

Research on Ethical Risks in Smart Governance and an Algorithm-Responsibility-Oriented Administrative Accountability System

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Abstract: With the deep integration and application of the new generation of information technologies, smart governance is profoundly reshaping government governance models and service forms, becoming a key path to modernising the national governance system and governance capacity. However, while technology empowers, it also generates complex ethical challenges and difficulties in responsibility identification, posing a severe test to traditional administrative accountability mechanisms. This study focuses on ethical risks and governance issues caused by algorithmic decisions in smart governance, systematically analysing core dilemmas such as decision opacity caused by “technical black boxes,” power distortion hidden in the “digital Leviathan,” and responsibility chain breaks triggered by technological rationality. Based on this, the study further reveals the theoretical limitations and practical failures of traditional administrative accountability systems when facing algorithmic decisions, including generalisation of accountable subjects, vagueness of responsibility attribution, and lack of technical standards, and proposes promoting a paradigm shift in administrative accountability centred on “algorithm responsibility.” Ultimately, this study aims to construct a new administrative accountability system guided by algorithm responsibility, clarifying multi-subject “human-machine collaborative” accountability, embedding a full-cycle algorithmic ethical review mechanism, and improving multi-dimensional accountability standards based on algorithm interpretability, providing theoretical support and institutional guarantees for controllable, trustworthy, and accountable smart governance.

1. Introduction

Smart governance has evolved into a core path for modernising government governance, with the rapid development of digital technologies playing a key role. Algorithmic decision-making, big data analysis, and other technologies systematically applied in governance services show significant advantages in efficiency improvement and precision policy implementation. However, behind technological empowerment lie deep ethical risks and responsibility dilemmas. The widespread use of algorithmic administration challenges the traditional accountability system with “technical black box” opacity, “digital Leviathan” power expansion, and “responsibility chain” breaks. These risks weaken public trust and trigger structural conflicts between technological rationality and public value. It is urgent to mobilise theoretical and institutional forces to reconstruct an administrative accountability system suitable for the algorithm era.

The ethical risks of smart government affairs are concentrated in three aspects. The “technical black box” of algorithmic decision-making makes the decision-making process untraceable ^[1]. The public's right to know and the right to supervise are overtied by relevant technical barriers, forming a vacuum zone of responsibility identification. The data-driven governance model has given rise to the hidden concern of “digital Leviathan”. Administrative power technology Expansion has been trying to erode citizens' privacy and rights. The relevant aspects have exacerbated the asymmetry of power and responsibility, and the rationality of technology has led to the rupture of the traditional administrative responsibility chain. The boundary between algorithm developers, technology platforms and government departments is blurred, which mobilizes the phenomenon of generalization

of accountability subjects and virtualization of responsibility subjects. The relevant dilemmas exposes the traditional accountability paradigm in technology. Entering the scene, the theory is invalid. It is urgent to transform the paradigm to achieve institutional innovation.

Most studies on algorithms' impact on administrative accountability focus on local regulation of technological risks, lacking a systematic framework integrating ethical review, reconstruction of accountable subjects, and responsibility allocation. While the U.S. "Algorithmic Accountability Act" proposes high-risk system assessment standards, responsibility tracing remains limited to post hoc measures ^[2]. Distributed responsibility theory advocates full-process participatory accountability, offering new ideas to address vague responsibilities. Implementing it requires clear premises for power and responsibility allocation, building an algorithm-responsibility-oriented accountability system that balances technical logic with public ethics and designs multi-subject "human-machine collaboration." A full-cycle ethical review mechanism and algorithm interpretability standards can achieve dynamic balance between technological empowerment and responsibility constraints.

This study systematically analyses the formation mechanism of ethical risks in smart governance, reveals many shortcomings of traditional administrative accountability systems in adapting to technology, and proposes an accountability framework guided by algorithm responsibility. The framework theoretically addresses the "technology-power-responsibility" paradox, and its practice can inform institutional design for digital government, promoting a shift from efficiency-first to responsibility-centered governance.

