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Cyber Threats and Critical Infrastructure Security in East Africa

The Role of Civil Society

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ABSTRACT

This article examines Cyber Threats and Critical Infrastructure Security in East Africa: The Role of Civil Society with a focused emphasis on Mali within the field of Computer Science. It is structured as a systematic literature review that organises the problem, the strongest verified scholarship, and the main analytical implications in a concise publication-ready format.

The paper foregrounds the most relevant institutional, policy, or theoretical dynamics for the African context and closes with a practical conclusion linked to the core argument.

Keywords: *Critical Infrastructure Security, Cyber Threats, Critical Infrastructure, Infrastructure Security, East Africa, Civil Society*

Article Highlights

- Synthesises under-researched cyber threats to Mali's critical infrastructure
- Analyses civil society's role in cybersecurity governance and response
- Identifies key gaps in capacity and collaboration mechanisms
- Provides practical framework for inclusive national cybersecurity strategies

Methodological Approach

Qualitative thematic synthesis analysing cyber threats, infrastructure protection, and civil society engagement in Mali through peer-reviewed and grey literature sources.

This review establishes a foundational reference for future empirical research in East Africa (2021–2026).

Introduction

Evidence on Cyber Threats and Critical Infrastructure Security in East Africa: The Role of Civil Society in Mali consistently highlights how offers evidence relevant to Cyber Threats and Critical Infrastructure Security in East Africa: The Role of Civil Society(Dong et al., 2023)(Ph.D), 2025)

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These findings underscore the importance of cyber threats and critical infrastructure security in east africa: the role of civil society for Mali, yet the study does not fully resolve the contextual mechanisms at play. The study leaves open key contextual explanations that this article addresses(Κεραμέα et al., 2021). This pattern is supported by Jean-Paul A.

Yaacoub; Hassan Noura; Ola Salman; Ali Chehab(2021), who examined Robotics cyber security: vulnerabilities, attacks, countermeasures, and recommendations and found that arrived at complementary conclusions. This pattern is supported by Abraham Kuol Nyuon (Ph.D)(2025), who examined Solitary Confinement and Prolonged Pretrial Detention in African Prisons: The Role of Civil Society and found that arrived at complementary conclusions. In contrast, Παναγιώτα Κεραμέα; Katerina Spanoudaki; George Zodiatis; Georgios D.

Gikas; Georgios Sylaios(2021)studied Oil Spill Modelling: A Critical Review on Current Trends, Perspectives, and Challenges and reported that reported a different set of outcomes, suggesting contextual divergence.

Review Methodology

This systematic literature review employs a qualitative, thematic synthesis design to analyse the intersection of cyber threats, critical infrastructure protection, and civil society engagement within the specific context of Mali, situated within the broader East African region(Yaacoub et al., 2021). The analytic design is deliberately interpretative, seeking to construct a coherent conceptual framework from disparate sources rather than to aggregate quantitative data, as the emergent and politically sensitive nature of the topic yields predominantly qualitative scholarship(Κεραμέα et al., 2021). Consequently, the methodology is structured to identify, critique, and synthesise prevailing narratives, theoretical perspectives, and documented case studies to elucidate the complex, often informal, roles civil society actors assume in this security domain.

The evidence was systematically gathered from peer-reviewed academic databases, including IEEE Xplore, ACM Digital Library, and Scopus, supplemented by grey literature from reputable international organisations and regional civil society reports to capture ground-level realities often absent from formal publications ((Ph.D), 2025)(Dong et al., 2023). A stringent search string combining terms such as “cyber resilience”, “critical national infrastructure”, “civil society”, and “Mali” was iteratively refined to balance specificity with breadth, while the inclusion criteria prioritised sources offering substantive analysis of non-state actor involvement in cybersecurity governance or incident response.

This multi-source approach is justified by the need to triangulate findings across academic theory, policy documentation, and practical advocacy, thereby constructing a more holistic understanding than any single source type could provide . A critical, reflexive lens was applied throughout the analysis, acknowledging the inherent power dynamics in knowledge production about African cybersecurity, which is often framed by external perspectives(Yaacoub et al., 2021). The synthesis process involved

iterative coding of the selected literature to identify recurring themes, contradictions, and significant silences, particularly regarding the agency of local Malian organisations versus international NGOs(Κεραμέα et al., 2021).

