Multi-level Collaborative Governance Framework for Designing Accountable AI Systems for Emergency Management

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Submitted: 31 January 2025, Revised: 26 March 2025, Accepted: 21 April 2025, Published: 21 May 2025

Abstract. This paper addresses a gap in the AI governance literature in understanding collaboration between national governments and tribal nations in governing AI systems for emergency management. This conceptual work develops and presents a governance design framework for accountable AI systems to fill the knowledge gap by drawing from the fields of public administration, information systems, indigenous studies, and emergency management. This framework situates the governance framework in a cross-sovereignty historical, legal, and policy contexts. It captures the multi-level features and embeddedness of governance structures, including the levels of collaborative governance structure, software system governance rules, and technical software system design. The focal governance dynamics involve the collaborative process in the bi-directional relationship between governance rules and technical design for accountability and the feedback loop. The framework highlights the importance of multi-level and process considerations in designing accountable AI systems. Productive future research avenues include empirical investigation and resulting refinement of the framework and analytical rigor employing institutional grammar.

Keywords. Collaborative governance, AI systems, governance design, tribal nations, socio-technical systems, AI chatbots
Research paper, DOI: https://doi.org/10.59490/dgo.2025.980

1. Introduction

The governance of artificial intelligence (AI) for public value creation is both a significant challenge and forward-looking opportunity for digital government. AI affords capabilities in finding patterns and making predictions by leveraging numeric, text, and image data to improve public policy and administration. However, the data-driven AI algorithm also tends to magnify and worsen the biases and errors existed in the data (Wirtz et al., 2020; Young et al., 2021). Such biases tend to disproportionately impact marginalized populations such as indigenous people that are not appropriately represented in the digital data sphere. The forward-looking opportunity lies in the design and implementation of a governance framework that proactively minimizes the harm and optimize public value creation.

The current literature on the governance of AI has provided governance options and frameworks (Chen et al., 2023; Wirtz et al., 2022; Young et al., 2019). Governance solutions span from within a particular governance agency, to national AI governance arrangement, and to a regional or global governance rules for responsible AI. EU AI Act passed in 2024 is an example of managing the risks of AI. Industry self-governance has been promoted by major international corporations as a governance option. The academic scholarship has provided governance frameworks that address the unique features of public administration (Chen et al., 2023; Gasco-Hernandez et al.,

2022; Ruijer, 2021; Wirtz et al., 2022; Young et al., 2019). One such framework is the four-layered and integrative AI governance framework, inclusive of risks, risk management, guidelines, and governance layers, that aims for risk management (Wirtz et al., 2022).

However, the knowledge gap of AI governance exists in several crucial areas as related to public value creation and salient issues facing our society. First, the governance of AI in cross-sovereignty context as related to marginalized tribal nations and indigenous communities is under-addressed. Second, there is a gap in fully addressing the complexity of the interactions between the social system and technical systems for effective governance of technologies such as AI. Lastly, the literature has opportunities to grow in governance of AI in addressing emergency management as a growing public service area.

This paper aims to provide a governance framework to address the three aforementioned areas of knowledge gap. This framework focuses the cross-sovereignty context of national government working with tribal nations while recognizing the legal and policy framework governing the design and implementation of AI systems. It takes an integrative and interdisciplinary approach to analyze the socio-technical system while recognizing the embeddedness of rules and processes at multiple levels. This paper focuses on the AI chatbots for emergency management to address the salient issues of EM in the wake of rising natural and manmade disasters. For public value creation, this paper selects accountability as an important public value recognized by both software and public administration scholars and encompassing other public values.

Section 2 provides the specifics on the cross-sovereignty context, accountability, AI systems, and emergency management to pinpoint the contribution of the proposed framework to the larger literature. Section 3 develops and describes the proposed multi-level collaborative cross-sovereignty governance framework grounded in the supporting literature and practice. This section constitutes the majority of the paper length. Section 4 provides a summary of the work and point to future research.

2. Context, Accountability, AI System Design, and Emergency Management

2.1 The Socio-Technical and Cross-Sovereignty Context

The broad socio-technical context includes biological and physical attributes, natural and man-made resources, data, technology, policy and legal frameworks, rules at the constitutional and collective action levels, political and power relationships, socioeconomic and cultural characteristics, and history of collaboration and conflicts (Chen & Lee, 2018; Emerson & Nabatchi, 2015a; Ostrom, 2010). Biological and physical attributes are essential for understanding the bio-physical context of public service challenges such as disaster recovery (Ostrom, 2010). The state of and need for data and technology are essential for digital governance across boundaries (Chen & Lee, 2018a). Data and technology elements relevant to the context are particularly salient for the development and implementation of information systems in tribal nations facing the challenge of limited internet accessibility and digital infrastructure (Intahchomphoo, 2018). Rules at the constitutional and collective action levels reflect the formal policy and legal requirements and the informal cultures and power relationships.

A cross-sovereignty context requires attending to both formal and informal aspects of collaboration. The history of conflicts and collaboration is another salient contextual element for collaborative governance. An important historical context is the harm U.S. federal government policies have inflicted on indigenous people, such as through the Indian Removal Act in 1830, which removed Indian tribes from their original lands, and the Dawes Act in 1887, which sent children in Indian tribes to boarding schools.

