcing findings and makes cross-study comparison difficult. Recent integrative efforts are promising: Adie et al. (2024) call for frameworks combining dynamic capabilities and digital contextual characteristics; Nurullah et al. (2025) link institutional and transformational theories; Aldhi et al. (2025) connect dynamic capabilities and governance perspectives. These efforts, though limited in number, point toward the development of middle-range theories that retain sensitivity to public sector governance conditions while enabling substantive cumulative dialogue. The practical implication of theoretical fragmentation extends beyond academic coherence: when researchers cannot agree on the theoretical premises that define Digital Leadership, it becomes difficult to identify what should be measured, how training effectiveness should be evaluated, or whether findings from one governance context can inform practice in another. Theoretical consolidation is therefore a prerequisite not only for knowledge accumulation but for evidence-based policy and practice development.

5.4 Challenges and Barriers in Digital Leadership Implementation

Figure 7 presents the five implementation barriers identified across the reviewed studies, with coverage rates ranging from 85.1% to 95.7%. The high and consistent coverage indicates that these are not incidental difficulties but structural features of the environment within which public sector Digital Leadership operates. Critically, the barriers do not function in isolation; they form a self-reinforcing system in which each constraint amplifies the effects of the others.

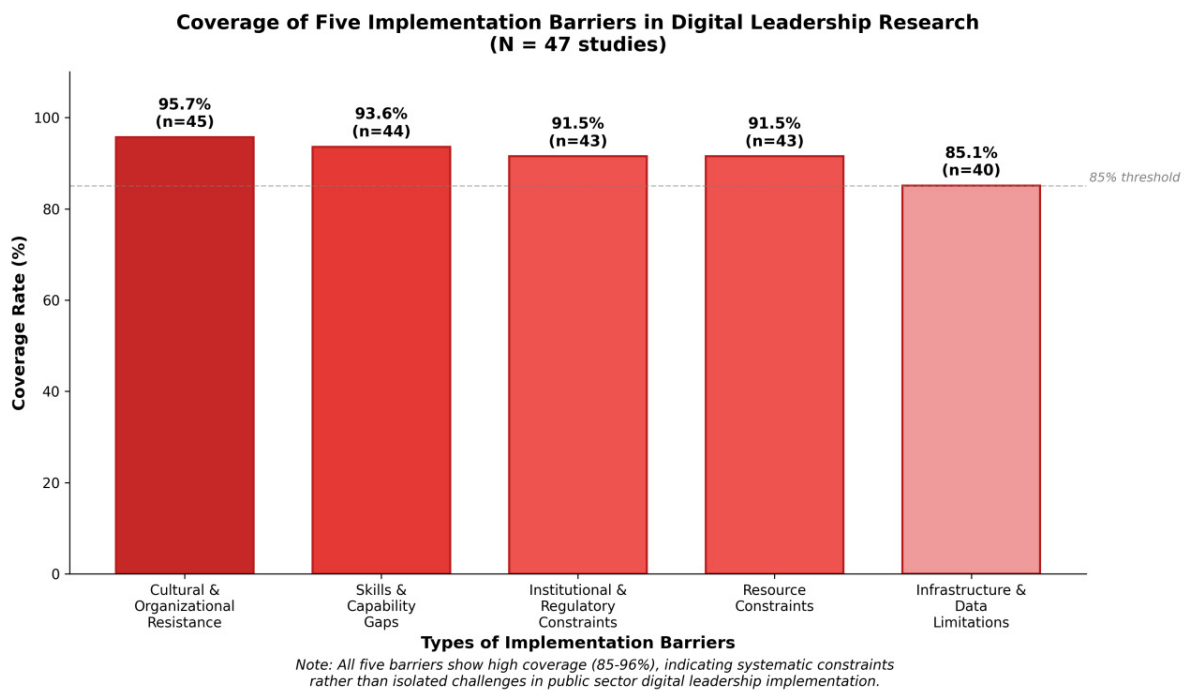


Figure 7. Coverage of Five Implementation Barriers in Digital Leadership Research (N = 47 studies)

Cultural and organisational resistance, the most frequently identified barrier (95.7%), reflects not simply discomfort with new technology but the disruption that digital transformation causes to established power distributions, decision-making authority, and professional identities [29, 45]. Role ambiguity exacerbates this resistance: when the boundaries of digital leadership responsibility are unclear, middle managers treat transformation initiatives as additional burden rather than core function, generating passive non-compliance even in the absence of explicit opposition [2]. This cultural resistance is closely connected to skills and capability gaps (93.6%), which create a feedback dynamic: staff who lack the competencies to operate in digital environments resist adoption, and sustained resistance makes investment in capability development harder to justify and maintain [37, 45]. The gap is not limited to technical skills; it extends to strategic, analytical, and interpersonal dimensions, making conventional IT training an insufficient response [2].

