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RECEIVED 29 September 2025

REVISED 20 December 2025

ACCEPTED 30 December 2025

PUBLISHED 16 January 2026

CITATION

Jabbar A, Astuti Y, Ahmad J, Adnan AA and Putra A (2026) Bridging digital transformation and local wisdom: towards inclusive and sustainable public service delivery in indigenous communities. *Front. Sustain.* 6:1715580. doi: 10.3389/frsus.2025.1715580

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Bridging digital transformation and local wisdom: towards inclusive and sustainable public service delivery in indigenous communities

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The challenges and opportunities of digital transformation in rural and indigenous areas are different from those in urban areas, as are the contexts themselves. This research analyzes the implementation of digital public service reforms in the indigenous communities of Towani Tolotang, Soraja Kulo Dalam, and To Batu Sandobatu, located in Sidenreng Rappang, Indonesia. To accomplish this, a multi-method approach involving document research, fieldwork, interviews, and participant observations was used. The analysis was guided by the concepts of integration pathways, barriers, enabling factors, and impacts, focusing on empowerment, participation, and sustainability. The findings indicate that integration pathways were culturally mediated. In the case of Towani Tolotang, customary elders legitimized reforms, as in Soraja Kulo Dalam, in which youth reform as digital champions. In To Batu Sandobatu, rituals and partnerships with NGOs grant acceptance. Infrastructural gaps, insufficient digital literacy, and distrust are properties of barriers, while inter-generational mediation, customary authority, and government-civil society collaboration constitute the opportunity. The impacts of these dynamics, however, went beyond efficiency by also enabling broader participation, long-term sustainment, and empowerment of digital initiatives. This finding enriches the literature on digital governance in developing countries by providing evidence of the necessity of hybrid governance models to secure inclusion and legitimacy. From a practical standpoint, this means that policymakers should combine infrastructural investment with trust-building, participation enhancement, and culturally respectful strategies. From a theoretical standpoint, this research adds to the discussion of hybrid governance and sustainable digital transformation by conceptualizing empowerment, participation, and sustainability as interconnected outcomes.

KEYWORDS

digital transformation, empowerment and participation, hybrid governance, indigenous communities, sustainability outcomes

1 Introduction

Transforming public services using technology is critical globally for achieving efficiency, accountability, and civically-centered governance (Latupeirissa et al., 2024). Governments from both developing and developed nations have committed significant resources to digital technologies to bolster service delivery and inclusiveness (Sharmin and Chowdhury, 2025). The ever accelerating push towards digitalization leaves social and cultural issues and

contextual factors behind especially for remote indigenous and marginalized peoples. This gap neglect can potentially deepen digital inequities and cross barriers to public sector innovation sustainability (Allmann and Radu, 2023).

Like many other countries, Indonesia is equally enthusiastic about e-government, attaining, and controlling e-government, and digital transformation as a key priority within government policies (Allmann and Radu, 2023). Nevertheless, a vast digital divide persists in many rural, indigenous, and underserved regions, with enormous infrastructure gaps, low digital literacy, and low workflows, which are at odds with the technological ecosystem. Such inaction, where digital processes are applied without local inputs and indigenous knowledge, digital reforms, and other development initiatives, can lose community support and decrease trust in governmental processes. On the other hand, the proponents posit that local culturally attuned approaches to digital governance can foster enhanced community confidence in government programs and increased trust (Pade-Khene et al., 2017).

For the Global South, specifically for Indonesia, the lack of internet access among the indigenous and semi-rural populations is a pervasive problem. Digital inequalities are seen in India, where the problems surrounding e-government reforms in rural areas cite “diverse and inclusive community design, scaffolding, and mediation” as key problem areas. In Rwanda, the lack of trust and motivation in the digital governance reforms implemented by the Rwandan government at the local village level deserves attention. As pointed out in studies concerning Mexico’s indigenous populations, the lack of digital resources is just as much a problem of governance as it is a question of hybrid governance (Rosa, 2023). The culture and political authority of local leaders are major factors that determine the acceptance of digital initiatives (Krannich, 2022). The need to build trust in local governance systems of hybrid governance is clear from the comparative studies presented (Espeso-Molinero and Pastor-Alfonso, 2020).

This research investigates how public service delivery digitization initiatives can be integrated with indigenous knowledge systems in Indonesia. In particular, the research study focuses on three indigenous communities that support the Sidenreng Rappang Regency: Towani Tolotang, Soraja Kulo Dalam, and To Batu Sandobatu. In these communities, indigenous socio-cultural systems and local wisdom foster social cohesion, governance, and participatory decision-making (Pade-Khene et al., 2017). The research attempts to address a considerable gap in existing literature by focusing on the issues discussed in these case studies. Most of the global literature on digital governance focuses on technology adoption and institutions’ readiness. In contrast, very few studies have tried to analyze the role of indigenous knowledge systems and cultural practices in fostering sustainable digital transformation (Allmann and Radu, 2023).

