How Citizen Science Advances the Sustainable Development Goals and Transformative Action in Africa: A Synthesis of Adoption, Policy Uptake, and Impact

CITIZEN SCIENCE:
THEORY AND PRACTICE

COLLECTION:
CITIZEN SCIENCE FOR EVIDENCE-BASED POLICY AND DECISION-MAKING

SYNTHESIS ARTICLES

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ABSTRACT

Citizen science and citizen-generated data (CGD) are increasingly recognised as potential complements to conventional evidence for Sustainable Development Goal (SDG) monitoring and governance, yet evidence of their realised contribution in African contexts remains fragmented. This synthesis examines how citizen science and CGD contribute to SDG monitoring and official reporting, institutional readiness, policy- and decision-making, and transformative action. A structured qualitative evidence synthesis informed by Preferred Reporting Items for Systematic Review and Meta-Analyses (PRISMA)-style screening analysed 50 peer-reviewed studies, institutional reports, policy documents, and National Statistical Office (NSO) frameworks.

The synthesis identifies four interconnected forms of contribution: monitoring and official reporting, institutional readiness and uptake, policy- and decision-making, and transformative action. Formal reporting integration was limited, with Ghana providing the clearest documented case of CGD entering national and international SDG reporting. Kenya progressed from institutional readiness to operational uptake through validation of named datasets, while Uganda showed institutional readiness and documented CGD use in gender-statistics practice. Policy contributions occurred mainly through local governance, advocacy, and priority-setting; transformative contributions included awareness, capacity-building, participation, and community mobilisation.

The findings demonstrate that these contributions do not follow a single linear progression. Instead, they occur through potentially intersecting institutional-statistical and participatory-transformative pathways. Institutional readiness should therefore not be equated with operational uptake, nor institutional recognition with transformation. The study provides a differentiated framework for assessing realised citizen science contribution while keeping claims of impact proportional to the available evidence.

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INTRODUCTION

The 2030 Agenda for Sustainable Development established 17 Sustainable Development Goals (SDGs) and 169 targets, supported by a global indicator framework for monitoring progress (UN 2015). Achieving these goals depends on timely, reliable, disaggregated, and locally relevant evidence for identifying inequalities and informing decision-making. Yet the breadth of the framework places considerable demands on national statistical systems, particularly in low- and middle-income countries where capacities for regular and spatially detailed data production remain constrained (MacFeely and Nastav 2019; Fraisl et al. 2020).

Across many African countries, limitations in the frequency, completeness, spatial coverage, and disaggregation of conventional data sources constrain SDG monitoring. Informal settlements, remote rural communities, and other underserved populations may remain poorly represented, although official statistics remain indispensable (Fritz et al. 2019; Fraisl et al. 2020). These limitations also raise questions about whose knowledge is represented and how local perspectives enter monitoring and decision-making (Mpakairi et al. 2025).

Within this evidence landscape, citizen science and citizen-generated data (CGD) offer complementary approaches to sustainable-development monitoring. Citizen science can extend beyond volunteer data collection to involve communities in problem identification, research design, data collection, validation, interpretation, communication, and mobilisation of evidence for action (Shirk et al. 2012). It can therefore generate locally grounded evidence while connecting communities, researchers, civil society, and public institutions.

Citizen science remains emerging and unevenly developed across Africa, but reviewed initiatives show distinct forms of contribution. In Ghana, citizen-generated marine plastic data entered official SDG 14.1.1b reporting (Fraisl et al. 2023); in Kenya, quality-assurance procedures were applied to named civil-society datasets, and two were validated as fit for official reporting (Omache and Kinyanjui 2023). Other cases include participatory urban planning in Luanda and Maputo (Croese, Dominique, and Raimundo 2021), air-quality monitoring and policy engagement in Nairobi (West et al. 2020), and cardiovascular-disease advocacy across Ethiopia, Malawi, Rwanda, and South Africa (Okop et al. 2023). These are reviewed cases, not evidence of uniform continental uptake.

This paper therefore adopts a participatory knowledge-to-action pathway as its conceptual lens. The pathway begins before data generation with problem identification and programme design: who defines priorities, who participates, how participants are recruited and trained, what protocols and technologies are used, and whether intended evidence users are engaged. These choices influence participation, relevance, credibility, and usability (Shirk et al. 2012). Mandeville (2025) identifies research flexibility as an important capacity of citizen science, allowing methods, participation, and priorities to respond to changing knowledge and decision-making needs.

The pathway then moves through data generation, quality assurance and validation, analysis and interpretation, communication, institutional recognition, and potential application in SDG reporting, policy, planning, advocacy, or service delivery. These processes are not necessarily linear, and knowledge production does not itself guarantee policy or societal effects (Pärli et al. 2022). Danielsen et al. (2024) similarly demonstrate that citizens and local communities can contribute substantially to biodiversity monitoring, while some indicators continue to require professional scientists and governmental statistical organisations. Citizen science should therefore complement rather than substitute official monitoring systems.

Importantly, generating citizen-derived evidence does not in itself demonstrate institutional adoption, policy influence, or transformative change. Movement from participation and data generation to realised contribution depends on interacting conditions including data credibility, institutional trust, alignment with decision-making needs, sustained partnerships, and meaningful opportunities for citizens to participate beyond data collection. Citizen science is therefore not inherently transformative; its contribution depends on the relationships through which knowledge is produced, validated, interpreted, communicated, and acted upon.

Despite growing scholarship on citizen science's potential contribution to the SDGs, less is known about how those contributions are realised in African contexts. SDG relevance does not necessarily establish institutional recognition, official reporting, policy influence, or transformative outcomes. This synthesis therefore examines four distinct but potentially intersecting forms of contribution: monitoring and official reporting, institutional readiness and uptake, policy and decision-making, and transformative action. It adopts a relational perspective to identify what contributions are documented, how they are realised, and the conditions shaping institutional, governance and community-level outcomes.

Specifically, the synthesis addresses three research questions:

RQ1. What forms of contribution do citizen science and citizen-generated data make to SDG monitoring and official reporting, institutional readiness and uptake, policy and decision-making, and transformative action in African contexts?

RQ2. What institutional, governance, and participatory conditions shape the translation of citizen-generated evidence into these contributions?
RQ3. How do institutional-statistical and participatory-transformative pathways intersect or diverge across the reviewed African cases?

LITERATURE REVIEW

CITIZEN SCIENCE AND SUSTAINABLE DEVELOPMENT GOAL MONITORING

The SDG framework requires timely, spatially disaggregated and contextually relevant evidence, placing substantial demands on national statistical systems. Citizen science and citizen-generated data (CGD) have therefore gained recognition as complementary evidence sources, particularly where conventional systems have limited spatial coverage, temporal frequency, or local disaggregation (MacFeely and Nastav 2019).