Institutional and regulatory constraints (91.5%) shape these dynamics at a structural level. Procurement rules, accountability frameworks, and compliance requirements limit the innovation space available to leaders and reduce the institutional incentive to experiment [2, 29]. Unlike the private sector, where tolerance for failure may be calibrated to market outcomes, the public sector's compliance culture tends to penalise visible failure in ways that discourage the risk-taking that effective digital innovation requires. Resource constraints (91.5%) further narrow the practical scope of action: leaders are frequently required to choose between maintaining legacy systems and investing in new capabilities, in contexts where budget authority resides above the digital leader's level [10]. Infrastructure and data limitations (85.1%) close the systemic cycle: incompatible legacy systems, non-standardised data across agencies, and insufficient integration capacity make it technically difficult to realise digital visions even when leadership commitment and resources are nominally present [2, 6].

The systemic interdependence of these barriers carries a direct implication for capability development: interventions focused exclusively on individual competency

address the skills gap in isolation while leaving institutional incentive structures, cultural inertia, and infrastructure deficits intact. The literature converges on the view that durable change requires coordinated intervention across competency, culture, governance, and infrastructure simultaneously rather than sequential or fragmented responses to each barrier in turn. Research by Nurullah et al. (2025) illustrates this most clearly: in hierarchical bureaucratic systems, institutional rigidity and cultural inertia are so deeply interwoven that addressing one without the other tends to produce surface-level compliance rather than genuine transformation. This observation has significant implications for how capability development programmes are designed and evaluated, as the following section discusses.

5.5 Practices and Strategies for Capability Development

The literature's response to implementation barriers clusters around three development practice categories: formal training mechanisms, organisational learning and cultural transformation, and capability-building ecosystems. Of the 47 included studies, 46 (97.9%) reference at least one of these approaches, reflecting broad consensus on the need for systematic capability development. However, the evidence for the effectiveness of specific practices is notably limited: most recommendations operate at the level of design principles, and rigorous evaluations comparing content, delivery methods, and measurable outcomes remain scarce.

Formal training mechanisms are the most extensively discussed approach (89.4% of studies). The literature identifies training needs across three levels: technical literacy (e-government platforms, data analytics, AI and cybersecurity fundamentals), strategic application (digital visioning, risk assessment, stakeholder communication), and ethical governance (privacy regulation, algorithmic accountability, inclusive design). Van Wart et al. (2019) emphasise that training for digital leaders must be purpose-built for digital contexts rather than simply translating conventional leadership curricula into online formats. The critical objective is developing leaders' capacity to navigate technology-mediated environments and make governance-aligned decisions under uncertainty. F. Loney-Burnett et al. (2024) add that political acumen and the ability to secure resources and stakeholder support are as important as technical knowledge in the digital leadership training portfolio, a finding that underscores the relational and institutional dimensions of effective practice. Despite the volume of training recommendations in the literature, comparative evaluations examining which training designs produce durable capability change in public sector leaders remain largely absent.

Organisational learning and cultural transformation address the systemic conditions that determine whether training effects persist. Hamouche et al. (2025) identify learning orientation as a more powerful predictor of transformation readiness than digital literacy alone, arguing that organisations must cultivate a cultural disposition toward experimentation, iteration, and reflective adaptation for individual skill gains to translate into collective capability. Hunitie and Akhorshaideh (2025) provide empirical support, finding that digitised human resource management practices spanning recruitment, performance management, training processes, and internal communication are among the strongest predictors of public sector transformation success. This finding implies that capability development must be embedded in organisational systems and aligned with strategic accountability structures rather than delivered as isolated events. Adie et al. (2024) reinforce this by emphasising alignment between leadership development, role redesign, and strategic accountabilities: competency investment produces limited behavioural change if roles

and incentive structures remain unchanged.