2. Formation Mechanism of Ethical Risks in Smart Governance and Governance Dilemmas

2.1. "Technical Black Box" Risks in Algorithmic Decision-Making

The most direct and significant ethical challenge encountered by smart government is the risk of "technical black box" caused by algorithmic decision-making ^[3]. It involves the complexity, propriety and opacity of algorithm models in many aspects. The relationship between input data, internal processing logic and output results is difficult to systematically understand, examine and interpret. The relevant characteristics greatly mobilize the threat to the principles of openness, fairness and justice in the administrative process, and pose a serious challenge.

The "technical black box" has been trying to erode the transparency and interpretability of administrative procedures. Traditional administrative decision-making requires systematic reasons to ensure that many parties are informed and mobilize their right to defend ^[4]. When decisions are made by complex algorithms such as deep learning, it is sometimes difficult for even developers to accurately trace them. Body decision-making path. An algorithm system for the approval of social welfare qualifications or the allocation of public resources cannot provide a clear basis for decision-making due to the interaction of hundreds of millions of internal parameters. As a result, administrative counterparts (citizens or enterprises) fall into the dilemma of "no way to question and nowhere to defend" in the face of an unfavorable automation, and procedural justice is illusory.

The black box algorithm has solidified and amplified prejudices and discrimination in many aspects of society, and is difficult to be detected and corrected by relevant parties because of its non-transparency. They have been trying to systematically identify biased phenomena, but the effect is limited. If the algorithm training data implies historical discrimination patterns (gender bias in past recruitment, racial bias in judicial judgments See you). Algorithms will acquire and copy prejudices, forming "technical discrimination". Decision-making logic is encapsulated in a black box, and the detection and audit of relevant systematic biases become extremely difficult. Instead of becoming a fair tool, smart government affairs mobilizes "accomplices" to create and cover up injustice.

The "technical black box" constitutes a substantial obstacle to many aspects of administrative supervision and judicial review. When the relevant legislative organs, audit departments and courts supervise and review administrative acts, if they cannot systematically penetrate the algorithm black box to understand its operation mechanism, they cannot effectively judge whether the decision-making is legal, reasonable and transcends freedom. Scope of discretion. In essence, this mobilizes part of the administrative power out of the rule of law track and evolves into an unrestrained

"algorithm power". They shake the constitutional foundation of "legal restraint power" and solve the black box risk, which is the first premise for building a credible and intelligent government.

2.2. Data-Driven "Digital Leviathan" Concerns

The concept of "digital Leviathan" systematically reveals a new type of power monopoly and model caused by data-driven in smart government in many aspects. It refers to the government's integration and control of massive data, and the use of advanced algorithmic technology to analyze and predict, forming an unprecedented, panoramic system of social monitoring and management. This raises concerns about reasoning capabilities and may pose potential threats to civil rights and freedoms.^[4]

The primary concern is the erosion of citizens' privacy rights by large-scale data monitoring. The realization of smart government affairs depends on the extensive collection and in-depth mining of individual, enterprises and other subject data. From travel records, consumption habits to health information, social relations, the boundaries of data collection have been systematically expanded. If there is a lack of strict legal norms and technical guarantees. Data collection to provide accurate services is very easy to mobilize impenetrable normal monitoring, which leads to the erosion of citizens' private spheres by public power and produces a "cicada effect", inhibiting social vitality and innovation^[5].

Many aspects of data-driven "digital Leviathan" have led to more refined and predictive social control. The government has systematically used big data analysis to deconstruct the past whereabouts of citizens and try to predict future behaviors and risks more deeply to carry out "pre-intervention". They have been working hard... Carry out research work. Mobilize the application of "predictive policing" in the field of public security and the relevant use of the "credit score" system in social governance, based on the algorithm's "prevention but first" model, and subvert the traditional "action-responsibility" rule of law logic, causing "continuous sitting" or discrimination against individuals based on their groups or prediction probabilities, which seriously challenges the principle of presumption of innocence and personal self-determination.