Existing scholarship establishes citizen science's potential to support SDG monitoring (Fritz et al. 2019; Fraisl et al. 2020). International work also shows applications in biodiversity and conservation monitoring (Danielsen et al. 2024; Mandeville 2025). Across African cases, applications span environmental monitoring, water and sanitation, public health, and urban sustainability, although the field remains unevenly developed.

Potential contribution, however, is not demonstrated operational use. SDG-relevant information may never be validated, institutionally recognised, incorporated into official reporting, or used in governance. The key question is therefore not only whether citizen science can contribute, but how citizen-generated evidence becomes operationally relevant.

Different evidentiary claims must consequently be distinguished: Locally useful information is not equivalent to evidence assessed by an NSO, incorporated into official reporting or used in a governance decision. Claims of contribution must therefore be matched to the evidence supporting them.

CITIZEN-GENERATED DATA, OFFICIAL STATISTICS, AND INSTITUTIONAL UPTAKE

Citizen-generated data complement rather than replace censuses, surveys, administrative records, and other official statistics. Transition into official use requires mechanisms for identification, assessment, validation, and integration, alongside methodological consistency, reliability, data governance, and institutional familiarity (Cázarez-Grageda et al. 2020; Proden, Fraisl, and See 2023).

African statistical institutions have begun developing such mechanisms. Kenya's Statistical Quality Assurance Framework (KeSQAF) establishes procedures through which statistics produced outside the National Statistical System may be assessed for potential official or complementary use (KNBS 2022). Uganda's Citizen-Generated Data Toolkit similarly establishes governance and quality-assurance procedures for mainstreaming CGD into the National Statistical System (UBOS 2021).

Institutional readiness can progress into operational uptake. In Kenya, quality criteria for CGD were applied to civil-society datasets; a Twaweza education dataset passed the criteria and was released by the Kenya National Bureau of Statistics as official data in 2022 (PARIS21 2023). This distinguishes readiness, which creates conditions for use, from operational uptake, where a specific dataset completes assessment and official use. Uganda's CGD Toolkit documents governance preparedness without equivalent evidence of a specific dataset completing this pathway into official use.

CITIZEN SCIENCE, PARTICIPATORY GOVERNANCE, AND TRANSFORMATIVE ACTION

Citizen science can function both as data production and as participation through which citizens define problems, generate and interpret knowledge, and engage governance institutions. Shirk et al. (2012) distinguish contributory, collaborative, co-created and collegial models, while Lorenz and Lepenies (2023) emphasise justice, epistemic inclusion, and influence in knowledge production.

A relational perspective helps explain how CGD acquire influence: credibility and use are mediated through relationships among citizens, researchers, civil society, statistical institutions, and decision makers, including processes of validation, trust, interpretation, advocacy, and recognition.

Two interconnected pathways are therefore relevant. An institutional-statistical pathway concerns validation, recognition and possible incorporation of CGD into monitoring, reporting or decision-making; a participatory-transformative pathway concerns interpretation, advocacy, accountability, mobilization, and engagement. They may intersect but need not occur sequentially.

Institutional recognition, policy influence, and community transformation are related but distinct. Conflating them risks overstating impact and overlooking meaningful influence outside formal statistical systems.

FROM POTENTIAL CONTRIBUTION TO REALISED CONTRIBUTION: THE ANALYTICAL GAP

Previous scholarship establishes citizen science's SDG potential and identifies conditions affecting CGD use (Fritz

et al. 2019; Fraisl et al. 2020; Cázarez-Grageda et al. 2020; Proden et al. 2023). Less clearly differentiated is the evidence for relevance, institutional preparedness, operational integration, policy influence, and transformative effects.

This synthesis addresses that gap using a comparative qualitative framework-synthesis approach. It examines monitoring and official reporting, institutional readiness, policy- and decision-making, and transformative contribution as analytically distinct but potentially intersecting domains, without assuming a linear hierarchy.

METHODS

SYNTHESIS DESIGN, SEARCH STRATEGY, AND SCOPE

This study used a structured qualitative evidence synthesis with a framework-synthesis design to examine how citizen science and CGD contribute to SDG monitoring, institutional integration, policy- and decision-making, and transformative action in African contexts. Evidence identification and screening were informed by PRISMA 2020 reporting principles (Page et al. 2021), and the analytical objective was qualitative comparison rather than statistical meta-analysis. RQ1 defined the four analytical domains; RQ2 and RQ3 guided comparison of enabling conditions and relationships between pathways. Inductive within-domain comparison refined subthemes and evidentiary distinctions.

Electronic searches were conducted between February and April 2026 using Google Scholar, PubMed, and Semantic Scholar. Targeted searches also covered PARIS21, *Citizen Science: Theory and Practice*, the Citizen Science Global Partnership, KNBS, UBOS, Ghana Statistical Service, other institutional and National Statistical Office (NSO) sources, and backward/forward citation searching. Scopus, Web of Science, and EBSCO were not searched. The strategy combined academic discovery with institutional and grey-literature routes important to official statistics, validation, and policy uptake; omission of those databases is therefore reported as a limitation rather than evidence of exhaustive coverage.

The synthesis covered English-language material published from 1 January 2015 to 30 April 2026. The recorded search items combined citizen science, citizen-generated data, community-based and participatory monitoring, SDGs, official statistics, governance, validation, policy uptake, decision-making, empowerment, transformative action, and African contexts. The exact recorded search items, information sources, dates, restrictions, and retained historic yields are reported in Supplementary File 1: Table S1. Individual query yields and complete platform histories were not retained and are reported as not recorded (NR) rather than retrospectively inferred.

A formal quantitative relative-recall or search-string sensitivity estimate could not be calculated validly because the historic query-level result sets needed to define the denominator were not retained. During revision, we conducted a source-level verification and robustness audit rather than fabricating retrospective sensitivity statistics. Candidate documents were mapped to the recorded search items, targeted institutional routes, or citation-tracing routes, and borderline records were re-assessed against the locked eligibility rules. This audit is reported in Supplementary File 1: Tables S1, S5, and S6 and is explicitly not presented as a substitute for formal relative-recall analysis.

SCREENING AND ELIGIBILITY CRITERIA

The retained archival review-flow record shows 137 records identified across academic, institutional, grey-literature, and citation-searching routes. Thirty duplicates were removed, leaving 107 records for title/abstract screening; 54 full texts were assessed and 50 documents were included in the historical qualitative synthesis. The four-box archival flow is shown in Figure 1, while the underlying search routes and historic yields are reported in Supplementary File 1: Table S1.

Sources were eligible if they: (1) fell within the publication period; (2) focused on African countries or contained separately extractable African evidence; (3) examined citizen science, citizen-generated data, community-based monitoring, participatory mapping, or another participatory evidence–production approach; and (4) addressed at least one analytical domain: SDG monitoring/reporting, institutional readiness or uptake, governance/policy or decision-making, or transformative action. Projects not labelled explicitly as "citizen science" were eligible when their documented practices met these participatory evidence–production criteria.