Capability-building ecosystems represent the most comprehensive and contextually demanding approach. Gasco-Hernandez et al. (2022) demonstrate that large-scale digital transformation requires coordinated contribution from both political leadership, responsible for vision-setting and resource mobilisation, and operational management leadership, responsible for implementation and adaptive problem-solving. The governance structures framing both levels must provide sufficient flexibility for adaptive implementation while maintaining the accountability and legitimacy requirements of public institutions. The hospital case documented by Bandara et al. (2018) illustrates the ecosystem model in practice: a digital leader drove a multi-stage transformation through co-designed situational analysis with all staff, process redesign, phased system implementation, organisation-wide IT training including non-technical roles, and shadow training to build succession capacity. These cases collectively indicate that effective capability development requires a convergence of individual leadership commitment, organisational system change, governance framework alignment, and broad staff participation; no single element suffices in isolation.

The overall implication is clear: while the direction of effective practice is reasonably well-established - integrated, culturally embedded, multi-level, and sustained over time - the field has not yet produced the evaluation studies needed to specify which intervention combinations are most effective in which contexts. The gap between descriptive prescription and evidence-based practice is partly a consequence of methodological constraints inherent in capability development research: longitudinal designs, control groups, and consistent outcome measurement are difficult to sustain in public sector contexts, where reform timelines are long, political environments shift, and the attribution of capability change to specific interventions is rarely straightforward. Acknowledging these constraints, future research should nonetheless prioritise intervention designs that can generate comparative evidence, including across-agency studies, pre-post assessments, and mixed-method evaluations that combine outcome measurement with contextual explanation.

5.6 Synthesis of Key Findings and Research Gaps

Figure 8 provides a SWOT-structured visual synthesis of the major findings of this review; the following discussion synthesises these findings and research gaps across three analytical levels.

At the ontological level, this review advances the positioning of Digital Leadership as a context-embedded integrated capability system. The analysis of 47 empirical studies supports three defining characteristics of this system: it is multi-dimensional, spanning strategic, technical, relational, ethical, cultural, and developmental competencies; it is trainable and developable through institutionalised learning mechanisms rather than dependent on fixed personal traits; and it is institutionally constrained, operating within the accountability frameworks, legitimacy requirements, and regulatory conditions distinctive to the public sector. This positioning diverges from efficiency-oriented frameworks common in private sector Digital Leadership research and foregrounds the governance logic that shapes what digital leaders in government must accomplish and under what structural conditions. The ten-dimensional framework adopted in this study provides a structured vocabulary for this positioning, grounded in systematic empirical synthesis rather than normative prescription.

At the theoretical level, this review diagnoses the field's fragmentation, 65 theories across 40 studies, and proposes a pathway toward integration. The four identified theoretical orientations (technology-organisation, strategic capability, leadership behaviour, and institutional governance) address different analytical levels of the phenomenon and are not rivals but complementary lenses. A consolidated theoretical paradigm has not yet emerged, but the integrative efforts by Adie et al. (2024), Aldhi et al. (2025), and Nurullah et al. (2025) point toward middle-range theories that combine sensitivity to public sector governance conditions with sufficient cross-study comparability to support cumulative knowledge-building.

At the empirical level, the coverage analysis identifies a structural asymmetry that future research must address. Dimensions D1 to D6 have accumulated sufficient evidence to establish their status as relatively well-understood competency domains. Dimensions D7 and D8 are gaining recognition but require more systematic investigation, particularly as AI-related governance challenges intensify. Dimensions D9 (Cultural and Intercultural Competence) and D10 (Talent Development and Digital-First Culture) represent genuine and consequential research gaps. The near-complete absence of cultural intelligence as a researched and trainable Digital Leadership capability is particularly significant: as digital transformation in the public sector extends across multicultural communities, decentralised teams, and cross-border governance partnerships, leaders require cross-cultural sensitivity and adaptation capacity that the existing literature has not yet conceptualised or measured. The persistent conflation of individual learning with organisational talent cultivation similarly leaves unaddressed the critical leadership function of building institutional digital capability that outlasts any individual leader and becomes embedded in organisational structures and culture.

