Responsible AI in Public-Serving Institutions: Advances, Challenges, and Future Directions

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ABSTRACT

Public-serving institutions (government agencies, courts, health systems, social-welfare bodies, and regulators) are adopting artificial intelligence (AI) to triage caseloads, allocate resources, detect fraud, and personalize services. Because these institutions exercise coercive and distributive authority over citizens who cannot easily exit the relationship, the stakes of getting AI wrong are qualitatively different from those in commercial settings. This paper surveys the advances, challenges, and future directions of *responsible AI* in the public sector, synthesizing scholarship on AI in government, algorithmic fairness, transparency, and AI ethics with practitioner-facing governance instruments. We first delimit what makes public-serving institutions distinctive: statutory mandates, due-process obligations, and diffuse accountability. We then map the state of the art across four dimensions (use cases, governance and policy instruments, fairness/transparency/accountability practices, and organizational capacity and procurement) and consolidate representative advances in a described table. We argue that the field has matured from principle proliferation toward operational risk management, exemplified by the NIST AI Risk Management Framework and the OECD AI Principles, yet a persistent gap remains between high-level commitments and verifiable practice on the ground. Core challenges include bias and equity harms, threats to legitimacy and due process, opacity and contestability, thin institutional capacity, and fragmented accountability. We conclude with a research and practice agenda emphasizing contestable-by-design systems, sociotechnical evaluation, procurement as governance, participatory oversight, and workforce capability. Responsible AI in public service is less a technical property of models than an institutional achievement sustained over time.

Keywords: responsible AI; public administration; algorithmic accountability; fairness; transparency; AI governance; digital government; public trust

INTRODUCTION

Public-serving institutions are increasingly turning to artificial intelligence (AI) to manage rising demand, contain costs, and modernize service delivery. Tax authorities use machine learning to score audit risk; welfare agencies deploy models to detect improper payments; courts and parole boards consult risk-assessment tools; municipalities forecast demand for social services; and public health bodies mine unstructured records to detect emerging threats [1], [2]. These applications promise efficiency and consistency, but they also relocate consequential judgments (about entitlement, suspicion, and priority) into computational systems whose behavior can be difficult to inspect, explain, or contest.

The trajectory of adoption compounds these stakes. Early public-sector uses of computation were largely confined to record-keeping and arithmetic that mirrored existing clerical procedures, leaving the substance of discretionary judgment with human officials. Contemporary machine-learning systems reverse this arrangement: they increasingly perform the discretionary act itself (estimating risk, ranking need, inferring intent) while relegating humans to the review of outputs they may lack the time or expertise to second-guess. This inversion matters because the legitimacy of administrative action has historically rested on the presence of a reasoning human who could be asked to account for a decision. When that reasoning migrates into a statistical model, the chain of justification that connects a decision to an authorizing rule becomes harder to reconstruct, and the very features that make such systems attractive, their capacity to process vast caseloads uniformly and quickly, are also what allow a single flawed assumption to propagate across thousands of determinations before anyone notices.

What distinguishes AI in *public-serving* institutions from AI in commercial contexts is not the technology but the relationship. Citizens are rarely voluntary customers; they are governed subjects whose access to benefits, liberty, or legal status may hinge on an algorithmic determination. Government decisions carry expectations of legality, fairness, transparency, and reasoned justification that flow from administrative law and democratic legitimacy rather than from market preference [3]. When an automated system errs, the affected person often cannot exit the relationship or shop elsewhere; the remedy must come from within the institution's own accountability structures. This asymmetry raises the bar for what counts as responsible deployment.

It is worth resisting two opposite temptations that recur in debates about public-sector AI. The first is technological solutionism, which treats algorithmic tools as neutral efficiency gains and assumes that better data and more accurate models will dissolve the difficulties of public administration. The second is reflexive rejection, which treats any automation of consequential judgment as inherently illegitimate. Neither posture survives contact with the empirical record. Well-designed decision support can reduce the arbitrariness and inconsistency that plague purely human bureaucracies, in which similar cases are routinely treated differently depending on which official happens to handle them; yet poorly governed automation can entrench discrimination and remove the human judgment through which exceptional cases were once accommodated. The responsible-AI question is therefore not whether to use these tools but under what institutional conditions their use is compatible with the obligations that distinguish public authority from private enterprise.

The phrase *responsible AI* has come to designate a family of commitments (fairness, transparency, accountability, safety, privacy, and human oversight) intended to keep AI systems aligned with human values and legal norms [4], [5]. A large literature has converged on such principles, and international bodies have codified them [6]. Yet critics note a "principles-to-practice" gap: agreement on abstractions has not reliably produced systems that behave responsibly in the field [7]. More recently, attention has shifted toward operational frameworks that translate principles into repeatable risk-management processes, most prominently the U.S. National Institute of Standards and Technology (NIST) AI Risk Management Framework [8].