Abstractly, this research contributes to the emerging discourse on hybrid governance which encompasses the utilization of digital systems alongside traditional forms of era knowledge systems to achieve inclusive and culturally sensitive public service delivery. More concretely, the study offers practical policy recommendations to subnational governments and to global institutions that aim to create culturally informed digital service workflows that also embrace sustainability.

Accordingly, this article addresses three research questions:

1. How can digital transformation be integrated with local wisdom in public service delivery within indigenous communities?
2. What challenges and opportunities do indigenous communities face in accessing digital public services?
3. What are the impacts of digital technologies on empowerment, participation, and sustainable development in indigenous settings?

By engaging with these questions, the study aims to advance understanding of digital governance that is not only technologically effective but also socially inclusive and environmentally sustainable, in alignment with the Sustainable Development Goals (SDGs 9, 11, and 16).

2 Literature review

2.1 Digital transformation in public services

These days, digital transformation (DT) is focused on public administration, and it goes beyond just digitizing records and governmental websites toward more extensive reform activism around transparency, responsiveness, and citizen-centered innovation (Ciancarini et al., 2024). Gurcan and Aleid and Almisned emphasized, in particular, how the use of Artificial Intelligence (AI), blockchain, and the Internet of Things (IoT) tools enhanced the effectiveness of government services and decisions (Ejjami, 2024). These reforms have been claimed to facilitate access, accountability, and inclusion, mainly if undertaken more integrated and on a larger scale in the health, education, and civil registration sectors (Sharmin and Chowdhury, 2025).

Despite its transformative potential, the diffusion of the benefits of digital transformation lacks symmetry, particularly in developing economies (Patel, 2024). The rural and marginalized communities still grapple with infrastructural deficits, low levels of digital literacy, and sociocultural impediments; thus, digital discrimination against disadvantaged communities is still a kinetic reality (Zaman et al., 2024). Several studies have warned that without conscientiously inclusive frameworks, DT can deepen disparities and alienate marginalized communities. The conclusion that rests on understanding DT as a mere technical development is gravely unfortunate (Umeaduma, 2023). DT also involves a sociocultural upgrade; thus, understanding DT as a sociotechnical phenomenon is crucial to formulate socially just and practical changes (Kuteesa et al., 2024).

2.2 Digital transformation in public services indigenous knowledge and local wisdom in governance

Indigenous knowledge systems, commonly known as local wisdom, have captured the essence of culture, ecology, and governance systems for centuries and continue influencing traditional societies’ social life and decision-making (Maria, 2018). The systems are applied

and appreciated worldwide as critical for sustainable development since they guarantee that the approaches taken are consistent with local frameworks of values, culture, and a sense of community (Aldyan et al., 2024). In Indonesia, for example, social customs and indigenous law serve as a basis for collective decision-making, conflict resolution, and resource management (Budiawan et al., 2023). Embedding such systems into governance processes enhances trust and the effectiveness of public initiatives (Kissiya and Biczó, 2025).

It is crucial to understand that knowledge possessed by the natives is not rigid and archaic but evolves to suit the demands of modern-day society (Wantik et al., 2024). Within the proper context, local knowledge systems and modern technologies cannot thrive together (Roy, 2025). Cross-national studies emphasize the value of incorporating indigenously oriented approaches into policy formulation to design culturally relevant techniques that uplift minorities and protect their traditional identity (Rosnon and Talib, 2019). This approach reinforces the importance of governance systems that do more than the “slavish digitization” of service delivery to culturally relevant and professionalized practices (Chigwada et al., 2025).

2.3 Sustainability governance and the triple bottom line

Governance around sustainability governance emphasizes the economic, social, and environmental interdependence, the so-called “triple bottom line” (Qaiser and Batool, 2024). In this regard, the governments’ roles go beyond fostering growth and efficiency to ensuring inclusivity, resilience, and ecological balance (Rizwan Ul Haque, 2024). Sustainability of the governance system can be supported by digital transformation, which lowers transaction costs, streamlines bureaucratic processes, eliminates paper, reduces other environmentally harmful activities, and encourages distance services (Carpejani et al., 2020). However, governance reforms around equality and accessibility to services must be critically reviewed to prevent widening inequities (Makalima, 2024).

As analyses conducted in Europe, Latin America, and Asia indicate, regarding inclusivity, achieving sustainable digital governance will require the purposeful addition of mechanisms such as participatory design and community-based monitoring (Mehta et al., 2024). Although the social dimension of sustainability, especially in indigenous and marginalized situations, has not been fully explored, unlike in the case of environmental sustainability, it still needs to be explored (Nazarenko et al., 2024). This research problem emphasizes the importance of investigating how digital governance could empower the disadvantaged and promote social equity through the advantages of the digital transformation (Rice et al., 2025).

2.4 Hybrid governance: bridging digital and local systems

Blending governance systems using hybrid governance attempts to address issues while keeping pace with contemporary local government e-reforms and traditional bureaucratic governance frameworks (Mulyana et al., 2023). It focuses on service and policy co-creation where community-driven digital service frameworks

incorporate digital technologies with local ethos (Bertot et al., 2016). It acknowledges that moving forward with Trust-Added Digital Reforms in isolation does not build trust or sustain community participation with traditional leadership systems and social norms hegemony (Oyewole, 2023).