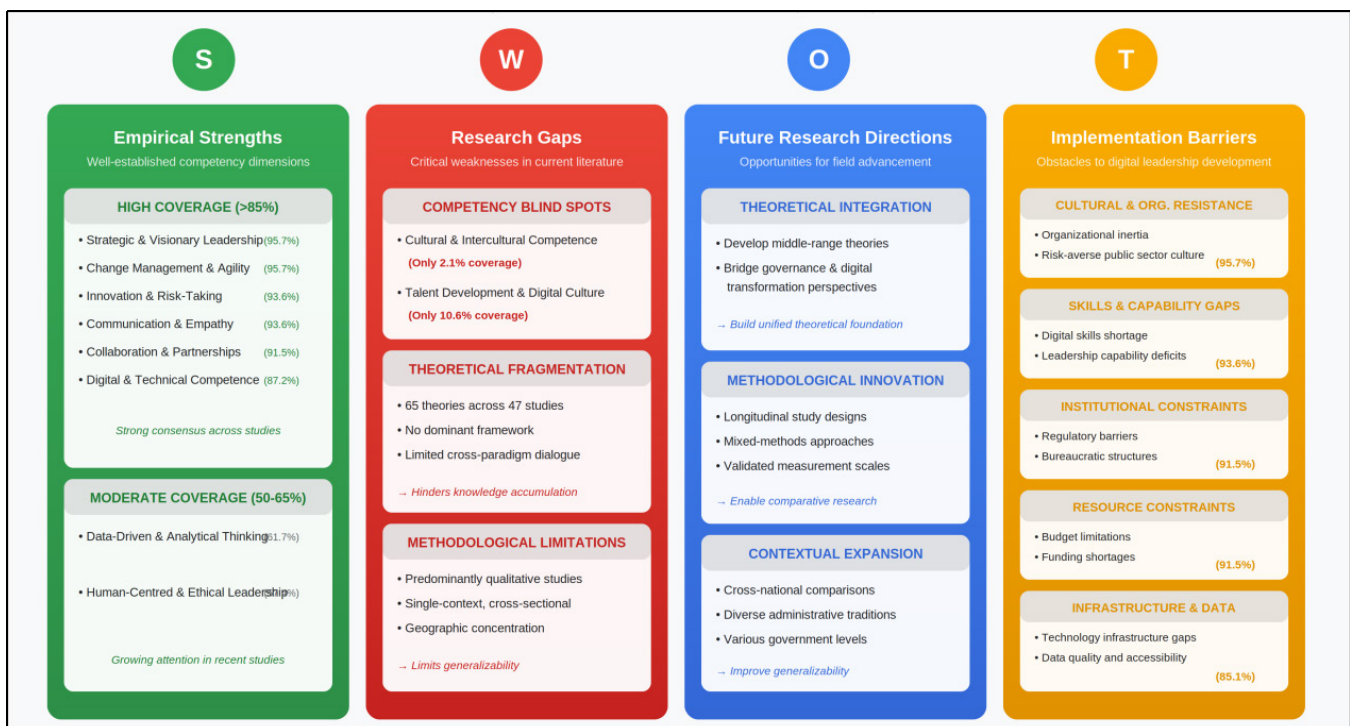


Figure 8. SWOT Synthesis of Digital Leadership Research in the Public Sector (N = 47 studies)

Taken together, these three contributions, ontological clarification, theoretical diagnosis, and empirical gap identification, advance the field from describing what

digital leaders need toward articulating how Digital Leadership in the public sector should be theorised, investigated, and systematically developed. They also underscore a broader argument that runs through this review: that Digital Leadership in the public sector is not a problem of individual competency alone but a challenge of institutional capacity-building, governance design, and sustained cultural change. Addressing this challenge requires not only better-trained leaders but more coherent theoretical frameworks, more rigorously evaluated development practices, and sustained research attention to the dimensions, cultural intelligence and talent cultivation, that the field has thus far neglected. The concluding section builds directly on these contributions to address implications for policy, practice, and future research design.

6. Conclusion

This section synthesises the findings of the review into conclusions that are actionable for theory, practice, and policy. It presents the study's findings and their theoretical and practical significance, implications for public sector managers and policymakers, the limitations that bound its conclusions, directions for future research, and a closing statement on the significance of Digital Leadership as a field of inquiry.

6.1 Theoretical and Practical Contributions

This study makes three interconnected contributions to the theoretical understanding of Digital Leadership in the public sector.

This framework extends existing competency models in three ways. First, it is explicitly anchored in public sector governance rather than assuming that private-sector digital leadership models can be transferred without adaptation. Second, it treats Digital Leadership as a capability system linking strategic, technical, relational, ethical, cultural, and talent-development dimensions, rather than as a list of isolated skills. Third, it converts the framework into an empirical mapping tool, making it possible to show where the literature is well developed and where important capabilities remain underexamined.

First, it advances the ontological positioning of Digital Leadership as a context-embedded integrated capability system, characterised by three properties: it is multi-dimensional, spanning ten interrelated competency dimensions; it is trainable through institutionalised mechanisms rather than dependent on fixed personal traits; and it is institutionally constrained by the accountability frameworks and governance conditions distinctive to the public sector. This positioning offers a more governance-sensitive conceptual foundation than the efficiency-oriented frameworks common in private sector research.