Such cross-sovereignty context increases the heterogeneity and complexity of governing and designing software systems. From the beginning, tribal nations have held land and their own form of governance, as determined in the Supreme Court cases of Cherokee Nation v. Georgia, 30 the U.S. 5 Pet. 1 (1831), and Worcester v. Georgia, 31 the U.S. 515 (1832) at 516. The complexity of governance grew after the passage of the Wheeler-Howard Act in 1934, also known as the Indian Reorganization Act. This Act created tribal governments that replicated the U.S. form of governance, complete with an executive branch, legislative branch, and judiciary. Today, this often translates to a tribal chairman, tribal councils, and court systems. This Act also created Constitutions written by the individual tribes, with their own laws, police, and set of procedures. Moreover, there is heterogeneity in the capacity, population, land area, and governance structure among tribes. There are 574 federally recognized Indian tribes 87 FR 4636 (United States Bureau of Indian Affairs, 2022). The Census Bureau's data on the American Indian and Alaska Native populations reveals the diversity of population sizes. Reservations can range from the 15-million-acre Navajo reservation in Arizona to the 1.32 acre Likely Rancheria of the Pit River Tribe in California (Tiller & Harris, 2015). Each reservation has its own government and governance structure and process that blend U.S. and tribal elements.

Explicit recognition and consideration of tribal sovereignty is essential for effective inter-governmental collaboration between the U.S. government and tribal nations (Quick, 2021). There is an urgency to address the

challenges of climate change and environmental stewardship that do not comply with jurisdictional boundaries (Kettl, 2006). The experiences in inter-governmental collaboration involving tribal nations suggest the importance of recognizing and protecting boundaries rather than dissolving them (Quick & Feldman, 2014). Mutual consent among sovereign entities is necessary. Sovereignty necessitates proper tribal consultation to facilitate inter-governmental collaboration (Quick, 2021).

2.2 Accountability and Its Assessment

Accountability is a core concept of public administration (Koppell, 2005) and a significant public value to enable the advancement of other public values (Nabatchi, 2018). Some people in the computer science community also recognize the importance of holding software systems accountable for the core values held by our society such as privacy and security (Feigenbaum et al., 2011). On a basic level, accountability is about holding an organization or individual to be responsible for its actions (Lampson, 2005). Some actors (either organizations or individuals) have the right to hold other actors to a set of responsibility standards, judge the fulfilment of these standards, and to impose sanctions for not meeting these standards (Grant & Keohane, 2005, p. 29). Although contexts and conceptualizations of accountability differ, the organizing question is who is accountable to whom and for what.

This paper takes an inclusive approach to accountability for public policy and administration by defining it as the achievement of policy objectives. This paper extends policy objectives to intermediate ones, including the development of technical and governance capacities needed for achieving the final policy objectives. The process capabilities are critical conditions for achieving policy goals (Overman & Schillemans, 2022). A design of effective collaborative process across organizations and jurisdictions constitutes a process capability.

Moreover, this paper incorporates the varying assessments by key stakeholders representing different sovereign entities and the people impacted. Stakeholder bodies include, but not limited to, governmental agencies, professional associations, civil society organizations, client representation groups, and interest groups (Brummel, 2025). The perspective and focus of a particular group of stakeholders can impact the assessment of goal attainment. For instance, the U.S. federal government probably focuses on what is prescribed by federal laws and regulations for their collective interactions with tribal nations. Tribal nations tend to focus on their unique conditions and needs. The proposed framework's inclusive approach allows for multiple assessments of accountability depending on the stakeholder in question. Moreover, the involvement of a variety of stakeholders brings the benefits of multiple perspectives, including control, institutional, managerial, learning, and reputational (Brummel, 2025).

2.3 Interdisciplinary and Integrative Design

This paper aims to develop a preliminary framework of collaborative governance of information systems for public service across sovereign entities. This framework integrates insights from collaborative governance by Emerson and Nabatchi (2015a, 2015b), institutional analysis and development by Ostrom and colleagues (Ostrom, 2010; Ostrom et al., 1994), and digital governance by Chen and Lee (Chen & Lee, 2018). Our framework first recognizes sovereign nations and the U.S. governments as autonomous entities entering a collaborative arrangement. Such recognition serves as the political and institutional basis for collaboration (Emerson & Nabatchi, 2015a). The recognition of autonomy in decision-making aligns with the self-determination and sovereignty of tribal nations.

This framework also integrates insights from human-computer interaction (HCI) research with an emphasis on working with indigenous people. Successful intercultural HCI design goes beyond a typical design process by considering different mentalities, thought patterns, and problem-solving strategies unique to different cultures (Abdelnour-Nocera et al., 2013). It is important to acknowledge local epistemologies in HCI research and prioritize values such as harmony and humanness in community-based interactions. One main challenge facing HCI design involving indigenous people is that information dissimilarities may arise from a knowledge mismatch between indigenous participants and researchers (Parsons et al., 2016). Participatory design empowers indigenous members as co-participants to enhance the understanding and application of indigenous knowledge and practices. For example, storytelling and reflection are more appropriate ways of knowledge sharing with indigenous people (Ostashewski et al., 2020).