Empirical studies were required to demonstrate active citizen or community participation in data generation, monitoring, interpretation, knowledge production, or evidence mobilisation. Institutional and policy documents were eligible when they documented validation, governance, institutionalisation, official reporting, statistical integration, or application of citizen-generated evidence. Framework, methodological, and synthesis sources were retained only when they were directly necessary to interpret the African cases and were not treated as independent evidence of realised African uptake unless they contained case-level evidence.

Records were excluded for absence of a citizen-science/CGD or participatory evidence component; absence

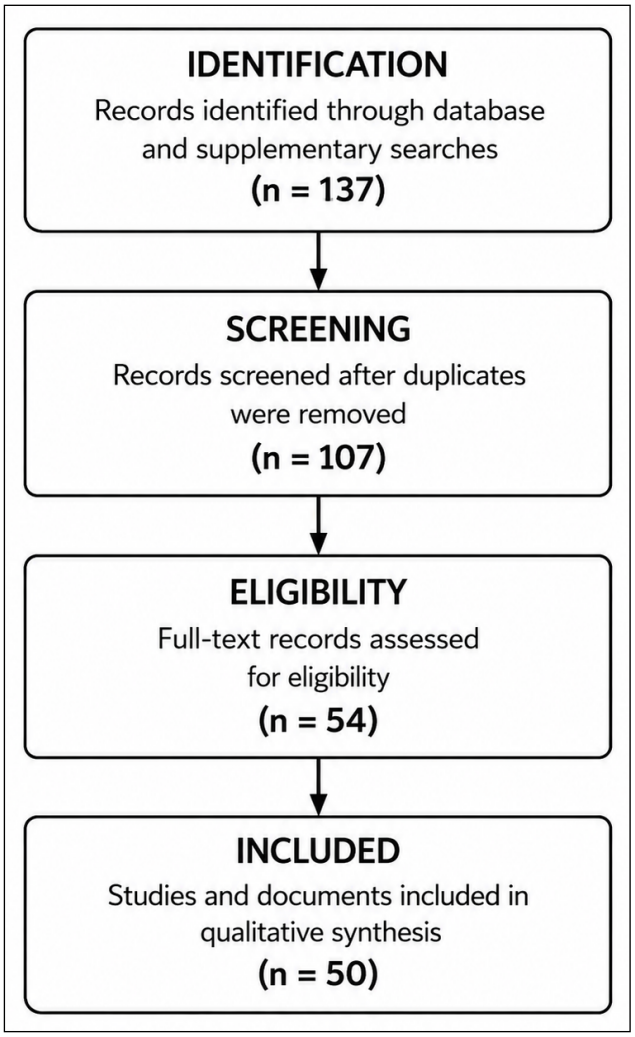

Figure 1 PRISMA-style flow diagram for study identification and selection.

Note: This structured qualitative evidence synthesis (not a meta-analysis) was informed by screening procedures adapted from the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) Framework.

of African evidence; no relevance to SDG monitoring, governance, policy, or decision-making; purely technical research without meaningful citizen participation; publication before 2015; duplicate reporting without additional evidentiary value; unavailable full text; ineligible publication type; or non-English full text.

Only English-language material was included because the team lacked the linguistic capacity to screen and critically interpret evidence consistently across multiple languages. This restriction may underrepresent Francophone, Lusophone, Arabic-speaking, and other African contexts. Evidence-synthesis research shows that excluding non-English literature can alter geographical coverage and conclusions (Konno et al. 2020; Amano et al. 2021; Chowdhury et al. 2022); the restriction is therefore treated as a substantive limitation rather than as an assumption of lower relevance.

The historical review documentation does not substantiate duplicate independent screening. We therefore report a single-screening workflow and do not calculate an inter-rater agreement statistic. Uncertain records were retained for fuller examination rather than excluded on limited information, and final eligibility decisions were made against the stated criteria. The same non-duplicated workflow applied to extraction and coding, and this is acknowledged as a limitation.

SOURCE-LEVEL VERIFICATION DURING REVISION

Because the original database-specific final-inclusion export and source-by-source coding file were not retained, the revision did not claim to reconstruct the historical 50 records one-for-one. Instead, a source-level verification audit was conducted in August 2026 using retained full texts, the pre-review reference list, recovered institutional and grey-literature documents, official source pages, and backward/forward citation tracing. The historical publication cutoff of 30 April 2026 and the locked eligibility rules were preserved.

Sixty-five candidate records were reassessed. Fifty records met the eligibility and evidentiary rules and were retained as the revised analytic corpus; 15 were excluded or retained only as contextual literature. Every retained record, verification basis, source URL, participation classification, pathway coding, key outcome, and evidentiary boundary is reported in Supplementary File 1: Table S2. The complete verification screening log is provided in Supplementary File 1: Table S5 and excluded/contextual records with reasons are listed in Supplementary File 1: Table S6. The source-level audit improves transparency and reproducibility but is not presented as a recreation of the original Google Scholar, PubMed, or Semantic Scholar result sets.

EVIDENCE APPRAISAL, OPERATIONAL DEFINITIONS, AND PARTICIPATION CODING

Because the corpus combines peer-reviewed research, NSO frameworks, government and intergovernmental documents, policy material, and programme grey literature, no single numerical risk-of-bias instrument was appropriate. Sources were appraised for provenance/authority, methodological transparency, directness for the claim, and traceability or corroboration. Peer-reviewed studies were prioritised for empirical and participatory outcomes; NSO/government documents for formal frameworks, validation, official release, and reporting; and programme/NGO sources for process, advocacy, and

engagement, but not alone for national policy adoption unless directly documented.

Operational coding distinguished potential relevance, monitoring supplementation, formal reporting, institutional readiness, operational uptake, policy/decision-making contribution and transformative contribution. Potential relevance indicated plausible SDG use without documented uptake; monitoring supplementation required documented augmentation of monitoring; and formal reporting required a named official reporting output, Voluntary National Review (VNR), indicator process, or dataset. Readiness required a framework, toolkit or governance arrangement, while operational uptake required a specific evidence product to complete validation, recognition, official release, or comparable institutional anchoring. Policy/decision-making contribution required documented use in planning, budgeting, deliberation, recommendations, advocacy, or governance. Transformative contribution required reported changes in awareness, capacity, agency, participation, mobilisation, relationships, or community action; causal effects were not inferred beyond source evidence.

Grey-literature claims were coded at the strongest level directly supported by the source. Where a dataset was referenced indirectly, a higher-level claim was accepted only when the responsible institution, dataset, or process could be traced. For example, the UBOS CGD Toolkit was coded as institutional readiness because it establishes governance and quality-assurance procedures; the Kenyan Usawa/Twaweza validation family was coded as operational uptake because named datasets were assessed and validated for official reporting; and Zambia's water-quality case was coded as monitoring supplementation because it expanded monitoring evidence without equivalent documented incorporation into formal SDG reporting.