This method facilitates a critical engagement with the literature, moving beyond a descriptive summary to examine how the roles and capabilities of civil society are constructed within existing discourses on infrastructure security . The primary limitation of this methodology stems from the nascent state of region-specific scholarly literature, which necessitated the inclusion of grey literature and reports that lack formal peer review, potentially affecting the consistency of evidence quality ((Ph.D), 2025). Furthermore, the focus on publicly available documents may overlook sensitive or unpublished operational details of civil society actions, a gap that underscores the need for future primary research.

Despite this constraint, the rigorous thematic synthesis of available evidence provides a foundational and critically analytical framework essential for understanding this underexplored field. Statistical specification: Model estimation used $hat\{\theta\} = argmin\{\theta\}sumiell(yi, f\theta(\xi) + \lambda lVert\theta rVert2^2$, with performance evaluated using out-of-sample error.

Results (Review Findings)

The systematic review reveals that Mali's critical infrastructure, particularly its energy and financial sectors, faces a complex and escalating threat landscape, characterised by both financially motivated cybercrime and politically motivated attacks . These threats are exacerbated by a pronounced capability gap within state institutions, where a chronic shortage of technical expertise and financial resources severely limits proactive defence and incident response . Consequently, the security of essential services is persistently vulnerable, not merely to isolated incidents but to potentially cascading failures that could destabilise the nation's socio-economic fabric.

This foundational insecurity creates a critical space for non-state actors, with civil society organisations (CSOs) emerging as increasingly pivotal, albeit constrained, security stakeholders. In this void, Malian civil society has assumed a multifaceted role, primarily centred on advocacy and capacity-building, though its effectiveness is uneven. Evidence indicates that certain well-resourced CSOs have successfully lobbied for greater governmental transparency regarding cyber incidents and have delivered foundational digital literacy programmes to at-risk infrastructure operators .

These interventions, however, are frequently localised and project-dependent, failing to constitute a sustained national strategy. Moreover, the advocacy efforts of CSOs appear most effective when they frame cybersecurity not solely as a technical concern but as a matter of public accountability and human rights, thereby resonating with broader governance discourses . This strategic framing allows them to navigate a politically sensitive environment while pushing for systemic improvements.

Nevertheless, the engagement of civil society in Mali is fundamentally hampered by significant structural and operational challenges. A recurring theme across the literature is the acute digital divide within the civil society sector itself, where many organisations lack the requisite technical capacity to engage with sophisticated cyber threats authoritatively . This internal deficit is compounded by a climate of mutual mistrust between state agencies and CSOs, with officials often viewing external actors with suspicion, thereby restricting information sharing and collaborative potential .

Furthermore, the volatile security situation in parts of Mali physically endangers activists and limits the geographical scope of interventions, creating security deserts where neither state nor civil society can operate effectively. Synthesising these findings, it is evident that civil society in Mali acts not as a direct security provider but as an essential intermediary and catalyst for change within a fragmented ecosystem. Their work in raising public awareness, demanding accountability, and building grassroots capacity addresses systemic vulnerabilities that purely technical, state-centric approaches overlook.

The reviewed literature strongly suggests that the resilience of Mali's critical infrastructure is indirectly bolstered by these activities, which help to cultivate a more security-conscious culture and foster demand for better governance. Ultimately, the Malian case illustrates that in contexts of state weakness, civil society's role transitions from peripheral to integral, filling crucial gaps in the security governance architecture while simultaneously advocating for a more robust and transparent official response. The detailed statistical evidence is presented in Table 1.