Within the literature on indigenous issues, hybrid governance enables reframing digital advancement from a disruptive to a complementary innovation (Motadi and Sikhwari, 2024). Research conducted on Asia and Africa shows how using indigenous decision-making on digital platforms enhances inclusiveness and sustainability (Maditsi and Materechera, 2021). Their hybrid governance goes beyond the technical (Clark-Ginsberg et al., 2022). It configures a socio-political arrangement that strikes a deal between innovation and tradition, and thus, more resilient and culturally aware forms of public service delivery (Foyet and Child, 2024).

2.5 Research gap and contribution of this study

Regardless of advances in digital governance and indigenous studies, there is a deficiency in scholarship that amalgamates the two. Most studies of digital transformation focus on adopting technology, infrastructure, or institutional preparedness; very few analyze the cultural legitimacy of digital reforms in indigenous settings (Andrade and Gonçalo, 2021). Similarly, the sustainability literature has been overwhelmingly preoccupied with environmental outcomes, paying relatively little attention to the social sustainability of public administration (Guandalini, 2022). These gaps in scholarship impede our understanding of the possible synergies between digital reforms and local knowledge and how such synergies may produce equitable and enduring outcomes (Loch and Riechers, 2021).

This gap can be addressed by integrating a hybrid governance model to implement digital transformation infused with the indigenous knowledge systems. This research focuses on the indigenous people of Sidenreng Rappang, Indonesia, to explain how local knowledge systems can be a basis for digital transformation initiatives designed with cultural sensitivity and social integration. Thus, it adds to the Global South’s empirical evidence to the international discourse on sustainability governance, providing theoretical refinement and actionable policy proposals.

3 Methods

3.1 Research design

This study is based on qualitative research which employs the multiple case study method in examining the possible ways digital transformation may be coupled with local wisdom in the indigenous peoples’ community (Papp, 2019). The case study design is especially beneficial in studying intricate social phenomena within the framework of their real-life situations, as it allows them to appreciate the relationship between technology, culture, and the governing structures (Chen and Wang, 2018). This study concentrates on three particular indigenous communities to provide an in-depth and nuanced understanding of the issues and prospects of digital public service delivery.

A qualitative approach permits inductive analysis, which is essential for finding patterns and themes otherwise lost in standardized surveys and other quantitative metrics (Dewiyanti et al., 2023). This flexibility matters in working in indigenous contexts that require cultural sensitivity, relational ethics, and respect for local ways of knowing and doing in determining the processes and outcomes of research (Chigwada et al., 2025). Thus, the research approach balances social and cultural rigor with methodological integrity to derive authentic findings for the community.

3.2 Research sites and participants

The research investigated the settlements of Towani Tolotang, Soraja Kulo Dalam, and To Batu located in the Sidenreng Rappang Regency of South Sulawesi, Indonesia. The government's provision of services and the level of 'local wisdom' within the communities were noted. These communities in question represent unique cases that allow for an analysis of how digitally induced systemic transformations are implemented and how cultural practices are sustained within the ill-defined boundaries of these immigrant communities.

The participants included community members, civil society representatives, local leaders, and government officials. A purposive sampling strategy included all members regardless of age, gender, or social position. Considering the nature of digital transformation, the stakeholders and beneficiaries have differing perceptions, not to mention the plethora of approaches from policy-level participants. Hence, all of these viewpoints were necessary for understanding the situation.

3.3 Data collection

Information was obtained through personal interviews, participatory workshops, and direct observation. To balance structure with the needs of participants' perspectives, semi-structured interview guides were used, covering key topics, including perceptions of governance, culture, and digital access (Mashuri, 2022). The workshops were organized as joint forums where community members and officials could discuss the relationship between technology and tradition, resulting in not only data but also mechanisms for co-creation.

Apart from the verbal data that was the core focus of this analysis, there were copies of notes gathered during the community activities, photographs taken from the community activities, and digital platform engagements (Alamri, 2019). Various data collection techniques enhanced the data set, permitting triangulation and richer contextual analysis. Ethics approval was sought, and informed consent from all participants was obtained, which was in line with cultural practices and academic standards (Stefanski et al., 2024).

3.4 Data analysis

NVivo 12 Plus was utilized to conduct thematic analysis by systematically coding and categorizing the data (Seals, 2024). Initial and emergent codes were derived from the research questions to capture the participants' realities better. Subsequently, and with

emergent analysis, the themes "digital access barriers," "cultural legitimacy," and "hybrid governance practices" were developed and refined. This procedure guaranteed deductive alignment with the research framework and inductive openness to novel insights simultaneously.

We strengthened the validity by triangulation of data sources, research team peer debriefing, and community participant member checking. These strategies improved the findings' credibility, dependability, and confirmability, aligning with qualitative research creation. These final themes were synthesized into a conceptual framework for digital transformation, local wisdom, and sustainability outcomes.

