

Cross-Sectoral Synergy Measurement Framework for Multimodal NGOs in Public Health, Agriculture, and Education in Sub-Saharan Africa

[1,2]Oluremi Nurudeen Olaleye, [3]Ahmed Adebowale Adedeji, [4]Tunde Biya Olakunle, [2,5]Maryam Kofoworola Olaleye

Affiliations:
[1] Lagos State University of Science and Technology, Ikorodu, Lagos, Nigeria
[2] Safe-Revive Africa for Health and Education, Lagos, Nigeria
[3] University of Rwanda, Kigali, Rwanda
[4] Talkworld Foundation, Lagos, Nigeria
[5] Lagos State University, College of Medicine Ikeja, Nigeria
*Correspondence: olaleye.on@lasustech.edu.ng

ABSTRACT

Multimodal non-governmental organisations (NGOs) operating simultaneously across health, education, and agriculture represent an increasingly important vehicle for integrated development programming in Sub-Saharan Africa. However, these organisations face a persistent challenge: the absence of standardised metrics capable of capturing the complex cross-sectoral synergies that emerge when interventions in one domain interact with and amplify outcomes in another. This paper addresses this gap by proposing the Cross-Sectoral Synergy Measurement Framework (CSSMF), a three-tiered evaluation architecture comprising sector-specific indicators, cross-sectoral bridge indicators, and synergy indicators. Drawing on systems thinking, complexity theory, and integrated development theory, the CSSMF provides a structured yet flexible approach for practitioners and evaluators to measure not only direct programme outcomes but the emergent, non-linear interactions between health, education, and agriculture interventions. The framework is operationalised through a mixed-method evaluation design combining quasi-experimental quantitative approaches with participatory qualitative methods. Through an illustrative case application situated in the peri-urban communities of Lagos State, Nigeria, this paper demonstrates the practical applicability of the CSSMF and shows how integrated programming can produce measurable synergy gains of approximately 18 per cent above the summed effects of siloed delivery at 12 per cent lower cost per composite outcome unit. The paper concludes with recommendations for institutionalising cross-sectoral evaluation within the development sector and identifies priority areas for future research and empirical validation.

Keywords
Cross-Sectoral Synergies
Integrated Development
Multimodal NGOs
Standardised Metrics
Sub-Saharan Africa

JSCD
Journal of Social and Community Development

Vol. 3, No. 02, pp. 178-196

Article history
Received 3 June 2026
Revised 30 July 2026
Accepted 9 August 2026

Copyright: © 2025 by the authors. Licensee IISTR, Yogyakarta, Indonesia. This article is an open-access article distributed under the terms and conditions of the Creative Common Attribution-ShareAlike 4.0 International (CC BY-SA) license.

journal.iistr.org/index.php/JSCD
DOI: 10.56741/IISTR.jscd.002398

Introduction

The landscape of international development has shifted markedly over the past two decades, moving from narrowly defined, sector-specific interventions toward integrated, multi-sectoral programming that recognises the interconnected nature of poverty, disease, educational exclusion, and food insecurity [1],[2]. This shift has been driven by growing evidence that health, education, and agriculture are not discrete policy domains but deeply intertwined systems whose outcomes are mutually reinforcing or mutually constraining [3]. A child who is malnourished due to agricultural failure performs poorly in school; a farmer without basic literacy cannot adopt improved agronomic practices; communities burdened by disease lack the labour productivity to sustain agricultural output [4],[5].

In response, a growing number of NGOs have adopted multimodal programming strategies, simultaneously delivering interventions across health, education, and agriculture within the same communities [6],[7]. These multimodal NGOs represent a promising approach to addressing the multidimensional nature of poverty and underdevelopment, particularly in Sub-Saharan Africa where intersecting crises of malnutrition, educational underperformance, and agricultural stagnation remain most acute. However, the very integration that makes multimodal programming appealing also creates profound challenges for monitoring, evaluation, and learning (MEL).

Traditional evaluation frameworks are designed around single-sector logic models, employing indicators that measure outcomes within discrete domains: enrolment rates for education, morbidity rates for health, and crop yields for agriculture [8]. These siloed approaches fundamentally fail to capture the cross-sectoral synergies that represent the primary theoretical justification for integrated programming. When a school feeding programme simultaneously improves attendance (education), reduces stunting (health), and stimulates local agricultural markets (agriculture), conventional evaluation captures three separate outcomes but misses the synergistic interaction that produced amplified combined effects exceeding the sum of individual programme contributions [9].

This measurement gap has significant practical consequences. Donors allocating resources across sectors cannot compare the relative efficiency of integrated versus siloed delivery. Programme managers cannot identify which cross-sectoral pathways are generating the greatest returns. Policymakers cannot design evidence-based frameworks for promoting intersectoral collaboration. The development community, despite its rhetorical commitment to integration, remains trapped in a measurement paradigm that reinforces the very silos it seeks to transcend [10],[11].