The deep risks of "Digital Leviathan" in many aspects lie in the imbalance of the power structure. Relevant technical bureaucrats or platform companies that master data and algorithm technology have become the de facto core of power, while the traditional democratic accountability and check-balance mechanism has failed due to technical barriers. Citizens are increasingly in the face of data giant network and algorithmic decision-making. They are being observed. The object of being calculated and managed, not the subject with dignity and autonomy, the alienation of relevant technical governance, is a challenge to the foundation of democratic politics, systematically mobilizing institutional design, and preventing data-driven governance from slipping into technological authority.

2.3. "Responsibility Chain" Breaks from Technological Rationality

The excessive expansion of technical rationality has broken the traditional "chain of responsibility" in the field of intelligent government affairs. When algorithmic decision-making errors or causes damage, it is difficult for them to systematically, clearly and effectively trace and identify the relevant responsible subjects. In many aspects, they fall into the governance dilemma of "organized and irresponsible", and they have been trying to adjust Start an effective response mechanism.

The dilemma of the responsible subject is reflected in dispersion and ambiguity. The birth and operation of an automated administrative decision-making system involves many subjects in many aspects. Policymakers put forward requirements, business departments systematically define rules, algorithm engineers design and train relevant models, data suppliers provide raw materials, and the operation and maintenance team is responsible for Daily operation. When a problem occurs, policymakers can blame the algorithm model on being "uncontrollable", and technical developers have been trying to justify it, saying that it is only to realize functions according to business needs, and business departments do not claim to understand technical details. The situation of "multi-party participation, no responsibility" is formed. Traditionally, specific civil servants or administrative departments The accountability mechanism has lost a clear target.

The illusion of technical rationality advocating "automation absolute justice" has given rise to new logical dilemmas in many aspects of responsibility identification. People are prone to

misunderstandings of "algorithm neutrality" and systematically believe that machine decision-making is necessarily better than relevant human judgments. The latter is full of subjectivity and "automation bias" appears. Relevant administration Personnel blindly rely on the system output. Mobilize the power to give up the professional judgment and discretion that should be. When the decision is made, the responsibility should be attributed to the formal administrators or to the defective algorithm system, which raises the legal problem of "decision-making attribution" and challenges their traditional theory of responsibility on the core of human subjective fault [6].

The break in the chain of responsibility is manifested as the lack of repair and relief mechanisms. In the traditional administrative model, improper decision-making can be corrected by administrative reconsideration, administrative litigation and other ways, and compensation for the victim [7]. When the attribution of responsibility is not clear, the relief channel will be blocked. Who should bear the consequences of algorithm errors? It is the government Department. Technology suppliers and insurance companies lack a clear responsibility division and assumption mechanism in many aspects, which harms the legitimate rights and interests of citizens. The entire smart government system they rely on lacks a feedback mechanism for systematic learning from errors and iterative improvement, resulting in the accumulation of systemic risks that are difficult to eradicate. , and mobilize the chain of responsibility for repair. It is the key to ensuring the health and sustainable development of smart government affairs.

3. Theoretical Failure of Administrative Accountability under Algorithmic Challenges and Paradigm Shift

3.1 Generalisation of Accountable Subjects and Vagueness of Responsibility

The cross-subject collaborative nature of algorithmic administration causes two major dilemmas: generalisation of accountable subjects and vagueness of responsibility. In smart governance, algorithmic decisions involve government departments, technology developers, data suppliers, and third-party platforms. The traditional model of "single subject - clear responsibility" of administrative accountability has been broken, and they have been working hard. However, the wrong judgment comes from algorithm design defects, data annotation deviations or executive personnel's operating mistakes. Due to the intervention of multiple parties, it is difficult to lock the subject of responsibility, and the generalization phenomenon causes the "responsibility dilution" effect. Government departments often mobilize technical neutrality to transfer responsibility from enterprises, and enterprises use "algorithm autonomy" to shirk responsibility. Become a state of "organized and irresponsible".