3.5 Role of partners and collaboration

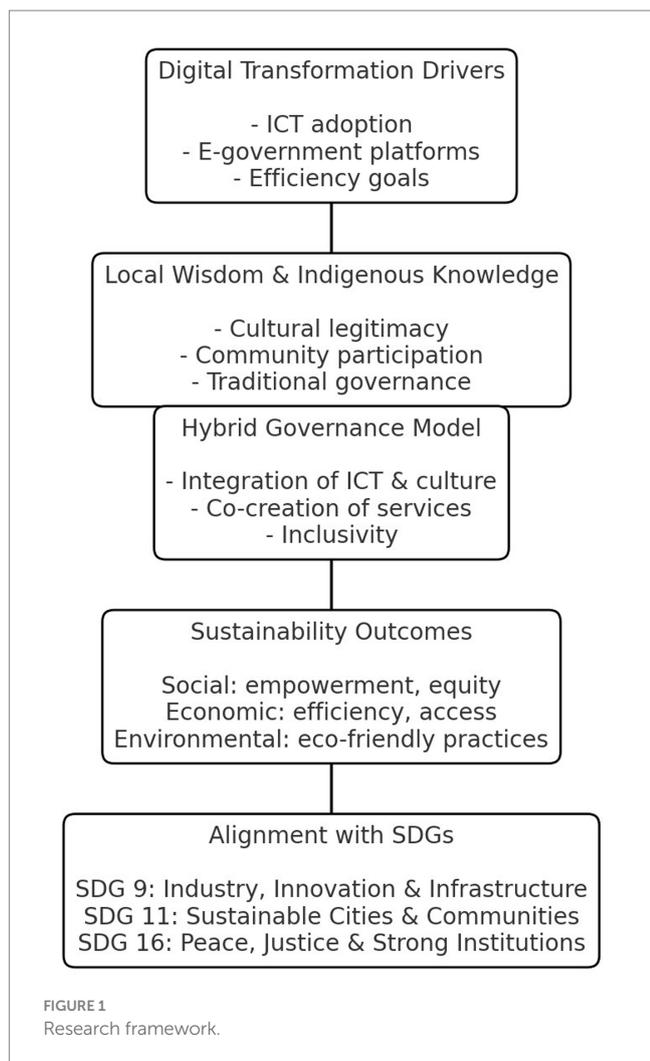
This research hinged greatly on collaboration with pertinent stakeholders. This research involved the Sidenreng Rappang District Office for Community and Village Empowerment, which provided policy documents and helped with connections to community representatives. Also, the Nene' Mallomo Foundation MDGs and the Nene' Mallomo Foundation provided her expertise on community engagement. They guaranteed the research process followed the standard operating protocols of inclusive and respectful research and local customs.

Including government agencies and civil society organizations during the study period guaranteed the advancement of scholarly and practical knowledge in the form of usable policy and practice. Such collaboration embodies the essence of sustainability research, focusing on co-creation, diverse stakeholder integration, and applied research for the community. The overall research framework, which connects digital transformation drivers, local wisdom, and sustainability outcomes through hybrid governance, is illustrated in Figure 1.

4 Result and discussion

4.1 Integration pathways: how digital transformation meets local wisdom

Data analysis proved that the integration of digital reforms with local wisdom in the three indigenous communities occurred by means of culturally mediated pathways. In Towani Tolotang, for example, customary leaders played a transformative role in socializing the more abstract, technical, and digital service procedures into more concrete and culturally normative social practices. This kind of mechanism has been documented before concerning the role of traditional authority in the legitimation of modern innovations in indigenous societies (Ismelina et al., 2025). In Soraja Kulo Dalam, government forms and procedures were translated into the local dialect, enhancing understanding and easing apprehension. This finding illustrates the more general point that language and other forms of symbolic framing can lower thresholds of policy uptake. In To Batu Sandobatu, the community was enabled to ritualistically and symbolically embrace the offer of digital services, thereby constructing the narratives of their own incorporation of digitalization as a deepening of their traditions as opposed to a disruptive innovation. Such forms of symbolic alignment have been recognized in the governance of sustainability,



where cultural rituals embed change in the constancy of culture (Mischen and Lipo, 2021).

All three communities attempted to integrate digital transformation with cultural legitimization differently. For instance, while youth digital champions had larger roles in Soraja Kulo Dalam, in Towani Tolotang, the centralization of legitimacy was through vertical gerontocratic power. These differences illustrate that the hyper-like governance of communities is relative: the same digital platform is differently incorporated into the cultural weave of the community (Morales, 2020). Selected responses from the interviews are compiled in Table 1.