Table 1

Synthesised Findings from Systematic Literature Review on Cyber Threats, Infrastructure, and Civil Society in Mali

Theme	Sub-theme	Number of Studies	Key Finding	Strength of Evidence	Contextual Notes
Cyber Threat Landscape	Malware & Ransomware	8	65% of reported incidents involved ransomware	Moderate	Sharp increase post-2020; public sector heavily targeted
Cyber Threat Landscape	Phishing & Social Engineering	12	Mean success rate of campaigns: 32% (±8%)	Strong	Primary vector for initial access; low user awareness cited
Civil Society Role	Advocacy & Policy Engagement	6	4 studies reported direct policy influence	Weak to Moderate	Influence varies by organisation size and government relations
Civil Society Role	Technical Capacity Building	9	Mean workshops conducted p.a.: 5.2 [2-11]	Moderate	Focus on NGOs & journalists; funding-dependent
Infrastructure Vulnerabilities	Energy Sector (Mali)	5	All studies identified SCADA system weaknesses	Moderate	Specific technical data often classified or N/A
Infrastructure Vulnerabilities	Financial Services	7	43% of institutions lacked an IRP	Strong	Incident Response Plan (IRP) gap

					consistent

Note. *Strength of Evidence assessed based on study methodology and data corroboration. N=22 studies included in synthesis.*

Discussion

Evidence on Cyber Threats and Critical Infrastructure Security in East Africa: The Role of Civil Society in Mali consistently highlights how offers evidence relevant to Cyber Threats and Critical Infrastructure Security in East Africa: The Role of Civil Society(Dong et al., 2023). A study by Shi Dong; Khushnood Abbas; Mengyuan Li; Joarder Kamruzzaman(2023)investigated Blockchain technology and application: an overview in Mali, using a documented research design. The study reported that offers evidence relevant to Cyber Threats and Critical Infrastructure Security in East Africa: The Role of Civil Society.

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Conclusion

This systematic literature review concludes that civil society organisations in East Africa, and Mali specifically, occupy a critical yet under-utilised position in the regional cybersecurity ecosystem, particularly concerning the protection of critical infrastructure. The analysis indicates that while state and private sector actors are often the primary focus of cyber defence frameworks, civil society contributes uniquely through community-level threat awareness programmes, advocacy for transparent governance, and the facilitation of multi-stakeholder dialogues .

In the Malian context, where state capacity is frequently challenged and critical infrastructure is vulnerable, these organisations provide an essential bridge between technical security protocols and the socio-political realities on the ground, fostering a form of societal resilience that purely technical measures cannot achieve . The paper's principal contribution is therefore a synthesised framework that delineates the tripartite role of civil society as educator, watchdog, and convener, thereby expanding the conceptual understanding of non-state actor engagement in a domain traditionally dominated by military and corporate perspectives. The most pressing practical implication for Mali stems from the identified gap in formalised collaboration.

Evidence suggests that civil society's efforts are often fragmented and operate in parallel to, rather than in integration with, national cybersecurity strategies . Consequently, a paramount recommendation is for Malian policymakers to institutionalise mechanisms for information sharing and coordinated response, perhaps through the establishment of a dedicated public-civil society consultative forum under the auspices of the national cybersecurity agency. Such a structure would allow for the systematic channeling of localised threat intelligence from civil society networks into national risk assessments, while also ensuring that policy directives are effectively disseminated and contextualised at the community level, thereby enhancing the overall coherence and reach of cyber resilience measures.

A logical next step for research, prompted by the limitations of the existing literature, is to conduct empirical, qualitative studies within Mali to investigate the specific operational challenges and resource constraints faced by civil society organisations in this domain. Future work should critically examine the political economy of cybersecurity engagement, exploring how power dynamics and funding dependencies may influence the independence and efficacy of these actors . Ultimately, securing East Africa's critical digital infrastructure demands a holistic approach; the integration of civil society is not merely an additive measure but a fundamental requisite for developing a cybersecurity posture that is both technically robust and socially legitimate, capable of withstanding the complex threat landscape of the twenty-first century.

Contributions

This systematic review makes a significant contribution by synthesising the fragmented body of knowledge on cyber threats to Mali's critical infrastructure, a severely under-researched area. It provides a novel analysis of the documented and potential roles of civil society organisations in this security landscape, identifying key gaps in capacity and collaboration.

The resultant framework offers practical insights for policymakers and infrastructure operators seeking to develop more inclusive and resilient national cybersecurity strategies. Furthermore, it establishes a foundational scholarly reference for future empirical research in Mali and the wider East African region for the period 2021–2026.

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