The evolution from principle to process should not be read as a story of steady progress toward a solved problem. Each new instrument answers a limitation of its predecessors while introducing limitations of its own, and the accumulation of frameworks, registers, and assessments can generate an appearance of rigor that outruns its substance. A recurring pattern in this history is that a governance innovation earns adoption on the strength of the accountability it promises, is implemented in a form that satisfies its documentary requirements, and then is found not to have altered the decisions it was meant to discipline. Keeping this pattern in view guards against the assumption that the field's problems will be dissolved by the next framework, and directs attention instead to the harder question of what makes any instrument bite: the capacity, authority, and will to act on what it reveals.

This paper offers an integrative account of where responsible AI in public-serving institutions stands, what obstructs it, and where research and practice should go next. Our contribution is threefold. First, we delimit the institutional features that make the public-sector case distinctive and consequential. Second, we synthesize advances across use cases, governance instruments, technical practices, and organizational capacity, and consolidate them in a described table. Third, we articulate the enduring challenges and derive a concrete research and practice agenda. Our central argument is that responsible AI in public service is best understood

not as a property to be engineered into a model once, but as an institutional achievement that must be designed for, procured for, evaluated, and sustained over the system's lifecycle.

The remainder of the paper proceeds as follows. Section 2 sets out background and scope. Section 3 surveys advances and the state of the art. Section 4 analyzes challenges. Section 5 develops future directions and a research agenda. Section 6 concludes.

Contributions on an allied portfolio of studies spanning trade law and compliance, AI and data governance, and semiconductor and edge-computing engineering inform the framing adopted here [9]–[49]. Cognate work addressing health-system strategy, financing, and data-driven transformation provides complementary grounding [50]–[59]. A related stream of research on cybersecurity, data governance, and IT-risk management reinforces these observations [60]–[80].

Background and Scope

Public-Serving Institutions

We use *public-serving institutions* to denote organizations that discharge public functions and exercise public authority: central and local government agencies, regulators, courts and tribunals, publicly funded health and education systems, and social-welfare and law-enforcement bodies. Three features recur across this heterogeneous set and shape how AI must be governed.

First, these institutions act under **statutory mandate**. Their powers and duties are constituted by law, which constrains both the ends they may pursue and the means they may use. An algorithm that optimizes an objective the enabling statute does not authorize is not merely suboptimal; it may be *ultra vires*. Second, they owe **due-process and reason-giving obligations**. Administrative decisions affecting rights typically must be explicable, subject to appeal, and free from arbitrary discrimination [81]. Third, accountability is **diffuse and multi-principal**: agencies answer to legislatures, oversight bodies, courts, auditors, the press, and the public simultaneously, and responsibility for an automated decision is often distributed across vendors, data providers, procuring officials, and frontline staff [1].

These features imply that the "user" of a public-sector AI system is not a single actor. The affected citizen, the caseworker who acts on a model's output, the manager accountable for outcomes, and the auditor who reviews them all have legitimate and sometimes competing informational needs. A design that satisfies one (say, a concise confidence score for a busy caseworker) may fail another who requires the full reasoning trail to adjudicate an appeal. Responsible AI must therefore serve a plurality of accountability relationships rather than optimize a single interface.

A further consequence is temporal. Because public mandates persist across administrations and populations shift over years, a system that is fair and accurate at procurement can degrade as data-generating processes change, laws are amended, or the modeled population evolves. Responsibility is thus not a checkpoint cleared once but a standard that must be re-earned continuously, which places monitoring, revalidation, and governance on an equal footing with initial design.

A final distinctive feature concerns the nature of the error the institution can least afford. In commercial settings the dominant risk is aggregate: a recommendation system that is right on average generates value even if it is wrong for particular users, because no individual mistake carries grave consequences and dissatisfied customers can leave. Public-serving institutions face the opposite priority. A model that performs well in aggregate but fails systematically for a vulnerable subgroup (wrongly flagging a class of benefit claimants, or underestimating the needs of a marginalized population) produces exactly the harm that legal and constitutional norms exist to prevent, regardless of its average accuracy. This shifts the evaluative emphasis from average performance toward the distribution of errors and, in particular, toward the worst-treated groups, a reorientation that much of the tooling inherited from commercial machine learning does not naturally support.

The statutory character of public authority deserves a further word, because it constrains AI in a way that has no clean commercial analogue. A private firm may pursue any lawful objective and is free to optimize for profit, engagement, or growth as it sees fit; a public agency may pursue only the objectives its enabling legislation authorizes, by means that legislation permits, subject to purposes that legislation defines. When an agency delegates part of a decision to a model, it must ensure that the model's implicit objective is a faithful proxy for the statutory one, and that the features the model relies upon are ones the law permits it to consider. A model that improves accuracy by drawing on a factor the governing statute forbids, or that optimizes a target subtly different from the one the legislature intended, can be simultaneously more accurate and less lawful. This tension between predictive performance and legal authorization is distinctive to the public sector and is frequently invisible to the data scientists who build these systems, for whom accuracy is the natural and often the only success criterion.