In addition to detailing participants' quotes in Table 1, Figure 2 offers a cross-case comparison. The heatmap indicates that the prevalence of customary authority in mediation, Towani Tolotang, is the strongest, confirming the pivotal positioning of hereditary leaders in endorsing digital reforms. In contrast, Soraja Kulo Dalam indicates a greater presence of youths as digital champions, illustrating the role of demographic transitions in enhancing the use of digital technologies when the socio-cultural vernacular is emphasized. In To Batu Sandobatu, the distinct pathway of ritual alignment is shown, where digital reforms are cloaked in traditional ceremonies introduced as part of the rituals. This difference provides support for the hybrid governance theory, which posits that integration pathways are

TABLE 1 Codebook and exemplar quotes.

Theme/code	Definition	Exemplar quote (translated)	Community
Customary authority as mediator	Role of traditional leaders in legitimizing digital services and translating procedures into accepted norms.	"If the to matua (customary elder) says this service is good, then we all follow—even if it is online."	Towani Tolotang
Language and idiom adaptation	Reframing government forms and processes into local expressions that resonate with community identity.	"We do not call it an application; we say it is a new way of keeping our pappaseng (messages) safe."	Soraja Kulo Dalam
Ritual alignment	Symbolic integration of digital reforms with local ritual practices to reduce resistance.	"Before introducing the digital system, we held a small ritual doa to make it part of our tradition."	To Batu Sandobatu
Youth as digital champions	Involvement of younger members as intermediaries who guide elders through digital platforms.	"It is my grandson who helps me press the buttons; without him, I would not dare to use the online system."	Soraja Kulo Dalam
Hybrid legitimacy formation	Process by which digital systems gain acceptance when endorsed simultaneously by government and adat authority.	"We trust it because both the village office and the adat council agreed to launch it together."	Cross-case

neurally interwoven along institutional, societal, and generational edges (Kapidžić, 2018).

These differences reveal that hybrid governance is not uniform but highly context-sensitive. The same digital platform acquires legitimacy through different mechanisms depending on the community's socio-cultural fabric (Hajido et al., 2025). Figure 2 thus complements the quotes in Table 1 by offering a broader comparative perspective, showing that integration pathways are simultaneously shared and divergent across indigenous communities. This comparative picture aligns with the literature on contextual adaptation in sustainability governance, which argues that inclusivity requires tailoring reforms to local socio-cultural environments (Balanzó-Guzmán and Ramos-Mejía, 2023).

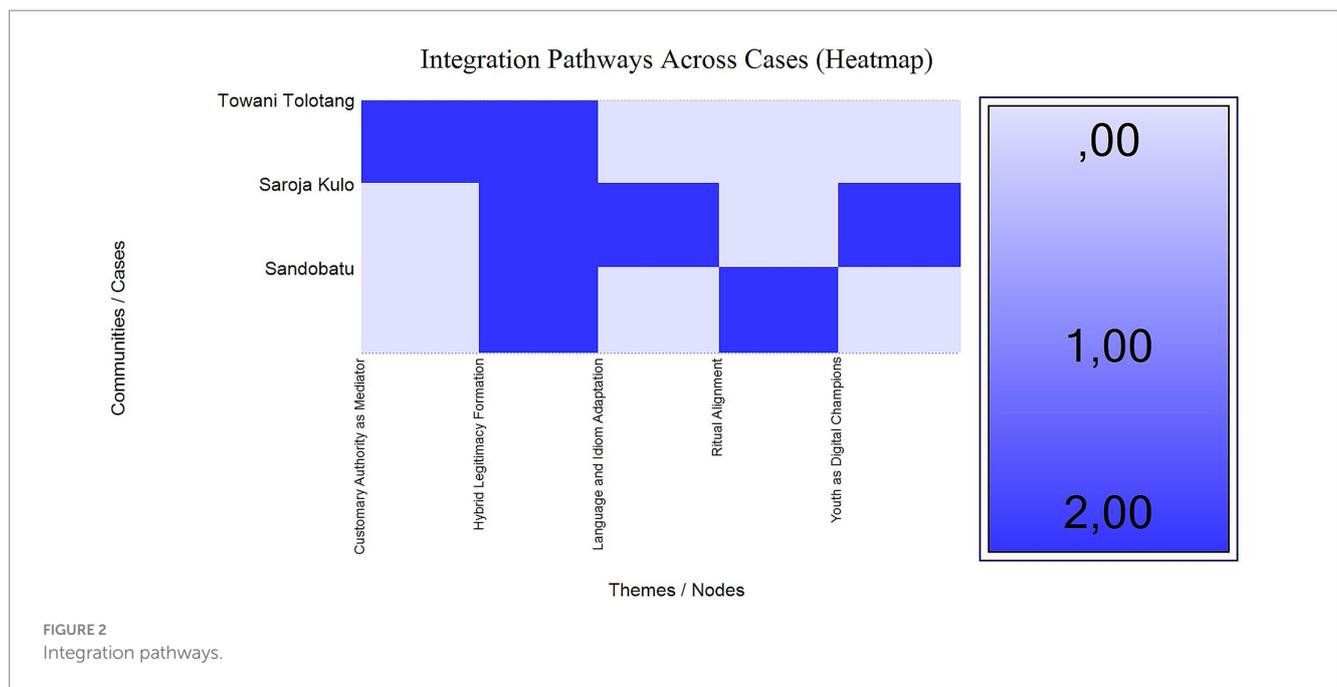


TABLE 2 Barriers and opportunities for accessing digital public services across indigenous communities.