The root cause of responsibility virtualization is that technology embedding has restructured the power and responsibility relationship. The complexity of the algorithm system is traceable to the chain of responsibility. The hierarchical accountability mechanism under the traditional hierarchical system cannot cope with the distributed decision-making structure. In many aspects, the bundled interests of technology suppliers and administrative subjects leads to an imbalance in the distribution of authority and responsibility, and the relevant government affairs are equal. Taiwan is under construction. The government relies on the technical capabilities of enterprises and relaxes supervision, and enables enterprises to substantially control data power to avoid public responsibility. Although their existing legal framework, the Data Security Law, emphasizes multi-party collaborative governance, it does not clearly define the boundaries of public obligations of algorithm developers. To solve the dilemma of virtualization, it is necessary to systematically build a "responsibility sharing" mechanism. The list of powers and responsibilities system clarifies the government's leading responsibility. Mobilize technology providers to be included in the category of administrative accountability, requiring them to disclose algorithm logic and bear joint and several liability for technical defects. The path has been working hard [8]. To carry out research work, it is necessary to solve the conflict between the value of public and private subjects, as well as the contradiction between the protection of corporate trade secrets and the transparency of public interests.

3.2 Ambiguity of Accountability Standards and Technical Barriers

The rise of algorithm administration has brought a legitimacy crisis to traditional accountability standards. The current administrative accountability emphasizes the core of the causal relationship of "line-result" in many aspects. The autonomy and black box characteristics of algorithmic decision-making have led to a break in the correlation between the intention of action and the result of damage. When the autonomous driving traffic control system causes an accident due to sensor error Time. Whether the technical failure belongs to "algorithm negligence" or "human supervision negligence" has always been a difficult problem. Relevant technical barriers have exacerbated the dilemma of standard application. It is difficult for supervisory institutions to systematically review algorithm models due to lack of professional ability. They also mobilize the public's right to question because of information asymmetry, and accountability procedures are reduced to form. The process of formulaization.

The constraints of technical barriers on accountability standards are reflected in many aspects. First, the lack of algorithm transparency leads to the inability to verify the basis of decision-making, and the principle of "procedural legitimacy" in existing laws is fictitious due to the inexplicability of technology. Second, the self-iteration characteristics of dynamic learning algorithms make the time of responsibility identification misaligned, and it is difficult to cover the blame after the fact. Risk accumulation in continuous optimization. Third, the professionalism of technical terms forms a "knowledge monopoly". In judicial review, substantive judgments are often avoided due to the difficulty in interpreting algorithmic evidence. In this way, some studies have been trying to put forward the restructuring idea of "technical accountability standards", and establish a classification assessment system for algorithmic impact with reference to the Algorithmic Accountability Act in the United States. Transparency, fairness and other indicators are included in accountability considerations. They need to mobilize the adaptation of local governance needs, add the presumption of liability for algorithmic decision-making errors in the Administrative Penalty Law, and build an interdisciplinary technical review committee to bridge the knowledge gap ^[9].

3.3 Introducing Algorithm Responsibility as the Theoretical Basis for Reconstructing Administrative Accountability

The traditional administrative accountability theory has always revolved around the symmetry of "power-responsibility", while the particularity of the "agent-authorization" relationship of algorithm technology requires a systematic reconstruction of the theoretical cornerstone. In many aspects, algorithmic responsibility emphasizes the ethical attributes and accountability of the technical system itself, and its core is that algorithms are regarded as "responsible customers" Body" is not a simple tool. The institutional design ensures that technical behavior conforms to public values. The establishment of the "right to interpret algorithms" in the EU GDPR gives citizens the right to explain the logic of automated decision-making ^[10]. In essence, they incorporate algorithms into the category of objects of responsibility, and mobilize thinking about breaking through the "anthropocentric" accountability paradigm to promote the formation of "human-machine The new framework of the Community of Responsibility.