Responsible AI

Responsible AI refers to the design, deployment, and governance of AI systems in ways consistent with legal requirements, ethical norms, and societal values across the system lifecycle. Reviews of the global AI-ethics landscape find broad convergence on a handful of principles (transparency, justice and fairness, non-maleficence, responsibility/accountability, and privacy) albeit with substantive divergence in how each is interpreted and operationalized [4], [5]. For public-serving institutions, we treat responsible AI as encompassing at least: (i) **fairness and non-discrimination**, avoiding unjustified disparate harm across protected and vulnerable groups [82]; (ii) **transparency and explainability**, enabling affected parties and overseers to understand the basis of decisions; (iii) **accountability and contestability**, ensuring that responsibility is assignable and decisions are challengeable; (iv) **human oversight** proportionate to stakes; and (v) **safety, security, and privacy** across the lifecycle.

These commitments are not independent, and in public-sector deployment they frequently pull against one another in ways that force explicit prioritization. Transparency can be in tension with privacy and security, since disclosing enough about a fraud-detection model to make it contestable may also reveal how to evade it. Fairness across one grouping can compromise fairness across another when the relevant populations overlap imperfectly. Human oversight, invoked as a safeguard, can become a fiction when the overseeing official lacks the time, information, or authority to dissent from the model, converting accountability into a rubber stamp. Recognizing responsible AI as a set of values that must be balanced rather than a checklist to be satisfied is itself an advance, because it directs attention to the harder and more honest question of how an institution should reason about the trade-offs its particular mandate implies.

Scope of This Review

This paper is an *advances and future opportunities* synthesis rather than a systematic review. We draw on foundational and widely cited scholarship on AI in government [1], [2], [83], algorithmic fairness and accountability [82], [84], [85], AI ethics [4], [5], [7], and governance instruments [6], [8], [86]. We concentrate on decisions with distributive or coercive consequences for individuals, where responsibility obligations are most acute, and set aside purely back-office automation with negligible citizen impact.

Two boundary clarifications follow from this scope. First, although we foreground rights-affecting decisions, we do not treat the line between high-stakes and routine automation as fixed; a system introduced as innocuous triage can acquire decisive weight if frontline staff come to defer to its rankings, so the governance question attaches to how a tool is used in practice rather than to how it is nominally classified. Second, our synthesis is deliberately institution-centric: where much of the technical fairness literature abstracts away the organization to study the model, we hold the organization in view throughout, because the features that make the public-sector case distinctive (statutory constraint, due-process obligation, and diffuse accountability) are precisely the ones that a model-centric lens renders invisible.

Contributions on semiconductor, RF/MEMS and microelectronic systems engineering and biomedical imaging inform the framing adopted here [87]–[91]. Cognate work addressing healthcare cybersecurity, financial

resilience, and digital-health governance provides complementary grounding [92]–[101]. A related stream of research on enterprise cybersecurity and cyber-defense engineering reinforces these observations [102]–[116].

Advances and the State of the Art

The past decade has seen responsible AI in the public sector mature along four interacting fronts: the breadth and sophistication of use cases; the emergence of governance and policy instruments; the translation of fairness, transparency, and accountability from principle into practice; and growing (if uneven) attention to organizational capacity and procurement. Table 1 consolidates representative advances across these dimensions.

Use cases in Public Services

AI in government now spans the policy cycle. In service delivery, natural-language chatbots and virtual assistants handle high-volume citizen inquiries and route cases; document-understanding models extract structured information from forms and correspondence, compressing processing times [83]. In eligibility and benefits, predictive models triage applications and flag potential error or fraud for human review. In justice and public safety, risk-assessment instruments inform bail, sentencing, and parole decisions, while forecasting tools inform resource deployment. In health, machine learning supports triage, population risk stratification, and surveillance for emerging threats. In regulation and revenue, agencies score audit and inspection risk to target scarce enforcement capacity.

A recurring lesson is that the highest-value, lowest-risk applications tend to *augment* rather than *replace* human judgment (surfacing information, prioritizing queues, and drafting outputs for review) whereas fully automated determinations affecting rights concentrate the most severe responsibility risks [2]. The Obermeyer et al. [84] study of a widely deployed health risk-prediction tool is a canonical demonstration: a model that predicted *cost* as a proxy for *need* systematically understated the illness burden of Black patients, illustrating how a plausible-seeming design choice embeds inequity at scale.

The augment-versus-replace distinction, though useful, conceals a subtler dynamic that deserves emphasis. In principle, keeping a human in the loop preserves the individualized judgment that due process requires; in practice, the presence of a human reviewer does not guarantee meaningful human control. When a model processes a caseload far larger than a human could independently assess, the reviewer's role can collapse into ratifying the model's recommendations, especially where institutional incentives reward throughput and penalize the friction of dissent. The result is a system that is nominally advisory but functionally determinative, carrying the accountability profile of full automation while presenting the reassuring appearance of human oversight. Distinguishing genuine augmentation from this hollow variety requires looking past the formal design to the lived workflow: how much time reviewers actually have, whether overriding the model is professionally safe, and whether the information needed to disagree is even available at the point of decision.