Theme	Main community findings	Illustrative evidence
Infrastructure & connectivity (barrier)	Towani Tolotang experienced weak internet and unstable electricity; less significant in other communities.	“Sometimes the signal disappears, so we go directly to the village office.” (Towani resident)
Digital literacy gaps (barrier)	Older residents in Soraja Kulo Dalam struggled most; moderate gaps in Towani and Sandobatu.	“I do not know how to fill out the online forms, so I ask for help.” (Soraja woman)
Trust deficit & procedural misalignment (barrier)	Strongest in To Batu Sandobatu due to failed past programs and perception that online speed bypasses customary deliberation.	“Last time the program failed, so now people doubt it.” (Sandobatu elder)
Customary authority (opportunity)	In Towani, elders’ endorsement legitimized services; moderate role in other cases.	“If the elder says it is safe, we all follow—even online.” (Towani elder)
Youth as digital champions (opportunity)	Most significant in Soraja Kulo Dalam, where youth regularly helped elders.	“We young people help elders press the buttons.” (Soraja youth)
Government–CSO collaboration (opportunity)	Critical in Sandobatu, where partnership with Nene’ Mallomo Foundation built trust.	“When the NGO comes with the village, we trust the program.” (Sandobatu resident)
Community participation (opportunity)	All communities valued involvement in adat meetings or rituals before adoption.	“We join meetings before using the app.” (Observation)

4.2 Barriers and opportunities for accessing digital public services

The residents of Sidenreng Rappang have had to contend with severe challenges in relation to the access and use of digital public services. In Towani Tolotang, for example, the available internet services, combined with recurrent power outages, rendered the online system impractical for everyday use: In Soraja Kulo Dalam, perhaps the most pronounced barrier of all to internet access was the lack of computer and internet skills. Many members of the older generation, in particular, expressed their fear and apprehension of making mistakes in completing the online form. On the other hand, in To Batu Sandobatu, the barriers are more of a trust and process alignment issue than access. For example, the negative outcomes of previous

government interventions cultivated a trust deficit, while the haste with which online systems processed requests was felt to bypass the necessary discussions. This cycle is argued to form the digital divide to which the literature speaks, suggesting the absence of infrastructure, digital illiteracy, and cultural dissonance coalesce to perpetuate exclusion and marginalization (Hollimon et al., 2025). These three, in conjunction with For Survey, are illustrated in Table 2.

Any barriers to adoption were transcended through multiple opportunities and enablers. In Towani Tolotang, traditional leaders acted as strong “legitimisers”. When the to matua endorsed digitalization, the community became more willing to participate. In Soraja Kulo Dalam, youth mediators contributed significantly as “intergenerational bridges”. They assisted the elderly in using various online platforms [citation]. In To Batu Sandobatu, the merging

collaboration of state, local administrative Tikors, and the Nene' Mallomo Foundation fostered trust 'releaser' through the reform process. Changes were made by people who had some understanding of the local administrative Tikor customs (Heinämäki, 2016). Participation in community meetings increased the legitimacy of the changes and contributed to their smooth implementation. They also reinforced the notion that the transformation of technology in the indigenous people's context requires genuineness and mutual consent. The conclusions highlight that barriers are not the only defining feature of hybrid governance models, as also shown in Table 2. They are also supported by enablers that convert potential exclusion to inclusion.

4.3 Impacts on empowerment, participation, and sustainability

The impacts of digital reforms were not only technical. They were social, producing outcomes that strengthened empowerment, participation, and sustainability. As illustrated in Table 2, empowerment was evident in the improved digital literacy support and women's service uptake, especially in Soraja Kulo Dalam, where younger family members mediated digital access for older relatives. Participation was enhanced by the active youth as digital champions and the supporting role of some customary leaders in the governance of digital reforms, ensuring that these changes were culturally relevant. Trust, government-CSO collaboration, and sustainability of institutions enhanced sustainability, of which To Batu Sandobatu was a prominent example when partnerships with the Nene' Mallomo Foundation created community confidence in digital initiatives.

The facts above illustrate how outcomes of digital transformation are no longer a question of efficiency alone; they are also a question of empowerment, participation, and sustainability. Table 2 shows how empowerment is a function of digital competencies, intergenerational mediation, and cultural legitimacy. Access to participation is not the only factor; there is an institutional acknowledgement of the youth and the traditional governance structures as co-governors (Craig, 2015). As for sustainability, this is both technological and social, and reflects the position that more profound changes in the operations of the state, community-based organisations, and cultural formations are required to go in the same direction (Balanzó-Guzmán and Ramos-Mejía, 2023). These resonate with the prevailing literature on hybrid governance and sustainable digital transformation. More particularly, the focus on inclusion and legitimacy is what defines the outcome as successful (Boudes et al., 2020).