The development of this framework advances the knowledge about governance design by following the guidelines for applying design science in public administration (Meijer, 2024). The focus of this paper is on governance design. The considerations of methodological guidelines such as studying causal mechanisms, understanding the distinctive impacts of context and design intervention, and addressing the interactive effect of design and context. The proposed framework also shares the goal of moving from the specific cases to generic knowledge (Meijer, 2024) and adds the multi-level and dynamic nature of governance design and outcomes.

2.4 Emergency Management (EM) and EM Technologies

This study focuses on emergency management as a critical area of knowledge advancement in the face of more

frequent and larger scale climate-related disaster events such as wildfire, hurricane, flood, etc. An effective approach to emergency management requires a life-cycle approach, including phases of emergency management as defined by the U.S. Federal Emergency Management Agency include preparedness, mitigation, response, and recovery. Collaboration among organizations and individuals in the public, private, and nonprofit sectors is critical for leveraging people and resources needed to respond and recover from an emergency, as defined by FEMA as the whole community approach. Moreover, a cross-jurisdiction coordination and collaboration are equally important as those disasters impact multiple jurisdictions (Kettl, 2006).

Emergency management is even more critical because of the magnified vulnerability experienced by indigenous communities on tribal lands. The impact of climate change hits the indigenous communities particularly hard because of being pushed to move to the marginalized land by the colonizers (Flavelle & Goodluck, 2021). The lack of federal recognition needed for financial assistance for some indigenous tribes exacerbates the recovery challenge (Chavez, 2021). A vast majority of indigenous tribes has only limited financial and human resources for emergency management.

Technologies play an important role in effective emergency management. There are a variety of communication technologies such as social media, web-based EOC, mass notification software programs deployed to facilitate notification of an emergency and coordination of disaster responses (Chen et al., 2024). Technologies can also support decision-making at an emergency operation center by creating a common operating picture to coordinate organizations and individuals to facilitate timely and coordinated responses (Kapucu, 2006).

The recent developments of AI afford the opportunity to process incident-related information from a variety of sources and conduct real-time translation for community-members speaking different languages. Moreover, AI can facilitate the reporting of emergency situation or damage via chats. For instance, AI chatbot can serve as an emergency reporter for the tribal members (Tsai et al., 2023).

3. A Multi-level Collaborative Cross-sovereignty Governance framework for Software System Accountability for Emergency Management

3.1 Governance Design: An Institutional Approach

The governance framework adapts pertinent rules from institutional design (Ostrom, 2010; Ostrom et al., 1994) to model the governance structure of a sociotechnical system for software design. First, participant rules prescribe who can participate in various positions and decisions. For a software system regarding tribal affairs, a participant rule can require someone to be a tribal member to participate in the design. Second, position rules specify the positions that participants can take in the governance structure. At the system design governance level, one position can be policymakers, who decide whether to adopt a certain software system for the entire tribe. Another position is the software co-designer. The third type is authority rules, which prescribe a set of decisions attached to a position. For instance, a software developer has the authority to make technical decisions on the choice of the software development environment. The fourth type is information rules, which prescribe what information is available to each position and decision. For instance, an information rule can allow tribal leadership council members to have full access to the software system development history and system specifications for making the decision on tribe-wide adoption of the system. The payoff rules specify how benefits and costs are allocated to a participant in a specific position. For instance, a tribal member may be a software system user who can use the system for free. This framework utilizes these rules to model the governance structure.

The application of this framework will utilize typology and the specifics of rules to model the governance structure. The governance structure includes the specifics of each type of rules and their configuration. Rule configuration is important to understanding the governance structure and its impact on outcomes (Ostrom, 2010). Moreover, attention will be paid to the rules-in-use, which reflect practice better than the rules in the book. Rules-in-use structure the actual behavior of the participants taking on various positions and making decisions. Thus, some of the empirical work proposed by this project is understanding the rules-in-use.

3.2 Multi-level Governance Structure and Embeddedness for Emergency Management

The sociotechnical system of software system design has three levels within the legal and policy framework for cross-sovereignty relations as seen within the dotted box in Figure 1. The “collaborative governance structure” level includes the laws and policies that structure the interaction between FEMA and tribal nations for emergency management. Tribes typically go through the states where they have land to declare disasters and receive funds from FEMA. Post Hurricane Sandy in 2012, the Federal Government started the Pilot Program, wherein tribes could declare disasters and directly petition on the federal level for funding and help. This process requires a Tribal Chief Executive to declare a disaster after an event has occurred. At that time, the Tribe’s Emergency Plan should be activated (Robert T. Stafford Disaster Relief and Emergency Assistance Act, 1988). An Initial Damage Assessment should be conducted. The disaster event should be of such severity and magnitude that it is beyond the ability of

the tribal government to respond (Federal Emergency Management Agency, 2017). The Initial Damage Assessment requires teams to collect data, travel to the affected areas, and conduct appropriate research on the matter. From there, a Joint Preliminary Damage Assessment is completed by FEMA to substantiate the Initial Damage Assessment. Damages should amount to a minimum of $250,000.00. All this must be done within a 30-day period.