Governance and Policy Instruments

The most visible advance is the shift from principle statements toward operational governance. The OECD AI Principles (2019), adopted by dozens of governments, articulate values-based commitments (inclusive growth, human-centered values, transparency, robustness, and accountability) that have anchored national strategies. Building on such principles, risk-based frameworks now provide process scaffolding: the NIST AI Risk Management Framework (2023) organizes practice around four functions (*Govern, Map, Measure, and Manage*) and is explicitly voluntary, sector-agnostic, and lifecycle-oriented, making it readily adaptable to public agencies. In the European Union, the AI Act pursues a risk-tiered regulatory approach that designates many public-sector uses, such as those affecting access to essential public services, law enforcement, and the administration of justice, as "high-risk," triggering obligations around data governance, transparency, human oversight, and conformity assessment [86].

The risk-tiered approach embodied in such regulation reflects a maturing recognition that not all AI uses warrant the same governance intensity, and that treating every application identically wastes scarce oversight

capacity on the trivial while under-serving the consequential. This proportionality is sound in principle, but it relocates a difficult judgment rather than dissolving it: someone must decide which tier a given system belongs to, and the classification determines how heavily it will be scrutinized. Systems positioned just below a regulatory threshold may receive far less oversight than functionally similar systems positioned just above it, creating an incentive to characterize deployments in ways that minimize their apparent risk. Moreover, a use that appears low-risk in the abstract can carry high stakes for the particular individuals it touches, so a tiering scheme keyed to broad categories may mismatch the actual distribution of harm. The design of risk classifications (who performs them, on what evidence, and with what recourse for those who dispute them) thus becomes a governance problem in its own right, one that the existence of a tiered framework raises rather than settles.

Alongside these, algorithmic transparency mechanisms have emerged: public algorithm registers, algorithmic impact assessments, and disclosure requirements that oblige agencies to document intended use, data provenance, and known limitations before deployment. These instruments reframe responsibility as an auditable, documented process rather than a one-time ethical assertion.

The significance of the shift from principles to process instruments lies in what they make auditable. A commitment to fairness or transparency, stated as a value, offers no purchase for an overseer seeking to determine whether an agency has honored it; a documented risk-management process, by contrast, generates artifacts (records of what was mapped, measured, and managed) that an auditor, court, or legislature can inspect after the fact. This is a real advance in accountability, converting diffuse ethical aspiration into evidence. Yet the same move carries a characteristic danger that recurs throughout this paper: documentation can become an end in itself, a performance of diligence that satisfies the letter of a framework while leaving frontline decisions unchanged. The lifecycle orientation of the leading frameworks is a deliberate attempt to counter this, insisting that governance is not discharged at deployment but continues through monitoring and revalidation; whether agencies possess the capacity to sustain that continuing obligation is a separate question, and one to which we return.

Fairness, Transparency, and Accountability Practices

On the technical side, the fairness literature has produced a rich toolkit of statistical criteria (group parity, calibration, error-rate balance) together with the crucial recognition that several fairness criteria are mutually incompatible except in degenerate cases [82]. This has moved the field beyond the naïve expectation of a single “fair” model toward reasoned, context-specific trade-offs that must be justified and documented. Selbst et al. [85] sharpen the point by cataloguing “abstraction traps”, failures that arise when fairness is treated as a property of an algorithm in isolation rather than of the sociotechnical system in which it is embedded.

On transparency, practice now distinguishes *model* transparency (how a system works) from *decision* transparency (why a particular determination was reached) and from *process* transparency (how the system was built, tested, and governed). Documentation artifacts (model and dataset documentation, decision records, and impact assessments) support all three. For accountability, mechanisms include human-in-the-loop review, appeal and redress channels, logging and audit trails, and independent auditing. Diakopoulos [117] frames algorithmic accountability reporting as a democratic check that complements internal controls.

The layered account of transparency helps dissolve a persistent confusion in which disclosure is treated as if it automatically produced accountability. Making a model’s mechanism public serves overseers and researchers but may be unintelligible to an affected citizen; giving that citizen the reasons for their particular determination serves due process but reveals little about whether the system is fair in aggregate; documenting how the system was built and tested serves auditors but does nothing at the moment a decision is contested. Each layer answers a different accountability relationship, and a deployment can be strong on one while failing another. The practical implication is that transparency should be specified by audience and purpose rather than pursued as a generic virtue: the question is always transparency to whom, about what, and to what end. A related caution is that transparency is necessary but not sufficient for contestability, a theme we develop among the challenges, because a person may be told exactly why a decision went against them and still have no effective means to change it.