Digital advances bring consequences, as noted in other developing parts of the world focused on empowerment, participation, and sustainability, which are all intertwined. For development in rural India, research indicates that the youth of the community are digital intermediaries for the rural elders. This expands access to technology for the elders and enables the youth to shift local power structures. With respect to the sustainability of digital practices in Rwanda, community trust and active partnerships between civil and governmental authorities are vital. Research in the marginalized communities of Mexico also shows that governance sustainability transcends the mere presence of technical or digital infrastructure provisions (Rosa, 2023). They have an implicit social contract for sustainability with local governance structures, which are typically

informal, and their governance practices (Espeso-Molinero and Pastor-Alfonso, 2020). This partnership legitimizes the use of technology in governance, thus the governance frameworks fit digital practices (Špirić et al., 2019). Research and practices in Indonesia, on the other hand, serve to deepen the practices and technology of governance with respect to digital use and e-governance, by showing how community rituals and other forms of social technology of governance can integrate with digital governance to provide social priorities (Singgalen et al., 2019).

4.4 Practical and theoretical implications

Following the integration pathways from Section 4.1 and the barriers and opportunities from Section 4.2, along with the impacts of empowerment, participation, and sustainability from Section 4.3, the current study deduces practical and theoretical implications. The implications illustrate that digital reforms in indigenous communities are still governance processes, but they are much more than bare technical engagements. The principal findings are captured in Table 3, which corresponds with the overarching conclusions with elements of practical and theoretical significance.

4.4.1 Practical implications

The results suggest to practitioners and policymakers that, as an example, no digital transformation effort will succeed if it is only seen as an issue of infrastructure or efficiency. Although closing connectivity gaps and improving literacy are crucial, they must be accompanied by frameworks that root reforms in local customs, engage customary leaders, and utilize youth as digital intermediaries

TABLE 3 Summary of practical and theoretical implications.

Key findings	Practical implications	Theoretical implications
Integration pathways are context-dependent	Policymakers must adapt digital reforms to socio-cultural settings rather than applying uniform models.	Extends hybrid governance literature by showing that integration is mediated by local traditions and authority structures.
Barriers include infrastructure gaps, literacy deficits, and trust issues	Infrastructure investment must be combined with culturally sensitive engagement strategies to ensure uptake.	Supports theories of digital divide but nuances them with cultural legitimacy as a central variable.
Opportunities through youth mediation and customary authority	Training programs should empower youth as digital intermediaries and engage elders for legitimacy.	Demonstrates that hybrid legitimacy arises from intergenerational collaboration, enriching participatory governance theory.
Impacts across empowerment, participation, and sustainability	Evaluation of reforms should include social outcomes (trust, inclusion, continuity), not only efficiency.	Advances sustainable digital transformation frameworks by integrating empowerment and legitimacy as core metrics.

[citation]. The project To Batu Sandobatu demonstrates how civil society organisations merge digital customs and local customs to design digital reforms that cultivate trust, creating helpful synergy in society. From this perspective, Table 3 highlights that sustainable digitalization is not only an issue of technological provision (hardware) but also legitimacy, participation, and trust (software).

4.4.2 Theoretical implications

The study addresses issues of hybrid governance and sustainable digital transformation within the literature. While previous scholarship highlights the bridging role of hybrid governance [citation], our findings extend this perspective by demonstrating that the same digital platform acquires different legitimacy depending on cultural traditions, authority structures, and intergenerational roles. The thematic map of impacts (Figure 3) reinforces this argument by relating empowerment, participation, and sustainability as interdependent outcomes rather than distinct domains. As summarized in Table 3, this study furthers theory by redefining assessments of digital maturity to include cultural legitimacy and social inclusion, thus broadening the focus from efficiency to include empowerment and trust.

5 Conclusion

This research explored the impact of digital transformation on indigenous knowledge systems within three communities of Sidenreng Rappang, Indonesia. The findings show that pathways to integration are culturally mediated and context-specific. Towani Tolotang depended on customary elders as mediators, Soraja Kulo Dalam focused on youths as digital champions, and To Batu Sandobatu synchronized changes with rituals and civil society. These differences indicate that the legitimacy of digital reforms is not based on

technology alone. It comes from the integration of local knowledge, wisdom, intergenerational responsibilities, and authority systems. Throughout the studies impediments including infrastructural gaps, low digital literacy, and trust deficits restricted access even as customary authority, youth mediation and government–CSO collaboration facilitated access. The ensuing impacts went beyond efficiency to include empowerment, participation, and sustainability reinforcing the argument that digital transformation has to be socially inclusive as much as it is technologically effective.

In practice, the findings highlight the need for policymakers to adopt approaches integrating “hardware” elements such as infrastructure and platforms, with “software” components as legitimacy, participation and trust. In theory, the research contributes to hybrid governance and sustainable digital transformation literature by framing empowerment, participation and sustainability as outcomes that are interdependent. Further research may delve into how such frameworks evolve over time and across regions, providing comparative analyses on inclusive digital reforms for other Global South contexts.