Participation was coded using Shirk et al.'s (2012) typology where descriptions permitted: contributory for primarily data collection/submission; collaborative for additional roles in validation, interpretation or communication within a largely institution-led design; co-created for substantive citizen roles in problem definition, design, interpretation, or mobilisation; and collegial for independently led public investigations with professional support. Institutional frameworks without a discrete participatory project were not applicable. No case could be confidently classified as collegial. Full classifications and definitions are in Supplementary File 1: Tables S2 and S3.

EVIDENCE FAMILIES AND FRAMEWORK SYNTHESIS

A final independence audit was conducted to avoid pseudo-replication. The 50 source records correspond to 39 evidence families: 20 empirical/programme/institutional case families and 19 cross-cutting framework or synthesis families. Four empirical families contain multiple documents that describe the same underlying process and are therefore synthesised jointly rather than counted as independent replications: Kenya official CGD/statistical integration (8 documents), Uganda official/gender-CGD integration (3 documents), the Angola-Mozambique SDG 11/VNR pathway (2 documents), and the Southern African Development Community (SADC) gender-accountability/citizen-scorecard pathway (2 documents). The family mapping and synthesis rules are reported in Supplementary File 1: Table S4.

The four a priori domains provided the deductive structure for synthesis, while inductive within-domain comparison refined distinctions between potential and operational use, readiness and completed uptake, governance influence and formal policy adoption, statistical integration and transformative participation, and participation model and institutional pathway. To operationalise the three research questions consistently across sources, coding used five analytical prompts: (1) which SDG areas are addressed; (2) whether evidence demonstrates potential or concrete use; (3) which institutions are involved in validation or uptake; (4) which pathways connect citizen-generated evidence to decision-making; and (5) what forms of transformative action are documented.

RESULTS

The revised analytic corpus contains 50 source records grouped into 39 evidence families. Twenty families are empirical, programme, or institutional case families, and 19 are framework or synthesis families. The empirical families cover 12 named African countries: Angola, Ethiopia, Ghana, Kenya, Malawi, Mozambique, Nigeria, Rwanda, Somalia, South Africa, Uganda, and Zambia, plus regional SADC evidence. Coverage remains uneven, with particularly dense institutional documentation for Kenya, Ghana, and Uganda; therefore, results describe patterns in the reviewed evidence rather than continent-wide prevalence.

MONITORING AND OFFICIAL REPORTING

The strongest direct reporting pathway was identified in Ghana. Citizen-generated marine plastic litter data contributed to monitoring SDG indicator 14.1.1b and entered national and international SDG reporting, providing the clearest evidence in the corpus of CGD moving from community data generation into formal reporting (Fraisl et al. 2023).

A second reporting pathway is visible in Angola and Mozambique. Croese, Dominique, and Raimundo (2021)

describe co-produced urban data on SDG 11 indicators in Luanda and Maputo that were used to inform participatory urban planning and SDG localisation; in Mozambique, the project findings were linked to the country's 2020 VNR process. This evidence family was treated as one case, with the peer-reviewed study providing the causal/process account, and the VNR serving as a policy/reporting endpoint rather than as an independent replication.

Kenya provides evidence of official statistical validation rather than an identical reporting pathway. Across the Kenya institutional family, KNBS and partners developed quality criteria for CGD, evaluated eight citizen-generated datasets, and validated two as fit for official reporting (Omache and Kinyanjui 2023). This is stronger evidence than general monitoring relevance because named datasets completed a formal validation process.

Other cases remained at different levels. Zambia's citizen science water quality monitoring expanded spatial and temporal evidence relevant to SDG 6.3.2 but did not show equivalent incorporation into formal national or UN reporting (Bishop et al. 2020). The SADC Gender Protocol Barometer combined regional indicator monitoring with a citizen scorecard to support accountability on gender commitments (Gender Links, Glenwright, and Makamure, 2018), illustrating regional monitoring and accountability without being treated as equivalent to national SDG-indicator reporting.

Thus, the monitoring evidence differentiates at least four outcomes: formal reporting, validated official-use pathways, operational monitoring supplementation, and accountability-oriented regional monitoring. Treating these as a single category of "SDG contribution" would overstate equivalence across the cases.

INSTITUTIONAL READINESS, OPERATIONAL UPTAKE, AND STATISTICAL INTEGRATION

The Kenya official-CGD family provides the clearest evidence of progression from readiness to operational uptake. KeSQAF established the quality-assurance architecture for assessing statistics produced outside the National Statistical System (KNBS 2022). Subsequent collaboration involving KNBS, civil-society organisations, the SDGs Kenya Forum, and development partners applied those criteria to named CGD datasets; eight datasets were evaluated and two were validated as fit for official reporting (Omache and Kinyanjui 2023). The Kenya family is therefore coded as both institutional readiness and operational uptake, but its eight documents are treated as one evidence family rather than eight independent cases.

Uganda represents a related but distinct institutional pathway. The Uganda Bureau of Statistics (UBOS) Citizen-Generated Data Toolkit establishes formal governance and quality-assurance procedures for mainstreaming CGD into the National Statistical System (UBOS 2021). Later, UN Women briefs document the use of citizen-generated data by Uganda's statistical system to address gender-data gaps and support demand for more timely and disaggregated evidence (UN Women 2024a,b). This supports a stronger interpretation than readiness alone, while still falling short of claiming that every citizen-generated dataset has become an official statistic.

The comparison confirms that readiness, operational uptake, and institutionalisation should remain separate concepts. Readiness concerns whether procedures and governance arrangements exist; operational uptake concerns whether a particular dataset or evidence product passes through those arrangements; institutionalisation concerns whether these practices become structurally anchored and routine. The reviewed documentation shows movement among these states, but not an automatic progression.

POLICY- AND DECISION-MAKING CONTRIBUTION

Policy and governance contribution was more commonly documented through deliberation, advocacy, service accountability, and planning than through formal national policy adoption. In Lanet Umoja, Kenya, the DataShift initiative linked citizen-generated gender evidence to community priority setting and advocacy around the Nakuru County budget process (DataShift 2017). The documented process is most consistent with co-created participation because citizens were involved in identifying priorities, generating evidence, and mobilising findings toward a governance process.

The Kenya-Uganda Development Initiatives case-study report provides additional evidence that CGD can enter accountability and service-delivery processes. The Kenyan School Report Card initiative sought to strengthen parent engagement and use local evidence in education accountability, while Ugandan community resource trackers used locally generated information to monitor services and resource flows (Development Initiatives and Development Research and Training 2017). These cases demonstrate governance use without requiring a claim of national legislative change.