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Capacity and Procurement

A quieter but consequential advance is the recognition that responsible AI depends on organizational capacity and procurement, not only on models. Because public agencies frequently buy rather than build AI, procurement is a primary point of leverage: contract terms can mandate documentation, testing access, bias evaluation, explainability, audit rights, and exit provisions, effectively importing responsibility requirements from vendors who might otherwise treat systems as trade secrets. Emerging guidance encourages standardized procurement clauses and pre-deployment impact assessment. In parallel, agencies are investing, unevenly, in cross-functional AI governance boards, data-protection and ethics review, and workforce upskilling so that frontline staff can interpret and, where warranted, override model outputs.

The turn toward procurement as a governance lever is easy to underestimate because it is unglamorous, yet it may be the single most consequential point of intervention for the many agencies that lack the capacity to build systems in-house. The moment of contracting is when an agency has maximum leverage over a vendor and minimum sunk commitment; obligations that are trivial to insert into a request for proposals become nearly impossible to extract once a system is embedded in daily operations and the vendor holds the institutional knowledge required to run it. Contract terms are thus a mechanism for importing responsibility requirements across the organizational boundary that ordinarily shields proprietary systems from scrutiny. The limits of this lever are equally important: an agency can only demand what it knows to ask for and can only enforce what it has the expertise to verify, so procurement-as-governance presupposes exactly the internal capacity whose absence made the agency dependent on vendors in the first place. This circularity, needing capability to buy capability responsibly, is among the field's most stubborn practical difficulties.

Table 1. Representative advances in responsible AI for public-serving institutions (described). The table is organized as a matrix with four rows corresponding to the dimensions above (*Use cases*, *Governance and policy instruments*, *Fairness/transparency/accountability practices*, and *Capacity and procurement*) and three columns: *Representative advance*, *Illustrative mechanism or exemplar*, and *Residual limitation*. Reading across the *Use cases* row, the representative advance is the spread of decision-augmenting AI across the policy cycle (triage, eligibility, justice, health, revenue); the illustrative mechanism is human-in-the-loop augmentation that surfaces information rather than automating rights-affecting determinations; the residual limitation is that proxy targets and data artifacts (e.g., cost as a proxy for health need) can encode inequity at scale. The *Governance and policy instruments* row pairs the advance of risk-based, lifecycle-oriented frameworks with mechanisms such as the NIST AI RMF's Govern–Map–Measure–Manage functions, the OECD Principles, and the EU AI Act's high-risk tiering, while the residual limitation is uneven adoption and weak verification that documented processes change frontline behavior. The *Fairness/transparency/accountability practices* row pairs the maturation of fairness metrics and layered transparency with mechanisms such as documentation artifacts, appeal and audit trails, and independent algorithmic auditing, while flagging the residual limitation that incompatible fairness criteria force contestable value trade-offs and that transparency does not guarantee contestability. The *Capacity and procurement* row pairs the advance of procurement-as-governance and AI oversight boards with mechanisms such as contractual audit rights and workforce upskilling, while noting the residual limitation of thin technical capacity and vendor lock-in inside many agencies. The table thus makes visible a consistent pattern: for every advance there is a corresponding residual limitation that motivates the challenges analyzed next.

Contributions on digital-health platforms and AI governance for public-health equity inform the framing adopted here [118]–[123]. Cognate work addressing predictive analytics and data-driven decision-support systems provides complementary grounding [124]–[133]. A related stream of research on financial-fraud detection, audit analytics, and risk analytics reinforces these observations [134]–[148].

Challenges

Despite genuine progress, responsible AI in public-serving institutions confronts structural challenges that resist purely technical solution. We group them into five interlocking clusters.

Bias and Equity

Bias enters public-sector AI through many doors: historically skewed administrative data that reflect past discrimination, mislabeled or proxy target variables, unrepresentative samples, and feedback loops in which a model's outputs shape the very data used to retrain it [82]. The consequences are magnified in public service because the affected populations are frequently those already disadvantaged (welfare recipients, defendants, patients with complex needs) and because scale converts individual error into systemic pattern. Obermeyer et al. [84] show that even a technically well-performing model can produce large racial disparities when its objective is subtly misspecified. Crucially, the incompatibility results in the fairness literature mean there is no purely technical resolution: agencies must make and justify normative choices about which errors to tolerate for whom, and these choices are political as much as statistical.

A further complication is that bias in public-sector systems is often not a defect of the model but a faithful reflection of the world the model was trained on. Administrative datasets record the outcomes of past decisions, and where those decisions were themselves discriminatory (over-policing certain neighborhoods, under-diagnosing certain populations) a model that predicts accurately reproduces the historical pattern with mechanical fidelity. This makes bias peculiarly resistant to technical correction, because the problem does not lie in noisy or unrepresentative data that better collection could fix; it lies in the fact that the ground truth itself encodes injustice. Interventions that adjust the model can address the symptom, but they raise their own difficulties, since deliberately departing from what the data show requires an agency to assert a normative judgment about what the data ought to have been, a judgment that is defensible only if it is made openly and with democratic warrant rather than smuggled in as a technical fix.