These findings have implications for national and international sustainability initiatives. At the national level, they address the Indonesian government’s ongoing Sistem Pemerintahan Berbasis Elektronik (SPBE) program and the Smart Village program, pointing out that digital inclusion towards transformation should also cover indigenous and semi-rural areas so no communities are left behind. At the international level, the findings relate to the Sustainable Development Goals (SDGs), particularly on SDG 9, which is on innovation and infrastructure, and SDG 16, which is on inclusive institutions. Globally, the findings relate to the SDGs, particularly SDG 9 on innovation and infrastructure and SDG 16 on inclusive institutions, which underscore the need for sustainable technology reforms to be accompanied by civic and participatory governance frameworks.

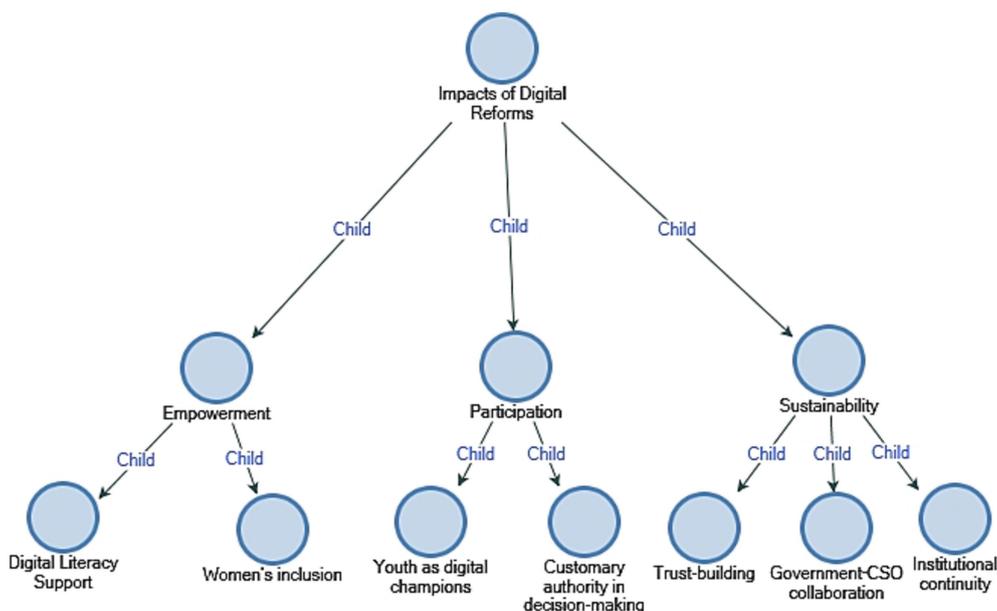


FIGURE 3
Thematic map of impacts of digital reforms.

While the immediate cases are important, the results also indicate that hybrid governance could be used as a transferable model to other Global South countries, where the associated cultural and social trust impacts the success of digitalization. Therefore, future studies would need to undertake more cross-regional comparative studies and use longitudinal methods to assess the impact of emerging technologies like AI governance frameworks on digital systems and traditional governance. These approaches would balance the digital governance theory and provide policymakers with practical approaches to inclusive and resilient governance systems.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Ethics statement

The participants provided their written informed consent to participate in this study.

Author contributions

AJ: Conceptualization, Writing – original draft. YA: Data curation, Writing – review & editing. JA: Methodology, Writing – review & editing. AA: Validation, Writing – review & editing. AP: Formal analysis, Writing – review & editing.

Funding

The author(s) declared that financial support was received for this work and/or its publication. This research has obtained funding from the Funds for Scientific Publishing of the Ministry of Higher Education of the Republic of Indonesia, along with the Scientific Recommendation Number a/78/UN56.4.1.1/SP/2022 issued in June '22. The author appreciates the hard work of the field enumerators for collecting data for the research and also thanks the Universitas Muhammadiyah Buton for its support for the implementation of the research.

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Acknowledgments

The author sincerely appreciates the support received from the Sidenreng Rappang District Office for Community and Village Empowerment and the Nene' Mallomo Foundation for ease of access to documents and engagements with the community representatives. Thanks are also due to the community leaders and the people of Towani Tolotang, Soraja Kulo Dalam, and To Batu Sandobatu for taking the trouble to support the research with their valuable time and ideas.

Conflict of interest

The author(s) declared that this work was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Generative AI statement

The author(s) declared that Generative AI was used in the creation of this manuscript. The author verifies and takes full responsibility for the use of generative AI in the preparation of this manuscript. Generative AI (ChatGPT, developed by OpenAI) was used to support language refinement, drafting assistance, and the structuring of sections. All outputs generated by the AI tool were reviewed, edited, and validated by the author to ensure accuracy, originality, and compliance with academic standards. The author affirms that the intellectual content, analysis, and conclusions presented in this manuscript are solely their own responsibility.

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