Second, the empirical coverage analysis reveals a structural asymmetry in how the field has developed. The six core dimensions are relatively well-established; two intermediate dimensions are gaining recognition; and Cultural and Intercultural Competence and Talent Development and Digital-First Culture remain consequential blind spots. This pattern challenges the implicit assumption that Digital Leadership is primarily an individual-level capability, and draws attention to the neglected organisational-system dimensions of cultural adaptation and talent cultivation.

Third, the theoretical fragmentation identified across the reviewed studies points toward both a problem and a pathway. The four identifiable theoretical orientations ,technology-organisation, strategic capability, leadership behaviour, and institutional governance ,address complementary analytical levels rather than competing explanations, and their integration into middle-range frameworks attuned to public

sector governance represents a key theoretical task ahead.

At the practical level, this study offers three contributions that are directly applicable to public organisations. The empirical coverage data provides an evidence-based priority matrix for capability development investment, distinguishing dimensions where training mechanisms are relatively mature from those where conceptual foundations must first be established. The barrier analysis reveals the systemic interdependence of implementation obstacles, providing a diagnostic tool that helps organisations identify why single-point interventions, such as training alone, tend to produce limited results. The critical assessment of development practices helps practitioners distinguish between widely recommended approaches and those with verified effectiveness, promoting evidence-informed strategy selection over experience-driven convention.

6.2 Management and Policy Implications

6.2.1 Management Implications

The primary management implication of this study is that effective Digital Leadership development cannot be reduced to training programmes. Evidence from the reviewed literature consistently shows that training effects are contingent on the organisational conditions into which they are delivered: role designs, incentive structures, and cultural norms determine whether individual capability gains translate into changed leadership behaviour. Public sector managers should therefore approach capability development as a three-level system. Formal training should be calibrated to the differentiated needs of each competency dimension, shifting from awareness-building toward deep practice for well-established dimensions, and initiating conceptual foundations for neglected dimensions such as cultural intelligence and talent cultivation. Organisational learning culture should be cultivated through deliberate mechanisms, including performance management systems that reward experimentation rather than penalising failure, and digital HRM practices that model the digital-first orientation the organisation seeks to instil. Capability-building ecosystems, combining leadership commitment, structural change, external partnerships, and broad staff participation, represent the most sustainable approach to transformation, even though they demand more than any single training investment.

A practical priority for managers is to conduct a structured competency audit against the ten-dimensional framework before designing development programmes. Such an audit would reveal not only gaps in individual capability but also where the organisation's systems, culture, and governance structures inhibit effective Digital Leadership, enabling targeted rather than generic interventions.

6.2.2 Policy Implications

At the institutional level, three policy directions follow from the findings of this study. First, governance frameworks should be redesigned to create a differentiated accountability environment that maintains strict compliance norms for routine functions while establishing protected innovation space - through sandbox mechanisms and tolerant failure policies, for digital transformation initiatives. The current conflation of accountability and risk-avoidance within a single governance logic tends to penalise exactly the experimental behaviour that effective digital leadership requires.

Second, incentive structures within public sector human resource systems should be reformed to align with digital transformation objectives. Promotion criteria, performance evaluations, and compensation arrangements that currently

reward compliance and stability send signals that undermine investment in Digital Leadership development. Incorporating digital transformation performance indicators and innovation effectiveness measures into career advancement pathways would reorient organisational behaviour at scale.

Third, resource mobilisation for digital infrastructure should be coordinated at a supra-organisational level rather than left to individual agencies. Central or provincial coordination of shared digital platforms, standardised data infrastructure, and pooled innovation funds would address the resource and infrastructure constraints identified as systemic barriers, reducing redundant investment and enabling the interoperability that cross-agency digital collaboration requires.

6.3 Research Limitations

Three limitations bound the conclusions of this study and should be considered when interpreting its findings.

The first concerns the scope of the literature reviewed. Only English-language, peer-reviewed journal articles from Scopus, Web of Science, and IEEE Xplore were included. Research published in other languages, grey literature such as government reports and policy documents, conference papers, and dissertations were excluded. Given that digital governance practices vary significantly across cultural and institutional contexts, non-English research may document capability dimensions, implementation experiences, and theoretical perspectives that the current review does not capture. The coverage patterns reported here, particularly the low representation of cultural intelligence research, should therefore be interpreted as reflecting the state of the English-language academic literature rather than the global landscape of practice. This limitation is especially relevant to the interpretation of D9 and D10 because practice-oriented reports, policy documents, and non-English studies may contain evidence on intercultural leadership and organisational capability building that has not yet entered the English-language peer-reviewed literature.