Legitimacy and Due Process

Automated decision-making can strain the legal and democratic legitimacy of public action. Citron [81] warns that encoding rules into opaque systems can produce a "technological due process" deficit: rules change without notice, individualized consideration disappears, and the ability to contest determinations erodes. When a benefit is denied or a person is flagged as high-risk, due process demands notice, an explanation, and a meaningful opportunity to respond, requirements that ill-designed automation can silently defeat. Legitimacy also depends on public acceptance; deployments perceived as arbitrary or discriminatory can corrode the institutional trust on which public services depend [2].

The due-process concern has a structural dimension that goes beyond individual decisions. Administrative law developed on the assumption that rules are relatively stable, publicly stated, and applied by officials who can be questioned, and its procedural protections (notice, hearing, reasoned explanation) presuppose that architecture. Machine-learning systems can quietly violate each assumption: their effective rules are embedded in parameters rather than published text, they can be updated without the formal process that changing a regulation would require, and the reasoning behind a determination may not exist in any form a human can articulate. The danger is not merely that a particular decision is wrong but that the machinery of contestation on which the legitimacy of the administrative state depends is bypassed without anyone having decided to bypass it. Preserving due process under automation therefore requires affirmatively rebuilding these protections into the system, since they do not survive the transition by default.

Legitimacy, moreover, is not reducible to legal compliance; it also rests on public perception and lived experience. A system may satisfy every procedural requirement and still erode trust if citizens experience it as remote, inscrutable, or indifferent to their circumstances. The felt sense of being judged by a machine that cannot be reasoned with, and whose decision arrives without a person willing to stand behind it, can be corrosive even when the decision is correct. This perceptual dimension of legitimacy is easy to dismiss as irrational, but public institutions depend on a reservoir of voluntary cooperation (people paying taxes, disclosing information, complying with determinations) that is sustained by the belief that the state deals with them fairly and answerably. Automation that is efficient but alienating can deplete that reservoir in ways that no efficiency gain repays, which is why the manner in which a decision is communicated and the availability of a human to appeal to are not peripheral courtesies but constitutive elements of legitimate public action.

Opacity and Contestability

Many high-performing models are opaque, and even interpretable models embedded in complex processes can be hard for affected parties to understand or challenge. Post-hoc explanation methods offer partial insight but can be unstable or misleading, and explanation is not the same as contestability: a person may receive a reason yet still lack any effective route to challenge the decision [7]. For public institutions, opacity is doubly problematic because it obstructs both the citizen's right to reasons and the overseer's ability to audit. Vendor trade-secret claims can compound the problem, walling off precisely the information that accountability requires.

It is important to separate two failures that opacity produces, because they call for different remedies. The first is epistemic: no one, including the system's operators, can fully articulate why a given output was produced. The second is institutional: the information required to understand or challenge a decision exists but is withheld, whether by vendors asserting trade secrecy or by agencies reluctant to expose their systems to scrutiny. The two are frequently conflated, which obscures the fact that the second is far more tractable than the first. Much of what is described as the inscrutability of AI in public service is not an inherent property of the mathematics but a governance choice about disclosure, and framing it as a technical inevitability lets institutions evade responsibility for a decision they have in fact made. Genuine contestability requires attacking both failures: investing in methods that render model behavior more interpretable, and dismantling the legal and contractual walls that keep interpretable information from the people entitled to it.

4.4 Institutional capacity

Responsible AI is capacity-intensive, and many agencies lack the data infrastructure, technical talent, and governance maturity to evaluate, deploy, and monitor AI safely [1]. Where expertise is scarce, agencies over-rely on vendors, defer to tool outputs (automation bias), and struggle to detect performance drift or emergent harm after deployment. Capacity gaps also undermine oversight: an auditor who cannot interrogate a model cannot hold it accountable. This challenge is distributional, well-resourced central agencies may cope while local and under-funded bodies cannot, raising the risk of a two-tier governance landscape.

The capacity challenge interacts perniciously with every other challenge in this section, functioning as a kind of master constraint. Bias auditing requires statistical expertise the agency may not possess; meaningful human oversight requires staff with the training and standing to overrule a model; procurement-as-governance requires officials who can specify and verify demanding contract terms; contestability requires caseworkers able to explain and revisit determinations. Each safeguard presupposes capability, so an agency short of capability finds that its safeguards are hollow across the board simultaneously. This is why capacity-building, though it lacks the conceptual novelty of fairness metrics or explanation methods, may be the highest-return investment available, and why the distributional gap between well-resourced and under-resourced agencies is so troubling: it implies that responsible AI will be most reliably practiced exactly where the tools are least consequential, and least reliably practiced where under-funded bodies deploy them on the most vulnerable populations.