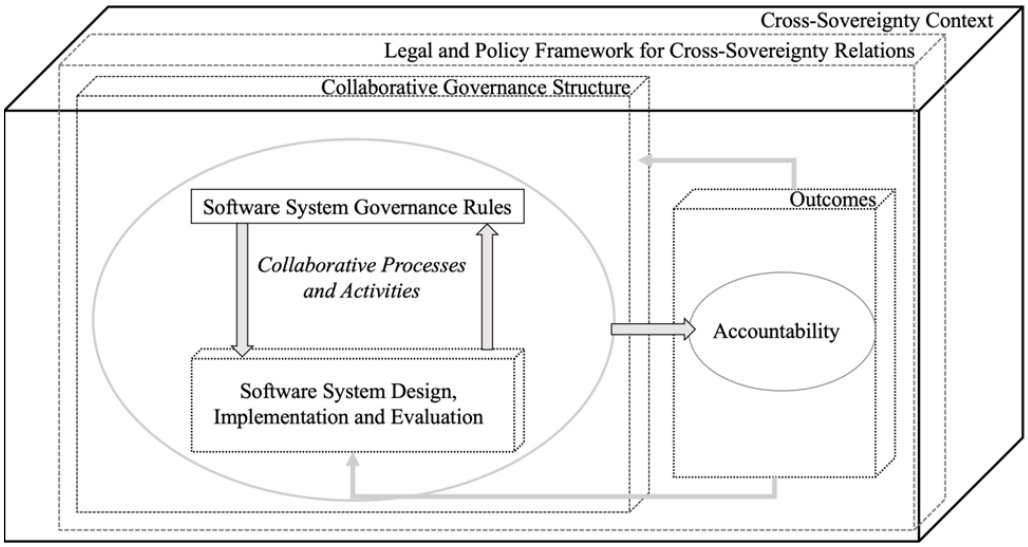

Fig. 1 - Multi-level Collaborative Design Framework for Cross-Sovereignty Software Accountability.

At the level of software system governance as illustrated as the top box inside the oval, there are rules prescribing the design and implementation of software systems across sovereign entities. Participant rules for participatory design can allow tribal members and the FEMA tribal liaison to participate as co-designers of the software system. Position rules prescribe various roles that participants can assume, such as tribal council members, software system designer, and software system users. Authority rules dictate what a position, such as a software system co-designer, can choose to do. For example, a software system co-designer may choose to decide on the features or express feature preferences. Information rules determine what information is available to various positions. For example, software system users may not have access to specific cost and revenue information about the system. The payoff rules specify how benefits and costs are allocated to a participant in a specific position. At this level, the payoff rules specify how the costs and benefits are distributed across users, designers, council leaders, and FEMA officers. Rule configuration and rules-in-use better reflect the reality of the governance structure at this level.

The third level is the technical design of software systems as illustrated as the bottom box inside the oval. The technical design operates within the rules governing participation, positions, authority, information, and payoffs at the system governance level. At this level, the decisions are more technical in nature. Such technical decisions include those on data, information architecture, server, telecommunication networks, and human-computer interface. Such technical design is likely to span across the design, implementation, and validation phases of a prototype.

These decisions at the level of technical software design are embedded in the software system governance level. Rules at the system governance level prescribe the roles, authority, and interactions between people assuming various positions. These rules are further embedded in the level of laws and policies that prescribe the parameters and boundaries within which the rules at the system governance level are legitimate. The base level of the sociotechnical system, such as laws and policies governing cross-sovereign relations, is the most difficult level to change. Such a change requires negotiation between sovereign entities and approval from their respective legislative bodies. The rules at the software system governance level are easier to change than those at the base level. The technical decisions made throughout a software system lifecycle are the easiest of the three levels to modify. Technical rationality is the main basis for justifying decisions. The relative difficulties of changing these levels have implications for the feasibility of recommendations targeting a specific level and for the dynamics of change connecting various levels.

3.3 Processes, Activities, and Dynamics of the Governance Framework

Several processes are essential for effective collaborative governance. These include building trust and shared understanding, cultivating institutions and the capacity for joint action, managing interdependence and motivation, and developing the technical capacity for collaboration (Chen & Lee, 2018; Emerson & Nabatchi, 2015a). Trust building is essential for addressing historical distrust between tribal nations and the U.S. government, which is a

barrier to collaboration (Quick, 2021). Furthermore, it is important to have a shared understanding of the goals of the collaboration and incentives for participation (Ansell & Gash, 2008). Joint actions between the U.S. government and tribal nations require guiding principles for collaboration and coordination, such as reciprocity and respect for sovereignty. Effectively managed interdependence provides the needed payoffs for motivating each participating organization to contribute to collaborative efforts. Tribal nations typically depend on the U.S. government's financial assistance in disaster recovery, especially for any damage to their infrastructure. Technological capacity is needed for cross-boundary coordination and collaboration, especially for a sociotechnical system spanning organizations (Chen et al., 2021; Chen & Lee, 2018). Such technical capacity can be a centralized information system used to organize and produce collaborative services.