In Nairobi, co-created air-quality monitoring in an informal settlement combined personal exposure data, community learning, and workshops with local and national policymakers; the process contributed to the formation of the Kenya Air Quality Network as a knowledge-exchange platform (West et al. 2020). In Kenya's antimicrobial-resistance project, interactive radio, short message service (SMS), and listening groups generated citizen evidence that was translated into recommendations for citizens,

health workers, and policymakers (Global Partnership for Sustainable Development Data and Africa's Voices Foundation 2021). In Angola and Mozambique, co-produced urban evidence was explicitly oriented toward participatory planning and SDG 11 localisation (Croese, Dominique, and Raimundo 2021).

Across these cases, the recurring outcome is not formal policy adoption but a set of intermediate governance effects: agenda visibility, dialogue, recommendations, priority setting, accountability, planning, and institutional relationships. The results therefore code "policy contribution" at the level directly demonstrated rather than treating engagement as synonymous with formal policy change.

TRANSFORMATIVE AND COMMUNITY-LEVEL CONTRIBUTION

Transformative contribution was documented primarily through changes in knowledge, capacity, agency, participation, mobilisation, and relationships rather than through formal statistical integration. In Somalia, interactive radio, SMS, and group engagement generated evidence on women's access to sexual and reproductive health services, and informed awareness activities and programme recommendations (Africa's Voices Foundation et al. 2024). The documented roles are most consistent with collaborative participation.

In Ethiopia's Upper Blue Nile Basin, participation in environmental monitoring strengthened local knowledge and capacity for continued observation (Rigler et al. 2022). The multi-country cardiovascular initiative across Ethiopia, Malawi, Rwanda, and South Africa involved citizen scientists in co-design, interpretation, and stakeholder advocacy, with reported outcomes including advocacy capacity, local agency, and awareness of cardiovascular health risks (Okop et al. 2023); this case is most consistent with co-created participation.

Transformative effects were also documented in urban environmental cases. West et al. (2020) report community learning, policy dialogue, and network formation around air pollution in Nairobi, while UrbanBetter's Cityzens for Clean Air initiative linked youth-generated air quality evidence in Accra, Lagos, and Cape Town to advocacy calls and engagement with decision-makers (UrbanBetter 2023). These cases illustrate how participatory knowledge production can generate governance relationships and civic capacity even when the evidence does not enter formal statistical systems.

COMPARATIVE SYNTHESIS

Five comparative findings emerge. First, direct formal reporting is documented but uncommon; Ghana's marine plastics pathway remains the clearest case. Second, institutional readiness and operational uptake are empirically distinguishable, with Kenya showing a completed validation pathway and Uganda showing institutional structures plus documented use of citizen data in gender-statistics practice. Third, policy contribution is most often visible through planning, accountability, dialogue, and advocacy rather than formal national policy adoption. Fourth, transformative outcomes can occur without statistical integration. Fifth, the degree of citizen participation varies independently of the degree of institutional formalisation.

The evidence also reveals an apparent asymmetry. The most strongly institutionalised families—especially Ghana's reporting pathway and the Kenya and Uganda statistical-system families—are documented mainly through reporting, validation, and governance artefacts. Cases with stronger transformative outcomes are documented mainly through participatory programme studies that foreground agency, capacity, and mobilisation. This pattern should not be interpreted as proof that institutional uptake and transformation are inherently incompatible; it may reflect both institutional design and differences in what official versus participatory sources document.

No reviewed case could be classified confidently as collegial under Shirk et al.'s (2012) typology. The complete 50-source coding matrix, including participation model and evidentiary boundaries, is provided in Supplementary File 1: Table S2; the 39 evidence families and double-counting rules are reported in Supplementary File 1: Table S4.

DISCUSSION

The main contribution of this synthesis is a more disciplined account of what "actual contribution" means in the reviewed African evidence. Citizen science initiatives and citizen-generated data contribute through different forms of monitoring, institutional, governance, and transformative influence, but these outcomes are not equivalent and should not be presented as stages in a universal sequence.

FROM POTENTIAL CONTRIBUTION TO EVIDENTIARY DIFFERENTIATION

Earlier work demonstrated substantial technical potential for citizen science to support SDG indicators (Fritz et al. 2019; Fraisl et al. 2020). The verified African corpus shows why potential must be separated from demonstrated use: SDG-relevant evidence may never enter an institutional process; an NSO framework does not prove validation of a dataset; and local governance influence does not necessarily produce a formal policy instrument. Relevance, monitoring

use, formal reporting, readiness, operational uptake, governance influence, and transformative outcomes are therefore distinct claims requiring distinct evidence.

This distinction also addresses the risk of overstated continental conclusions. The revised corpus contains empirical/programme/institutional evidence across 12 named African countries plus regional SADC material, but documentation remains concentrated in a limited number of institutional ecosystems. The findings are therefore about the configurations observed in reviewed African cases, not estimates of how common each pathway is across the continent.

INSTITUTIONAL UPTAKE IS A GOVERNANCE PROCESS, NOT A TECHNICAL ENDPOINT

The Kenya and Uganda families show that institutional uptake is mediated by governance. Data quality matters, but so do the authority to define quality, the organisational relationships that permit evidence to be assessed, and the institutional incentives to use non-state data. Kenya's progression from practical guidance and quality criteria to the validation of named datasets illustrates that operational uptake requires both technical standards and institutional trust. Uganda's toolkit and subsequent gender-data practice show a parallel process in which governance structures and data demand create space for citizen-generated evidence.

This helps clarify the difference between readiness, operational uptake, and institutionalisation. Readiness is a prepared state; operational uptake is a documented event in which an evidence product enters a formal process; institutionalisation is the more durable structural anchoring of such practices. None should be assumed merely from the existence of another. The distinction responds to a broader official-statistics literature in which alternative data become usable only when procedures for quality, provenance, and responsibility are established (Cázarez-Grageda et al. 2020; Proden et al. 2023).

INSTITUTIONALISATION IS NOT INHERENTLY TRANSFORMATIVE

The strongest critical implication of the synthesis is that institutionalisation and transformation are analytically independent. Formal recognition can increase the legitimacy, durability, and visibility of CGD while leaving the distribution of epistemic authority unchanged. Conversely, participatory projects can strengthen agency, knowledge, advocacy, and accountability without ever entering an official statistical system.

This distinction is consistent with Shirk et al.'s (2012) differentiation of participation models and with critical citizen science scholarship on justice, decoloniality, and epistemic inclusion (Lorenz and Lepenies 2023; Mpakairi et al. 2025). The key question is, therefore, not simply whether institutions accept community-generated evidence, but whether communities retain meaningful influence over problem definition, data governance, interpretation, reuse, and benefit after the evidence enters formal systems. Institutionalisation can reproduce hierarchical or extractive relations when citizens remain data providers only; more transformative arrangements require continuing roles in agenda-setting, interpretation, communication, and decision-making.