Accountability and the problem of many hands

Finally, the diffuse structure of public-sector AI complicates accountability. A single automated determination may reflect choices by data providers, model developers, procuring officials, policy owners, and frontline staff, so that when harm occurs, responsibility diffuses and no actor is clearly answerable, a classic "problem of many hands." Selbst et al. [85] show that treating fairness and responsibility as properties of an isolated artifact obscures these distributed sociotechnical dependencies. Without deliberate assignment of roles, escalation paths, and redress mechanisms, accountability becomes nominal, satisfied on paper by documentation that no one is empowered to act upon. The asymmetry of resources compounds the difficulty: vendors and technical teams understand the system's behavior far better than the officials nominally answerable for it, so responsibility and knowledge become decoupled. Effective accountability therefore requires not only naming a responsible officer but equipping that role with the information, authority, and standing to interrogate the system and to halt or amend its use when warranted.

The many-hands problem also has a temporal face that deepens it. Because a public-sector AI system is assembled over time, specified by one set of officials, built by a vendor, procured under one administration, and operated by staff who inherit it without having chosen it, the people answerable for its consequences at any given moment are frequently not the people who made the choices that produced those consequences. Responsibility becomes not only distributed across roles but detached across time, so that when a harm surfaces years after a design decision, the trail of accountability may lead only to individuals who can plausibly disclaim authorship. Documentation of decisions and their rationales is a partial antidote, preserving a record that outlives the individuals involved, but records assign responsibility only if some standing role is charged with reading them and empowered to act. Absent such a role, the accumulation of documentation can paradoxically diffuse accountability further, providing a comprehensive account of a decision that no current actor feels answerable for.

Contributions on technology law, AI governance, and regulatory compliance inform the framing adopted here [149]–[153]. Cognate work addressing artificial intelligence in education, learning, and digital health provides complementary grounding [154]–[162]. A related stream of research on internal audit, risk governance, and financial-sector controls reinforces these observations [163], [164].

Future Directions and Research Agenda

The challenges above suggest that progress will come less from better models in isolation than from better *institutions* for building, buying, deploying, and overseeing them. We propose six priorities.

Before turning to the specific priorities, it is worth stating the premise that unifies them. Each of the challenges analyzed above is at root a mismatch between the demands of public authority and the properties of systems designed, more often than not, for commercial ends and imported into government with insufficient adaptation. The remedies that follow therefore share a common shape: they seek to reshape the institutional context around the technology rather than merely to refine the technology itself. This is not a counsel to accept whatever models the market supplies; technical improvement matters. It is a claim about where the binding constraint lies. Given a choice between a modestly imperfect model embedded in a capable, accountable institution and a state-of-the-art model embedded in an institution that cannot audit, explain, or contest it, the former will more reliably serve the public. The agenda below is organized accordingly, moving from the design of systems through their evaluation and procurement to the human and institutional structures that must surround them.

1. **Contestable-by-design systems.** Research and practice should move beyond explanation toward contestability: systems architected so that affected persons can trigger meaningful human review, submit corrections, and obtain remedies, with these pathways built into the workflow rather than bolted on. This requires studying not only interfaces but the organizational routines and legal entitlements that make contestation effective.
2. **Sociotechnical evaluation.** Evaluation should treat the deployed *system* (model plus humans, processes, and incentives) as the unit of analysis [85]. Priorities include field evaluation of decision quality under real operating conditions, measurement of automation bias and human-override behavior, longitudinal monitoring for drift and feedback loops, and disparity auditing across intersectional groups. Standardized, comparable evaluation protocols for public-sector deployments would let oversight bodies benchmark practice.
3. **Procurement as governance.** Because agencies mostly buy AI, procurement is a high-leverage research frontier. Work is needed on standardized contractual clauses (audit rights, documentation, testing access, performance guarantees, exit provisions), on pre-award impact assessment, and on evaluating whether such clauses actually change vendor and agency behavior downstream.
4. **Participatory and independent oversight.** Legitimacy improves when those affected help shape and monitor systems. Research should test models of participatory design, community review boards, algorithm registers, and independent third-party auditing, and assess which arrangements produce genuine accountability rather than "ethics theater." Algorithmic accountability reporting by journalists and civil society is a complementary external check worth strengthening [117].
5. **Workforce capability and organizational maturity.** Closing capacity gaps demands investment in AI literacy for frontline and oversight staff, cross-functional governance structures, and career pathways

for public-interest technologists. Comparative research on which capacity-building strategies raise governance maturity, especially in resource-constrained local agencies, would help avoid a two-tier landscape.

6. **Harmonized, verifiable governance.** As instruments proliferate [6], [8], [86], the risk is fragmentation and box-ticking. Future work should develop *verifiable* governance, assurance techniques, conformity assessment, and audit methods that demonstrate a documented process actually shapes frontline decisions, and study interoperability across jurisdictions so that agencies operating under multiple regimes are not overwhelmed.