Collaborative governance processes are used to achieve the intended outcomes. The outcomes for collaborative governance include productivity outcomes, such as effectiveness in achieving policy goals, and process outcomes, such as sustainability of the collaborative process (Emerson & Nabatchi, 2015b). Outcomes can be measured at the level of individual participating organizations or of the collaborative (Emerson & Nabatchi, 2015b; Provan & Milward, 2001). There can also be personal-level outcomes for individual participants. Moreover, these outcomes influence the adaptation of the system context and collaborative governance structures and processes (Emerson & Nabatchi, 2015a). An understanding of these influences over time provides insights into the feedback loops and evolution of the system.

A process framework for accountable AI-enabled systems involves the entire lifecycle of the service goal-setting, system development, service impact, and evaluation (Chen & Ahn, 2022). Participation of key stakeholders when implementing AI systems in the public sector is critical for achieving public values such as efficiency, effectiveness, and accountability. One governance solution is the participation of impacted groups, especially in the phase of goal-setting and evaluation of the impact of AI systems. Facilitative leadership for cross-boundary collaboration in aligning the goals and objectives of participating organizations is likely to be helpful for algorithmic accountability (Mikhaylov et al., 2018). Transparency is also an important element in achieving AI system accountability (Chen & Ahn, 2022). AI systems present new challenges related to transparency that are distinctive from other software systems. The machine learning of model development and refinement introduces opaqueness in system development. A solution to the opaqueness of AI systems that increases transparency is explainable AI that is considered an effective governance solution (Coglianese & Lehr, 2019; König & Wenzelburger, 2020). During the final phase of the lifecycle, it is important to have transparency on the specific impacts of AI systems on each stakeholder group. A process mechanism needs to be in place to ensure transparency from goal-setting to impact evaluation and thus achieve accountability (Chen & Ahn, 2022).

3.4 The Bi-Directional Structure and Processes of Accountable Cross-Sovereignty Smart Chatbot Design

This paper focuses on AI chatbots as a type of AI-enabled software system due to their relevance to a cross-sovereignty context involving tribal community members and their adaptability to a diversity of user capabilities and preferences. AI chatbots are AI-enabled systems that provide interactive, personalized assistance in accomplishing a particular task. The tasks can include finding relevant service information and submitting a service request. The conversational capability of smart chatbots fits the oral tradition of tribal communities, as the chatbots and these traditions use conversations to interact, learn, and organize. Smart chatbots with natural language processing capabilities also allow for voice inputs. Moreover, AI chatbots can adapt to user capabilities and preferences. The capability of both text and voice options on mobile phones supports a variety of user capabilities and preferences. Moreover, a smart chatbot can also personalize the information and support depending on the knowledge and needs of the users.

This section focuses on the bi-directional relationships between the software system governance level and the technical software design level, as illustrated within the oval in Figure 1. The software system governance level prescribes the goals, structure, and processes for the technical software level. The goals of an AI chatbot are to ensure public values such as efficiency, effectiveness, and equity (Chen & Ahn, 2022). These goals are also the basis for the performance metrics assessing process and productivity outcomes. The governance level also dictates the management of financial, human, and material resources for the AI system. The governance-level decisions impact the technical system design level by prescribing which organizations are eligible to participate, what positions are available, what authority is associated with each position, what information is available to what position, and the distribution of costs and benefits across organizational boundaries. A salient aspect of the governance level decision is determining the tribal office and U.S. government offices that are legitimate governmental participants in the cross-sovereignty collaboration.

The results of the decisions at the technical design level serve as important information feedback for the decisions made at the governance level. These technical decisions include how the design addresses use cases and user characteristics. These characteristics include efficacy in using technology, trust in technology, subject literacy, and system-specific familiarity and understanding. In addition, these decisions determine the data used, algorithm development, and the selection of a service platform. The performance of these technical decisions provides the

needed information for decisions made at the governance level. The performance information can cover the frequency and duration of using AI systems and the extent and quality of the service rendered by the AI system. The information on the practice and behavior of the technical design can be useful for understanding the alignment between prescribed rules and actual behavior.

These bi-directional relationships between the two levels and their joint results become important information feedback for the base level of the sociotechnical system for software design, namely the relations between sovereign entities. The sovereign entities, in this case, the U.S. and tribal governments, can review these bi-directional relationships and collective outcomes. In so doing, they can decide which government or governmental office is a legitimate entity for formulating system governance rules to ensure accountability of the software system to its stakeholders.

Collaborative governance activities shape the bi-directional relationships at the system governance level and system technical design level and their collective impact. Leadership activity can foster shared understanding across sovereign entities and motivation for collaboration. Another main area of activity is cultivating the rules for promoting cross-sovereign collaboration at the system governance level and the technical design level. The development of technical capacity for joint action facilitates coordination among participants across sovereign entities. Collectively, these collaborative governance activities strengthen the bi-directional relationships by providing the conditions for better alignment of activities at both levels and increasing the joint impact of activities at both levels.

The bi-directional relationships and their collective outcome can be seen in the participatory design process aiming to achieve accountability of AI systems for tribal emergency management. Participatory design involves the design of participant rules at the system governance level. Participants should include representatives and users from different stakeholder groups, such as FEMA's tribal affairs office, tribal leadership, tribal emergency management, and tribal user community. The position rules can appoint tribal emergency managers as system co-designers. Moving from the governance level to the technical decision level, these governance level rules prescribe the roles and responsibilities for making decisions at the technical design level. The reverse direction of the relationship involves information feedback on the performance of the AI-enabled chatbot resulting from implementing these participatory design features. The performance information used by participants at the governance level can result in modifications of the AI chatbot governance design, such as the creation of a coordinating committee.