The second limitation concerns the cross-sectional nature of the review method. The analysis captures research published between 2015 and 2025 but cannot track how research priorities, theoretical orientations, or capability definitions have evolved within this period. The finding that D9 coverage is at 2.1%, for example, does not distinguish between persistent neglect and a recent upturn in attention that has not yet accumulated sufficient studies. Longitudinal bibliometric analysis would provide a more dynamic view of the field's development.

The third limitation concerns the interpretive dimensions of the framework mapping process. Coding decisions involve researcher judgement, and different coders may make different determinations for ambiguous cases. Although coding consistency was supported through operational definitions and coding examples, the ten-dimensional framework was applied deductively, which means that capability dimensions present in the literature but not predefined by the framework may have been missed. Complementary inductive approaches, such as grounded theory analysis, could surface additional or differently framed competency constructs.

6.4 Future Research Directions

Three research directions follow most directly from the gaps and limitations identified in this study.

A key research priority is empirical investigation of the two underexplored dimensions. For Cultural and Intercultural Competence (D9), research is needed on how digital leaders adapt to the technological expectations and usage patterns

of culturally diverse populations, how cultural differences affect leadership effectiveness in cross-border or cross-regional digital governance collaborations, and whether cultural intelligence can be reliably developed through targeted training in public sector contexts. For Talent Development and Digital-First Culture (D10), research should shift from individual learning to the organisational mechanisms through which leaders systematically build digital capability in others, including mentoring structures, skills gap assessment and closure, succession planning, and the institutionalisation of digital-first norms within bureaucratic organisations.

The second priority is theoretical integration. The field currently lacks the middle-range theories needed to connect technology-organisation, strategic capability, leadership behaviour, and institutional governance perspectives into a coherent explanatory account of Digital Leadership in public sector contexts. Future theoretical work should aim to specify the core constructs, antecedent and consequence relationships, boundary conditions, and mediating mechanisms of public sector Digital Leadership as a distinct theoretical domain, rather than borrowing frameworks from general leadership or corporate digitalisation research without adaptation.

The third priority is methodological innovation in capability development evaluation. The reviewed literature is overwhelmingly descriptive and cross-sectional; it documents what capabilities matter and what obstacles exist but provides limited evidence on what interventions work and under what conditions. Future research should prioritise quasi-experimental designs and pre-post assessments that compare the effects of different development approaches, longitudinal studies that track capability development and transformation outcomes over time, and cross-context comparative studies that identify context-dependent and universal mechanisms. The development of a validated Digital Leadership measurement instrument grounded in the ten-dimensional framework would provide a shared measurement basis for this cumulative research agenda.

6.5 Conclusion

Digital Leadership in the public sector is no longer an emerging curiosity in the leadership literature; it is a practical necessity for governments navigating the demands of digital transformation while maintaining the accountability, equity, and public value commitments that distinguish governance from commercial management. This review has demonstrated that the academic community has made substantial progress in mapping the competency landscape, identifying implementation barriers, and exploring development strategies. At the same time, it has shown that this progress is uneven, theoretically fragmented, and insufficiently evaluated.

The ten-dimensional framework synthesised and validated in this study offers one response to that unevenness: a structured analytical vocabulary that covers the full range of competencies required for effective Digital Leadership, draws attention to the dimensions the field has neglected, and provides a common reference point for future research and practice. The framework's most important implication is not that every dimension must be developed equally or simultaneously, but that the capability system must eventually be addressed as a whole. Leaders who are strategically visionary but culturally insensitive, technically literate but unable to build organizational talent pipelines, or innovative in individual behavior but embedded in organizations that penalize experimentation will not sustain the transformations that citizens and governments need.

The research gaps identified here, particularly in cultural intelligence and organisational talent cultivation, are not peripheral. They represent the dimensions

most relevant to the challenges that public sector digital transformation will face in the decade ahead: governing AI across diverse populations, building cross-border digital partnerships, and ensuring that the capability to lead digital transformation is institutionalised rather than dependent on individual champions. Addressing these gaps, developing integrative middle-range theories, and investing in rigorous evaluation research will be the work that moves this field from evidence-informed description to evidence-based guidance for a major governance challenge in the digital era.

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