The evidence-family comparison suggests two reasons for the apparent trade-off between formal uptake and transformative outcomes. First, institutional designs optimised for standardisation and comparability may narrow the range of participatory roles that can be accommodated. Second, there is a documentation asymmetry: Official sources foreground validation, reporting status, and administrative use; whereas participatory studies foreground agency, learning, and mobilisation. The observed pattern should therefore be interpreted as a tension to be managed and studied, not as a deterministic incompatibility.

INTERCONNECTED INSTITUTIONAL-STATISTICAL AND PARTICIPATORY-TRANSFORMATIVE PATHWAYS

The evidence is best represented as two intersecting pathways rather than a linear progression. The institutional-statistical pathway links participation and evidence generation to quality assurance, validation, institutional recognition, and possible monitoring/reporting or official data use. The participatory-transformative pathway links co-production to interpretation, communication, advocacy, mobilisation, and community or governance outcomes. Initiatives may occupy one pathway, both pathways, or move between them over time (Figure 2).

Ghana's marine plastics evidence and the Kenya institutional family sit strongly on the institutional-statistical pathway. Somalia, the Upper Blue Nile, and the multi-country cardiovascular initiative sit more strongly on the participatory-transformative pathway. DataShift, Croese et al.'s Angola-Mozambique work, Nairobi air quality citizen science, and the Kenya AMR project demonstrate partial bridges because citizen-generated evidence was connected directly to planning, budgeting, policy dialogue, or advocacy. These bridging cases suggest that the two functions can coexist when institutions do not treat participation as ending at data submission.

Maintaining citizen science simultaneously as a knowledge system and a participatory governance mechanism requires at least five conditions: early co-

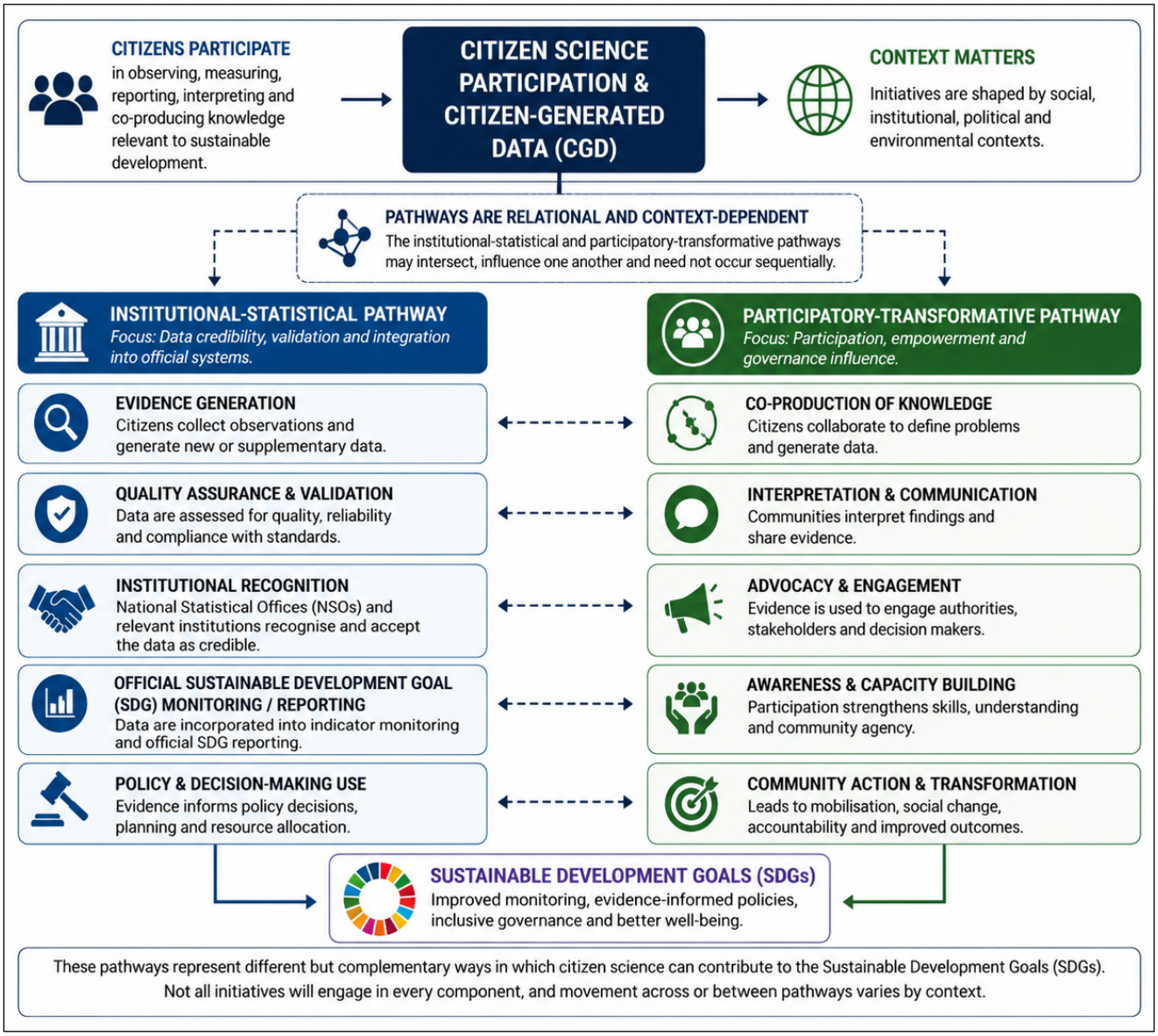

Figure 2 Interconnected institutional-statistical and participatory-transformative pathways of citizen science contribution to the Sustainable Development Goals (SDGs). The pathways are parallel and intersecting rather than a single linear progression.

definition of problems and intended uses; transparent and mutually understood quality/validation rules; community roles in interpretation and communication after data collection; reciprocal feedback and benefit when evidence is reused institutionally; and durable channels through which community priorities remain visible in decision-making. These conditions translate the paper's normative claim into an empirically grounded governance agenda.

IMPLICATIONS FOR CITIZEN-SCIENCE AND SUSTAINABLE DEVELOPMENT GOAL RESEARCH

Three implications follow. Reviews should distinguish evidentiary status rather than treat all SDG-relevant citizen science as uptake; separate source records from evidence families to avoid pseudo-replication; and code participation independently from institutional status. Future evaluations should likewise specify whether they demonstrate relevance, readiness, operational use, formal reporting, governance influence, or transformative outcomes.

The corpus also supports inclusion of community-based monitoring, participatory mapping, social-accountability data, and co-produced urban evidence where citizens actively generate or interpret evidence linked to monitoring or governance, even when initiatives do not use the citizen-science label.