4. Conclusion and Future Application and Research

4.1 Summary and Concluding Remarks

This paper is a development of a governance framework for the study of software accountability in the context of cross-sovereignty collaboration. The specific public administration challenge to address is emergency management that has become increasingly salient in light of the growing frequency and damage of natural and manmade disasters. The focal software system is AI chatbot that leverages natural language processing as an artificial intelligence capability. Such AI chatbot can benefit from the advancement of large language models and computational capabilities. This governance framework draws from collaborative governance in the public administration literature and the human-computer interaction (HCI) in the information science one.

The main contribution of this paper is the articulation of the governance structure and process and their relationships to the accountability results. Such articulation provides the foundation for theoretical and analytical advancements in the accountability of AI systems. The focal contribution lies in the cross-sovereignty context and marginalized circumstances facing indigenous communities.

The governance structure has three levels within the legal and policy framework for cross-sovereignty relations. The collaborative governance structure provides the high-level rules on what action is permitted, incentivized, or prohibited across the entities and individuals that are involved in the cross-sovereignty relationships. Emergency management is the public policy and management issue of focus. The next two levels are on software systems with AI chatbot as the focused system in this paper. Software system governance rules dictate who can participate in the design, who should be accountable for the design, who can get what information, and the benefits and risks associated with decisions. At the more technical level is the software system design, implementation, and evaluation. At this level, technical decisions are made to optimize the goals set by the governance body of the software systems.

Moreover, the levels are embedded from those of software system design, to the governance of such design, to the collaborative governance structure. The technical software system design operates within the goals, parameters, and rules set at the governance design levels. The software system governance rules need to be in congruent with those of collaborative governance structure dictating the eligibility and appropriate behavior of various organizations and individuals participating in the software governance. Such cross-boundary collaborative

governance structure embeds itself to the legal and policy framework for cross-sovereignty relations.

The main dynamics between levels are the collaborative processes and activities that address the bi-directional relations between the technical decisions on software systems at the most detailed level and the on decisions on the governance rules for structuring the decision-making, depicted inside the big oval in Figure 1. The governance rules dictate who can set the goals and functionalities of the software systems and who should be accountable for system performance. The technical decisions and their system performance shape the risks and benefits to various stakeholder groups participating and, to a certain degree, the legitimacy of their relative decision-making power. Moreover, there are dynamics jointly determined by actions taken at these two levels to impact accountability. Accountability is primarily measured by goal attainment. Complications lie in the divergent expectations of accountability across various stakeholder groups such as the tribal nations and U.S. governments. As depicted in Figure 1, the perceived accountability as the outcomes will feed back into some possible adjustment of the collaborative governance structure and the collaborative processes and activities for the bi-directional relationships.

4.2 Future Development and Research

The proposed governance framework integrates insights from various bodies of literature across disciplines and prescribes a comprehensive set of structure and process for future development of the theory and practice for AI system accountability. The next logical step is rigorous empirical investigation into the validity and relevance of the levels, their embeddedness, bi-directional relationships, and linkages of collective impact of multi-level governance structure on accountability, and the dynamism in feedback. This study will follow methodological guidelines developed from design science to understand the independent and combined contribution of context and governance design to impact (Meijer, 2024) Such investigation provides opportunities for validation, modification, or refinement of these conceptual elements and their relationships as depicted in Figure 1. Such investigation needs to include extensive policy and document review to study both the rules in the book. Moreover, extensive field research and user input would fill the details needed for the rules in practice and how these rules affect the software system development behavior and the perceived accountability.

Future research on governance for accountable AI systems can benefit from obtaining inputs on the structure and process of this governance framework from a variety of stakeholders. For emergency management, these include stakeholders such as tribal leadership and members and emergency management managers and personnel in U.S. governments. Moreover, the use of analytical framework and tools afforded by institutional grammar (Frantz & Siddiki, 2021) would advance the analytical rigor of studying rules and their configuration for understanding the entities involved and their actions and impacts.

Acknowledgement

- **Funding or Grant:** The authors acknowledge the support of the U.S. National Science Foundation Grant Award Number 2317086.
- **Contributor Statement***: Yu-Che Chen: conceptualization, methodology, visualization, and writing – original draft, final review, and editing. Chun-Hua Tsai: conceptualization and writing – elements of original draft. Edouardo Zendejas: conceptualization.
- **Use of AI***: During the preparation of this work, the author(s) used Grammarly with AI capabilities in order to provide some editing suggestions. After using this tool/service, the author(s) reviewed, edited, made the content their own and validated the outcome as needed, and take(s) full responsibility for the content of the publication.
- **Conflict Of Interest (COI)***: There is no conflict of interest.

References

Abdelnour-Nocera, J., Clemmensen, T., & Kurosu, M. (2013). Reframing HCI through local and indigenous perspectives. *International Journal of Human-Computer Interaction*, *29*(4), 201-204. https://doi.org/10.1080/10447318.2013.765759

Ansell, C., & Gash, A. (2008). Collaborative governance in theory and practice. *Journal of Public Administration Research and Theory*, *18*(4), 543-571.