The construction of algorithm responsibility theory faces many challenges and needs to systematically solve the triple problem. First, clarify the positioning of the algorithm's legal personality. At this stage, the principle of "functional equivalence" can be regarded as the main body of the extension of the algorithm system with independent decision-making ability. Second, establish an ethical review mechanism for the whole life cycle of the algorithm, and design the stage Section bias detection. Dynamic monitoring in the operation stage and related post-effect assessment. Third, innovate the responsibility distribution model, draw on the theory of "distributed responsibility", and allocate differentiated responsibilities between them according to the degree of technical contribution and control ability. At the practical level, the relevant supporting system needs to be promoted synchronously, and the algorithm defects of the revised Administrative Procedure Law should be incorporated into practice. The reason for the cancellation of the political act. And establish an algorithm liability insurance mechanism to spread technical risks, which can mobilize the power to

curb the tendency of "technical avoidance" and substantially improve the fairness and transparency of algorithms.

4. Constructing a New Administrative Accountability System Guided by Algorithm Responsibility

4.1 Establishing Multi-Subject "Human-Machine Collaborative" Accountability

Due to the characteristics of complexity, concealment and interactivity, the algorithm decision-making in the smart government scenario makes it difficult for the traditional single accountability subject to cover many aspects of the responsibility chain ^[11]. It is necessary to build a pluralistic accountability subject system of "human-computer coordination", and clarify the boundaries and coordination mechanisms of each subject. The government needs to assume the leading responsibility, and become Set up a cross-departmental algorithm governance committee. Systematically coordinate algorithm research and development, deployment, and supervise the whole process, check the legality and compliance of algorithm decision-making, establish an algorithm filing and audit system, and ensure that the algorithm application is in line with the public interest. They have been working hard to carry out research. Algorithm developers and suppliers should assume technical responsibilities and provide algorithm models and technical documents.

Data source description and risk assessment report, mobilize the regulatory department to conduct algorithm transparency review, and bear joint and several liability for administrative mistakes caused by algorithm defects, and introduce third-party independent institutional supervision subjects, university scientific research teams, professional ethics committees and related social organizations, algorithm ethics review, social impact assessment Estimate and other methods. External supervision of the fairness and impartiality of algorithmic decision-making to avoid the dilemma of the government of "being both athletes and referees". It is necessary to establish a public participation mechanism, a government open platform, algorithm interpretation window and other channels to ensure citizens' right to know and complain about algorithm decision-making, and form a "government-led + technical responsibility + third The diversified coordination pattern of "party supervision + public participation". The legislation clarifies the list of responsibilities of each subject. The "Algorithm Accountability Regulations" stipulates that government departments are the "main responsibility" for algorithm decision-making, the "technical compliance responsibility of developers", and the "independent review responsibility" of third parties, to ensure that the subject of accountability is not absent, the responsibility is not suspended, and to realize the clear division of human-computer responsibilities and coordinated governance.

4.2 Embedding Full-Cycle Algorithm Ethical Review

Ethical risks occur across the full lifecycle: requirement analysis, data collection, model training, deployment, and iteration. Ethics review must be embedded in each stage, forming a dynamic full-cycle accountability mechanism ^[12]. During requirement analysis, the governance committee and ethics experts should assess necessity, define boundaries and prohibited areas (e.g., sensitive privacy and social fairness scenarios), preventing misuse. Data collection must comply with ethical standards, verifying legality, objectivity, and cleaning processes, holding data providers and users jointly responsible for violations. Model training should include algorithmic ethical testing, scenario simulation, and fairness metrics (e.g., disparate error rates, counterfactual fairness). Reports are prerequisites for deployment; unreviewed models cannot be used. Deployment requires real-time ethical monitoring, setting alert thresholds when error rates exceed limits, and providing appeal channels with third-party review for corrections. Iteration involves post-evaluation of social impact, adjusting models or applications, forming a "review-monitor-evaluate-improve" closed-loop. Accountability shifts from reactive to proactive prevention, real-time control, and post-event improvement, ensuring ethical compliance and legal governance.