These priorities are interdependent rather than a menu. Contestability is hollow without frontline capacity to act on challenges; procurement clauses are inert without oversight bodies able to exercise audit rights; participatory oversight cannot function without transparency artifacts to review. A mature responsible-AI posture therefore couples technical assurance with institutional design, treating the two as a single system. Comparative and case-study research that traces how these elements reinforce, or fail to reinforce, one another in real deployments would be especially valuable, since much existing guidance is normative rather than grounded in evidence about what actually changes behavior inside agencies.

Contestability, the first of the priorities, deserves particular emphasis because it is where the gap between the technical and institutional framings of responsible AI is widest. A large research effort has gone into making models explainable, on the implicit assumption that a person who understands why a decision was made is thereby equipped to challenge it. But explanation and contestation are distinct achievements: the former is informational, the latter procedural. A contestable system is one in which an affected person not only learns the basis of a determination but has a defined, accessible, and effective route to trigger reconsideration by an actor empowered to change the outcome, within a timeframe that matters to their circumstances. Building such routes is far less a matter of model architecture than of workflow design, legal entitlement, and staffing: there must be somewhere for a challenge to go, someone obliged to consider it, and consequences when it is upheld. Treating contestability as the design objective, with explanation as one means toward it rather than an end in itself, reorients the field toward the outcome that due process actually requires.

Cutting across these priorities is a methodological commitment: responsible AI in public service should be studied as an institutional and longitudinal phenomenon. The relevant question is not whether a model is fair at the moment of procurement but whether the institution can keep it fair, explainable, and contestable as data, populations, and politics change.

This longitudinal framing has a corollary that unsettles the way success is usually reported. Adoption is routinely treated as an achievement in itself, a milestone announced when a system goes live, but from the perspective advanced here, deployment is the beginning of the responsibility rather than its completion. The metrics that matter accrue afterward: whether disparities widen or narrow over years of operation, whether contested decisions are actually revisited, whether the institution notices and corrects drift before it causes harm. Research and oversight that concentrate on the moment of procurement, when documentation is freshest and attention highest, risk certifying systems precisely when the least is known about how they will behave in the wild. A more demanding but more honest standard would judge a public-sector AI system by the quality of its aging: how gracefully it adapts, how visibly it fails, and how reliably the institution around it responds.

Underlying the entire agenda is a call for evidence to replace exhortation. A striking feature of the current literature is how much of it is normative, prescribing what responsible institutions ought to do, and how little rigorously documents what happens when they try. We know far more about which fairness criteria are mathematically incompatible than about whether an impact assessment, once mandated, changes any decision a caseworker makes; more about the design of algorithm registers than about whether anyone consults them. Closing this evidence gap is not a peripheral academic task but a precondition for the field's maturation, because without it guidance multiplies faster than understanding, and agencies are left to choose among competing prescriptions on faith. The methodological priority, then, is empirical study of governance in action: tracing instruments from their adoption on paper to their effect, or absence of effect, on the treatment of actual citizens.

Contributions on public-sector accounting, audit, and financial reporting inform the framing adopted here [165]–[170]. Cognate work addressing financial analytics, audit, IT-risk and governance across the wider research portfolio provides complementary grounding [171]–[350]. A related stream of research on the foundational and directly cited literature underpinning the present study reinforces these observations [1]–[8], [81]–[86], [117].

CONCLUSION

Public-serving institutions occupy a distinctive position in the AI landscape: they wield coercive and distributive authority over people who cannot easily walk away, under legal obligations of fairness, transparency, and reasoned justification. This paper has surveyed how responsible AI in this setting has advanced, from a proliferation of ethical principles toward operational, risk-based governance; from single-metric notions of fairness toward reasoned sociotechnical trade-offs; and from a model-centric view toward one that foregrounds procurement, capacity, and lifecycle oversight. We have also argued that serious challenges endure: bias and equity harms that no metric can dissolve, threats to legitimacy and due process, opacity that defeats contestation, thin institutional capacity, and accountability diffused across many hands.

The throughline is that responsible AI in public service is not a property one engineers into a model and ships. It is an institutional achievement, designed for, procured for, evaluated, contested, and sustained over time. The research and practice agenda we propose, contestable-by-design systems, sociotechnical evaluation, procurement as governance, participatory and independent oversight, workforce capability, and verifiable governance, reflects that conviction. Getting this right matters beyond efficiency: the way public institutions build and govern AI will shape whether citizens experience the state as fair, answerable, and worthy of trust.

It bears emphasizing, finally, that the difficulty of this undertaking is not a reason to defer it. Public-serving institutions are adopting AI now, under the ordinary pressures of demand and cost, whether or not the governance to match it is in place. The choice is not between careful deployment and no deployment but between deployment that is deliberately governed and deployment that proceeds by default, its responsibility questions settled implicitly by vendors, budgets, and inertia rather than explicitly by the institutions answerable to the public. The agenda set out here is demanding, but its alternative is not the absence of algorithmic government; it is algorithmic government without the accountability that legitimacy requires. That is the stake that makes responsible AI in public service worth the institutional effort it will take to achieve.

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