LIMITATIONS AND FUTURE RESEARCH

Several limitations qualify the conclusions. First, this structured qualitative framework synthesis does not

estimate prevalence or effect size. Second, the corpus is geographically and institutionally uneven, so absence of documented uptake cannot be interpreted as evidence that uptake has not occurred. The findings therefore describe patterns within the reviewed corpus rather than continental prevalence.

Third, the corpus combines peer-reviewed studies, NSO frameworks, government and intergovernmental documents, policy material, and programme grey literature. Source-type appraisal and evidentiary boundaries reduce but do not eliminate heterogeneity. Fourth, screening, extraction, and coding were not independently duplicated and no inter-rater agreement statistic was calculated. Fifth, English-language restriction may have excluded relevant Francophone, Lusophone, Arabic-speaking, and other African evidence. Sixth, Scopus, Web of Science, and EBSCO were not searched.

Seventh, a formal relative-recall assessment of the historical search strings could not be reconstructed because the query-level result histories were not retained. The revision-stage source-level verification audit improves traceability by documenting 65 candidate records, 50 retained records, 15 exclusions, retrieval routes, coding, and evidentiary boundaries, but it is not equivalent to a sensitivity estimate for the original searches. Eighth, the revised 50-record analytic corpus is fully traceable but is not claimed to be a one-for-one reconstruction of the historical 50 because the original database-specific final-inclusion mapping was not preserved.

Future updates should archive complete database exports and query histories, conduct duplicate screening and coding, include multilingual searching and broader bibliographic indexing, assess search-string sensitivity prospectively, and follow individual CGD initiatives longitudinally from data generation through validation, institutional use, policy processes, and community outcomes. Particular attention is needed to low-uptake and failed initiatives and to how data sovereignty, ownership, and epistemic authority change when community-generated evidence enters formal systems.

CONCLUSION

This synthesis examines how citizen science and citizen-generated data contribute to SDG monitoring, institutional processes, policy- and decision-making, and transformative action in reviewed African contexts. The revised corpus supports comparison across formal reporting, institutional readiness and uptake, participatory governance, and community-level outcomes.

The evidence supports a bounded conclusion: citizen science initiatives and citizen-generated evidence contribute through distinct forms of influence that must be described at the evidentiary level demonstrated. Ghana provides the clearest example of CGD entering formal SDG reporting; Kenya shows movement from quality-assurance infrastructure to validation of named datasets; and Uganda shows institutional structures and documented use of citizen data in gender-statistics practice. Other cases demonstrate monitoring supplementation, participatory planning, accountability, advocacy, learning, mobilisation, and capacity-building without equivalent formal statistical integration.

The findings reject a single linear pathway from participation to institutionalisation to transformation. Institutional-statistical and participatory-transformative pathways may intersect, but neither requires the other. Readiness is not uptake, institutionalisation is not inherently transformative, and community-level transformation does not depend on entry into official statistical systems.

The paper's contribution is comparative-relational rather than continentally generalising. It distinguishes relevance, readiness, uptake, governance influence, and transformation, matching claims of contribution to the evidence available.

DATA AVAILABILITY AND SUPPLEMENTARY MATERIALS

No primary participant dataset was generated for this synthesis. The data underlying the revised analysis are the source records and coding decisions. These are provided in the accompanying workbook Supplementary_Materials_S1-S6_Verified_Corpus.xlsx: Table S1 reports the recorded search strategy, dates, information sources, historic yields and verification procedure; Table S2 lists all 50 retained source records and source-level coding; Table S3 provides the operational codebook; Table S4 reports the 39 evidence families and double-counting rules; Table S5 provides the 65-record verification screening log; and Table S6 lists 15 excluded/contextual candidates with reasons. Historic database-specific query result sets that were not retained are not retrospectively reconstructed.

SUPPLEMENTARY FILE

The supplementary file for this article can be found as follows:

- **Supplementary File 1.** Tables S1–S6. DOI: https://doi.org/10.5334/cstp.1055.s1

ETHICS AND CONSENT

This study is based entirely on secondary literature and documentary analysis.

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COMPETING INTERESTS

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AUTHOR CONTRIBUTIONS

Kehinde Baruwa (KB) contributed to the conceptualisation of the study, literature scoping and review, thematic analysis, and manuscript drafting.

Oluwatimilehin Adenike Shonowo (OAS) contributed to the literature scoping and review, thematic analysis, and manuscript development.

Peter Elias (PE) provided intellectual guidance, coordinated the research process, and contributed to the critical review and refinement of the manuscript.

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REFERENCES

Africa's Voices Foundation, Kimeu, S., Ndegwa, D., Maina, M., Nzilani, M., Njung'e, M. and **Madegwa, J.** (2024) Utilizing citizen-generated data to enhance women's access to sexual and reproductive health services in Somalia: Insights, barriers, and pathways forward, *Journal of Health, Medicine and Nursing*, 10(4), pp. 66–80. DOI: https://doi.org/10.47604/jhmn.3021

Amano, T., Berdejo-Espinola, V., Christie, A.P., Willott, K., Akasaka, M., Baldi, A., Berthinussen, A., et al. (2021) Tapping into non-English-language science for the conservation of global biodiversity, *PLOS Biology*, 19(10), Article e3001296. DOI: https://doi.org/10.1371/journal.pbio.3001296

Bishop, I.J., Warner, S., van Noordwijk, T.C.G.E., Nyoni, F.C., and **Loiselle, S.** (2020) Citizen science monitoring for Sustainable Development Goal Indicator 6.3.2 in England and Zambia, *Sustainability*, 12(24), Article 10271. DOI: https://doi.org/10.3390/su122410271

Cázarez-Grageda, K., Schmidt, J., and **Ranjan, R.** (2020) Reusing citizen-generated data for official reporting: A quality framework for National Statistical Office-Civil Society Organisation engagement. PARIS21 Working Paper. Paris: PARIS21.

Chowdhury, S., Gonzalez, K., Aytekin, M.C.K., Baek, S.-Y., Belcik, M., Bertolino, S., Duijns, S., et al. (2022) Growth of non-English-language literature on biodiversity conservation, *Conservation Biology*, 36(4), Article e13883. DOI: https://doi.org/10.1111/cobi.13883

Croese, S., Dominique, M. and **Raimundo, I.M.** (2021) Co-producing urban knowledge in Angola and Mozambique: towards meeting SDG 11, *npj Urban Sustainability*, 1, Article 8. DOI: https://doi.org/10.1038/s42949-020-00006-6

Danielsen, F., Ali, N., Andrianandrasana, H.T., Baquero, A., Basilius, U., de Araujo Lima Constantino, P., Despot-Belmonte, K., et al. (2024) Involving citizens in monitoring the Kunming-Montreal Global Biodiversity Framework, *Nature Sustainability*, 7(12), pp. 1730–1739. https://doi.org/10.1038/s41893-024-01447-y

DataShift (2017) Using citizen-generated data to monitor the SDGs: A tool for the GPSDD Data Revolution Roadmaps Toolkit. DataShift/CIVICUS.