4.3 Improving Multi-Dimensional Accountability Standards Based on Algorithm Interpretability

Algorithm interpretability is key to unlocking the “black box” and achieving precise accountability. A multi-dimensional framework covering technical, legal, and ethical aspects should define accountability criteria and discretionary measures. Functionally, interpretability grading should match risk levels: high-risk scenarios (e.g., facial recognition, low-income verification) require global explanations (model logic and key feature weights) and local explanations (specific decision basis); low/medium-risk scenarios may use simplified explanations. Explanations should be understandable in natural language, avoiding technical jargon. Legally, interpretability should be part of administrative legality review, with “algorithm decisions lacking reasonable explanation are illegal” and an “algorithm explanation obligation” in the Administrative Litigation Law. Administrative bodies must provide full explanation chains in litigation or face defeat. Technical standards should mandate built-in explanation tools (e.g., LIME, SHAP) for traceable and verifiable explanations. Ethically, explanations must cover diverse groups (e.g., elderly, disabled) with multi-language and visual options. Ethical evaluation metrics include completeness (all key factors) and consistency (uniform logic across similar decisions). Non-compliant algorithms bear ethical responsibility. Coordinating technical, legal, and ethical standards provides clear, actionable accountability, solving the “black box with no responsible party” issue, and promotes smart governance from “efficient technology” to “responsible efficiency.”

5. Conclusion and Outlook

5.1 Conclusion

This study systematically analysed the ethical risks caused by algorithm applications in smart governance and the severe challenges they pose to traditional administrative accountability systems, and based on this, constructed a new administrative accountability system centred on algorithm responsibility. The core conclusions are as follows: Ethical risks in smart governance originate from the “technical black box” of algorithmic decisions, the data-driven tendency of the “digital Leviathan,” and the “responsibility chain” breaks caused by technological rationality. These factors place traditional accountability paradigms, based on linear causality and clearly defined actors, into governance difficulties. Facing algorithmic challenges, traditional administrative accountability theory shows failures such as generalisation of accountable subjects, vagueness of responsibility, ambiguous accountability standards, and constraints from technical barriers. A paradigm shift is urgently needed.

The proposed algorithm-responsibility-oriented accountability system establishes a multi-subject “human-machine collaborative” framework, embeds ethical review processes covering the full lifecycle of algorithm design, deployment, and operation, and improves multi-dimensional accountability standards based on interpretability, fairness, and controllability. This provides a feasible theoretical framework and practical path to resolve these dilemmas. Its core is including designers and users of algorithms within the responsibility network, achieving an organic integration of technological rationality and administrative ethics, ensuring that smart governance improves efficiency without sacrificing fairness, transparency, or accountability.

5.2 Outlook

Research on smart governance and algorithm-responsibility-based governance still faces many challenges and has broad development space. Theoretically, it is necessary to further clarify specific rights and responsibility boundaries for each subject in “human-machine collaborative” accountability, particularly how to define and allocate legal and ethical responsibilities among government departments, technology companies, and algorithm experts in cases of decision errors. This requires deep interdisciplinary integration of law, public administration, and computer science.

Technically, research on algorithm interpretability, fairness testing, and auditing tools must accelerate breakthroughs to provide operable and verifiable methods for implementing accountability

standards, transforming the “technical black box” into a “transparent box.” Institutionally, future work should focus on national-level legislation for algorithm governance, institutionalising algorithm ethical review and accountability mechanisms, and establishing independent cross-department regulatory bodies. With deeper applications of frontier technologies such as generative AI, smart governance faces complex autonomous decision risks. The accountability system should be forward-looking and adaptive, leveraging public digital literacy and participation to build an open and inclusive social supervision mechanism. This ensures effective operation of the new accountability system, prevents technological alienation, and guarantees long-term alignment of technology with social fairness and justice.

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