Brummel, L. (2025). Stakeholder involvement as a form of accountability? Perspectives on the accountability function of stakeholder bodies in Dutch public agencies. *Public Policy and Administration*, *40*(1), 27-49. https://doi.org/10.1177/09520767231203283

Chavez, R. (2021, October 20). *Why some Indigenous tribes are being left behind in Louisiana's Ida recovery*. PBS News. https://www.pbs.org/newshour/nation/why-some-indigenous-tribes-are-being-left-behind-in-louisianas-ida-recovery

Chen, T., Gil-Garcia, J. R., Burke, G. B., Dey, A., & Werthmuller, D. (2024). Characterizing technology affordances,

constraints, and coping strategies for information dissemination to the public: Insights from emergency messaging in US local governments. *Government Information Quarterly*, *41*(1), 101910. https://doi.org/10.1016/j.giq.2024.101910
Chen, Y.-C., & Ahn, M. (2022). Governing AI Systems for Public Values: Design Principles and a Process Framework. In J. B. Bullock, Y.-C. Chen, J. Himmelreich, V. M. Hudson, A. Korinek, M. M. Young, & B. Zhang (Eds.), *The Oxford Handbook of AI Governance. Oxford University Press*. https://doi.org/10.1093/oxfordhb/9780197579329.001.0001
Chen, Y.-C., Ahn, M. J., & Wang, Y.-F. (2023). Artificial Intelligence and Public Values: Value Impacts and Governance in the Public Sector. *Sustainability*, *15*(6), 1–22. https://doi.org/10.3390/su15064796
Chen, Y. C., Cheng, X., & Knepper, R. (2021, June). Performance of US scientific research cyberinfrastructure: Structural and relational factors for usage. In *Proceedings of the 22nd Annual International Conference on Digital Government Research* (pp. 424-436). https://doi.org/10.1145/3463677.3463722
Chen, Y.-C., & Lee, J. (2018a). Collaborative data networks for public service: Governance, management, and performance. *Public Management Review, 20*(5), Article 5. https://doi.org/10.1080/14719037.2017.1305691
Chen, Y.-C., & Lee, J. (2018b). Collaborative Data Networks for Public Service: Governance, Management, and Performance. *Public Management Review, 20*(5), 672–690.
Coglianese, C., & Lehr, D. (2019). Transparency and Algorithmic Governance. *Administrative Law Review*, *71*(1), 1-56. https://www.jstor.org/stable/27170531
Emerson, K., & Nabatchi, T. (2015). *Collaborative governance regimes*. Georgetown University Press.
Emerson, K., & Nabatchi, T. (2015). Evaluating the productivity of collaborative governance regimes: A performance matrix. *Public Performance & Management Review*, *38*(4), 717-747. https://doi.org/10.1080/15309576.2015.1031016
Feigenbaum, J., Jaggard, A. D., & Wright, R. N. (2011, September). Towards a formal model of accountability. In *Proceedings of the 2011 New Security Paradigms Workshop* (pp. 45-56). https://doi.org/10.1145/2073276.2073282
Flavelle, C., & Goodluck, K. (2021, June 27). Dispossessed, Again: Climate Change Hits Native Americans Especially Hard. *The New York Times*. https://www.nytimes.com/2021/06/27/climate/climate-Native-Americans.html
Frantz, C. K., & Siddiki, S. (2021). Institutional Grammar 2.0: A specification for encoding and analyzing institutional design. *Public Administration, 99*(2), 222-247. https://doi.org/10.1111/padm.12719
Gasco-Hernandez, M., Gil-Garcia, J. R., & Luna-Reyes, L. F. (2022). Unpacking the role of technology, leadership, governance and collaborative capacities in inter-agency collaborations. *Government Information Quarterly, 39*(3), 101710. https://doi.org/10.1016/j.giq.2022.101710
Grant, R. W., & Keohane, R. O. (2005). Accountability and abuses of power in world politics. *American Political Science Review*, *99*(1), 29-43. https://doi.org/10.1017/S0003055405051476
Intahchomphoo, C. (2018). Indigenous peoples, social media, and the digital divide: A systematic literature review. *American Indian Culture and Research Journal*, *42*(4), 85-111. https://doi.org/10.17953/aicrj.42.4.intahchomphoo
Kapucu, N. (2006). Interagency communication networks during emergencies: Boundary spanners in multiagency coordination. *The American review of public administration*, *36*(2), 207-225. https://doi.org/10.1177/0275074005280605
Kettl, D. F. (2006). Managing boundaries in American administration: The collaboration imperative. *Public Administration Review*, *66*(Supplement to Issue 6 (Special Symposium on Collaborative Public Management), 10-19.
König, P. D., & Wenzelburger, G. (2020). Opportunity for renewal or disruptive force? How artificial intelligence alters democratic politics. *Government Information Quarterly, 37*(3), 101489. https://doi.org/10.1016/j.giq.2020.101489
Koppell, J. G. (2005). Pathologies of Accountability: ICANN and the Challenge of "Multiple Accountabilities Disorder." *Public Administration Review, 65*(1), 94–108. https://doi.org/10.1111/j.1540-6210.2005.00434.x
Lampson, B. (2005, October). Accountability and freedom. In *Cambridge Computer Seminar, Cambridge, UK* (pp. 1-26).
Meijer, A. (2024). Design science in public administration: Producing both situational interventions and generic knowledge. *Perspectives on Public Management and Governance*, gvae012. https://doi.org/10.1093/ppmgov/gvae012
Mikhaylov, S. J., Esteve, M., & Campion, A. (2018). Artificial intelligence for the public sector: opportunities and challenges of cross-sector collaboration. *Philosophical transactions of the royal society a: mathematical, physical and engineering sciences*, *376*(2128), 20170357. https://doi.org/10.1098/rsta.2017.0357
Nabatchi, T. (2018). Public values frames in administration and governance. *Perspectives on public management and governance*, *1*(1), 59-72. https://doi.org/10.1093/ppmgov/gvx009
Ostashewski, M., Johnson, S., Marshall, G., & Paul, C. (2020). Fostering reconciliation through collaborative research in Unama'ki: engaging communities through indigenous methodologies and research-creation. *Yearbook for Traditional Music*, *52*, 23-40. https://doi.org/10.1017/ytm.2020.7