Development Initiatives and Development Research and Training (2017) Citizen-generated data and sustainable development: Evidence from case studies in Kenya and Uganda. Making All Voices Count research report.

Fraisl, D., Campbell, J., See, L., Wehn, U., Wardlaw, J., Gold, M., Moorthy, I., et al. (2020) Mapping citizen science contributions to the UN Sustainable Development Goals, *Sustainability Science*, 15, pp. 1735–1751. DOI: https://doi.org/10.1007/s11625-020-00833-7

Fraisl, D., See, L., Bowers, R., Seidu, O., Fredua, K.B., Bowser, A., Meloche, M., et al. (2023) The contributions of citizen science to SDG monitoring and reporting on marine plastics, *Sustainability Science*, 18, pp. 2629–2647. DOI: https://doi.org/10.1007/s11625-023-01402-4

Fritz, S., See, L., Carlson, T., Haklay, M., Oliver, J.L., Fraisl, D., Mondardini, R., et al. (2019) Citizen science and the United Nations Sustainable Development Goals, *Nature Sustainability*, 2, pp. 922–930. DOI: https://doi.org/10.1038/s41893-019-0390-3

Gender Links, Glenwright, D. and **Makamure, L.** (2018) SADC Gender Protocol Barometer 2018. Johannesburg: Gender Links.

Global Partnership for Sustainable Development Data and **Africa's Voices Foundation** (2021) People Power: Using citizen-generated data to address antimicrobial resistance in Kenya. Project report.

Kenya National Bureau of Statistics (KNBS) (2022) Kenya Statistical Quality Assurance Framework (KeSQAF). Nairobi: KNBS.

Konno, K., Akasaka, M., Koshida, C., Katayama, N., Osada, N., Spake, R. and **Amano, T.** (2020) Ignoring non-English-language studies may bias ecological meta-analyses, *Ecology and Evolution*, 10, pp. 6373–6384. DOI: https://doi.org/10.1002/ece3.6368

Lorenz, L. and **Lepenies, R.** (2023) Contributions of citizen science to the Sustainable Development Goals: Is transformative global citizen science possible?, *Citizen Science: Theory and Practice*, 8(1), Article 42. DOI: https://doi.org/10.5334/cstp.595

MacFeely, S. and **Nastav, B.** (2019) You say you want a [data] revolution: A proposal to use unofficial statistics for the SDG Global Indicator Framework, *Statistical Journal of the IAOS*, 35(3), pp. 309–327. DOI: https://doi.org/10.3233/SJI-180486

Mandeville, C.P. (2025) Citizen science offers untapped potential for conservation through research flexibility, *Conservation Letters*, 18(6), Article e70009. DOI: https://doi.org/10.1111/con4.70009

Mpakairi, K.S., Dalu, T., Kupika, O.L., Tagwireyi, P., Kavhu, B., Muvengwi, J., Muposhi, VK., et al. (2025) African voices and their role in improving north-south collaborations for biodiversity conservation, *Conservation Biology*, 39(4), Article e70032. DOI: https://doi.org/10.1111/cobi.70032

Okop, K.J., Kedir, K., Kasenda, S., Niyibizi, J.B., Chipeta, E., Getachew, H., Sell, K., et al. (2023) Multi-country collaborative citizen science projects to co-design cardiovascular disease prevention strategies and advocacy: Findings from Ethiopia, Malawi, Rwanda, and South Africa, *BMC Public Health*, 23, Article 2484. DOI: https://doi.org/10.1186/s12889-023-17393-x

Omache, S.B. and **Kinyanjui, J.** (2023) Collaborating to integrate citizen-generated data for official reporting on Sustainable Development Goals in Kenya, Global Partnership for Sustainable Development Data, 18 January. Available at: https://www.data4sdgs.org/collaborating-integrate-citizen-generated-data-official-reporting-sustainable-development-goals

Page, M.J., McKenzie, J.E., Bossuyt, P.M., Boutron, I., Hoffmann, T.C., Mulrow, C.D., Shamseer, L., et al. (2021) The PRISMA 2020 statement: An updated guideline for reporting systematic reviews, *BMJ*, 372, Article n71. DOI: https://doi.org/10.1136/bmj.n71

PARIS21 (2023) A Question of Quantity and Quality: How a participatory approach turned citizen-generated data into official statistics in Kenya, 6 April. Paris: PARIS21.

Pärli, R., Fischer, M., Späth, L. and **Lieberherr, E.** (2022) Transdisciplinary research for sustainable development-doing research about research, *GAIA – Ecological Perspectives for Science and Society*, 31(4), pp. 238–242. DOI: https://doi.org/10.14512/gaia.31.4.9

Proden, E., Fraisl, D. and **See, L.** (2023) Citizen science: What is in it for the official statistics community?, *Citizen Science: Theory and Practice*, 8(1), Article 35. DOI: https://doi.org/10.5334/cstp.584

Rigler, G., Dokou, Z., Khadim, F.K., Sinshaw, B.G., Eshete, D.G., Aseres, M., Amera, W., et al. (2022) Citizen science and the Sustainable Development Goals: Building social and technical capacity through data collection in the Upper Blue Nile Basin, Ethiopia, *Sustainability*, 14(6), Article 3647. DOI: https://doi.org/10.3390/su14063647

Shirk, J.L., Ballard, H.L., Wilderman, C.C., Phillips, T., Wiggins, A., Jordan, R., McCallie, E., et al. (2012) Public participation in scientific research: A framework for deliberate design, *Ecology and Society*, 17(2), Article 29. DOI: https://doi.org/10.5751/ES-04705-170229

Uganda Bureau of Statistics (UBOS) (2021) Citizen Generated Data Tool Kit. Kampala: UBOS.

UN Women (2024a) How Uganda is investing in citizen-generated data to improve the lives of women and girls. Brief. New York: UN Women Data Hub.

UN Women (2024b) Developments and achievements in the uptake and use of gender data: The case of Uganda. New York: UN Women Data Hub.

United Nations (2015) Transforming our world: The 2030 Agenda for Sustainable Development. United Nations General Assembly Resolution A/RES/70/1. New York: United Nations.

UrbanBetter (2023) Citizen science insights on air quality in three cities: Cityzens for Clean Air. Project report/campaign output.

West, S.E., Bueker, P., Ashmore, M., Njoroge, G., Welden, N., Muhoza, C., Osano, P., et al. (2020) Particulate matter pollution in an informal settlement in Nairobi: Using citizen science to make the invisible visible, *Applied Geography*, 114, Article 102133. DOI: https://doi.org/10.1016/j.apgeog.2019.102133

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