Ostrom, E. (2010). Institutional Analysis and Development: Elements of the Framework in Historical Perspective. In C. Crothers (Ed.), *Historical Developments and Theoretical Approaches in Sociology: Vol. II* (pp. 261–288). EOLSS (Encyclopedia of Life Support Systems) Publishers, Co. Ltd.

Ostrom, E., Gardner, R., & Walker, J. (1994). *Rules, games, and common-pool resources*. University of Michigan press.

Overman, S., & Schillemans, T. (2022). Toward a public administration theory of felt accountability. *Public Administration Review*, *82*(1), 12-22. https://doi.org/10.1111/puar.13417

Parsons, M., Fisher, K., & Nalau, J. (2016). Alternative approaches to co-design: Insights from indigenous/academic research collaborations. *Current Opinion in Environmental Sustainability, 20*, 99–105. https://doi.org/10.1016/j.cosust.2016.07.001

Provan, K. G., & Milward, H. B. (2001). Do networks really work? A framework for evaluating public-sector organizational networks. *Public Administration Review*, *61*(4), 414-423. https://doi.org/10.1111/0033-3352.00045

Quick, K. (2021). Tribal sovereignty and the limits and potential of inter-governmental collaboration. In J. W. Meek (Ed.), *Handbook of Collaborative Public Management* (pp. 253–267). Edward Elgar Publishing.

Quick, K. S., & Feldman, M. S. (2014). Boundaries as Junctures: Collaborative Boundary Work for Building Efficient Resilience. *Journal of Public Administration Research and Theory, 24*(3), 673–695. https://doi.org/10.1093/jopart/mut085

Robert, T. (1988). *Stafford Disaster Relief and Emergency Assistance Act (Public Law 93-288 as amended)*.

Ruijer, E. (2021). Designing and implementing data collaboratives: A governance perspective. *Government Information Quarterly*, *38*(4), 101612. https://doi.org/10.1016/j.giq.2021.101612

Tiller, V. E. V., & Harris, L. (2015). *Tiller's Guide to Indian Country: Economic Profiles of American Indian Reservations, Third Edition*. Bow Arrow Publishing Company.

Tsai, C. H., Rayi, P., Kadire, S., Wang, Y. F., Krafka, S., Zendejas, E., & Chen, Y. C. (2023). Co-design disaster management chatbot with indigenous communities. In *20th International Conference on Information Systems for Crisis Response and Management (ISCRAM)* (Vol. 2023, p. 1).

United States Bureau of Indian Affairs. (2022, January 28). *Indian Entities Recognized by and Eligible To Receive Services From the United States Bureau of Indian Affairs. Notices* (87 FR 4636). Office of the Federal Register, National Archives and Records Administration; Federal Register. https://www.govinfo.gov/app/details/FR-2022-01-28/2022-01789

Wirtz, B. W., Weyerer, J. C., & Kehl, I. (2022). Governance of artificial intelligence: A risk and guideline-based integrative framework. *Government Information Quarterly, 39*(4), 101685. https://doi.org/10.1016/j.giq.2022.101685

Wirtz, B. W., Weyerer, J. C., & Sturm, B. J. (2020). The Dark Sides of Artificial Intelligence: An Integrated AI Governance Framework for Public Administration. *International Journal of Public Administration, 43*(9), 818–829. https://doi.org/10.1080/01900692.2020.1749851

Young, M. M., Bullock, J., & Jesse D. Lecy. (2019). Artificial Discretion as a Tool of Governance: A Framework for Understanding the Impact of Artificial Intelligence on Public Administration. *Perspectives on Public Management and Governance, 2*(4), 301–314. https://doi.org/10.1093/ppmgov/gvz014

Young, M. M., Himmelreich, J., Bullock, J. B., & Kim, K. C. (2019). Artificial intelligence and administrative evil. *Perspectives on Public Management and Governance*, *4*(3), 244-258. https://doi.org/10.1093/ppmgov/gvab006