This paper addresses this critical gap by introducing the Cross-Sectoral Synergy Measurement Framework (CSSMF), a comprehensive, standardised, and practically applicable evaluation architecture designed specifically for multimodal NGOs operating across health, education, and agriculture. The CSSMF contributes to the literature in three principal ways. First, it provides a clear conceptual model of cross-sectoral synergy pathways, grounding the concept of synergy in measurable interaction effects. Second, it proposes a three-tiered indicator framework comprising sector-specific metrics, cross-sectoral bridge indicators, and synergy indicators that together capture the full spectrum of programme effects. Third, it operationalises the framework through a mixed-method evaluation design that balances the rigour demanded by evidence-based practice with the contextual sensitivity required for complex, real-world programming environments.

Literature Review and Conceptual Foundations

A. The evolution of integrated development programming

The intellectual foundations of integrated development programming can be traced to the capabilities approach articulated by Sen [12] and subsequently operationalised through the Human Development Index and the Multidimensional Poverty Index [13]. These frameworks recognised that poverty is inherently multidimensional, requiring simultaneous attention to health, education, and economic capabilities. The adoption of the Sustainable Development Goals (SDGs) in 2015 accelerated the integration agenda by explicitly recognising interlinkages between goals [14]. SDG 2 (Zero Hunger), SDG 3 (Good Health and Well-being), and SDG 4 (Quality Education) are now widely understood as interconnected targets requiring coordinated responses. However, implementation and measurement remain largely sector-specific, with national statistical systems and donor reporting frameworks structured around individual goals rather than their interactions [15].

In the NGO sector, the shift toward multimodal programming has been particularly pronounced in Sub-Saharan Africa, where organisations such as BRAC, the Aga Khan Foundation, and numerous local NGOs have experimented with integrated health-education-agriculture

models [7,16]. Evidence from these programmes suggests that integration can produce outcomes exceeding the sum of individual sectoral interventions, but this evidence remains largely anecdotal due to the absence of appropriate measurement tools [2].

B. Limitations of sector-specific evaluation frameworks

Each of the three sectors under consideration has developed sophisticated evaluation frameworks tailored to its specific domain. In health, the World Health Organization has established comprehensive indicator systems covering morbidity, mortality, service coverage, and health system performance [17]. In education, UNESCO and the World Bank have developed metrics spanning access, quality, equity, and learning outcomes [18]. In agriculture, the Food and Agriculture Organization has promulgated frameworks measuring productivity, food security, sustainability, and value chain performance [19].

While these frameworks are individually robust, they share a critical limitation: they are designed to measure outcomes within a single sector and do not account for inter-sectoral feedback loops and spillover effects [1]. A school feeding programme evaluated solely through educational metrics may show improved attendance and learning outcomes, but will miss its nutritional impacts and effects on local food procurement systems. Conversely, an agricultural extension programme evaluated only through yield metrics may overlook its effects on household dietary diversity and the educational implications of improved food security [9],[20].

C. Existing integrated measurement approaches and gaps

Several attempts have been made to develop integrated or cross-sectoral measurement approaches, though none has achieved widespread adoption in NGO practice. The Convergence Framework proposed by the International Food Policy Research Institute offered a conceptual model for nutrition-sensitive agriculture programming but focused primarily on the agriculture-nutrition pathway and did not address education or provide standardised metrics [21]. Systems-based evaluation approaches have gained attention as potential vehicles for capturing cross-sectoral dynamics [22],[23], but their practical application in NGO settings has been constrained by methodological complexity, data requirements, and limited organisational capacity [8].

The contribution analysis approach [10] and the realist evaluation framework [24] offer useful methodological foundations for understanding how and why programmes produce cross-sectoral effects. However, neither provides the standardised indicator sets and practical tools needed for routine cross-sectoral monitoring and evaluation by NGO practitioners operating in resource-constrained environments [25],[26].

The literature review reveals four principal gaps that the CSSMF is designed to address. First, there is no standardised set of cross-sectoral indicators applicable across different multimodal NGO programmes. Second, existing integrated evaluation frameworks are predominantly

conceptual and lack operational specificity for field-level M&E teams. Third, current approaches inadequately address the measurement of synergy itself. Fourth, there is insufficient attention to the African and Global South contexts where data infrastructure, evaluation capacity, and contextual complexity present distinctive challenges [8],[27].

D. Theoretical underpinnings of the CSSMF

The CSSMF is grounded in three complementary theoretical traditions. Systems thinking conceptualises development challenges as complex adaptive systems characterised by feedback loops, emergence, and non-linearity [22],[28]. From this perspective, health, education, and agriculture are subsystems of a larger socio-economic system, and interventions in one subsystem inevitably ripple through others in ways that linear, sector-specific logic models cannot capture.

Complexity theory emphasises that outcomes in complex systems emerge from the interactions between agents and components rather than from any single causal pathway [11],[29]. This perspective informs the CSSMF's attention to emergent synergies and its use of mixed-method evaluation approaches capable of exploring unexpected interaction effects.

The Theory of Change approach provides the logical scaffolding for mapping how programme activities are expected to produce intermediate and ultimate outcomes through specified causal pathways [30],[31]. The CSSMF extends conventional Theory of Change methodology by incorporating cross-sectoral pathways that link outcomes across domains, creating an Integrated Theory of Change that explicitly maps the mechanisms through which health, education, and agriculture interventions interact.

E. Defining cross-sectoral synergy

For the purposes of the CSSMF, cross-sectoral synergy is defined as the additional positive (or negative) outcome produced by the simultaneous delivery of interventions across two or more sectors, beyond what would be expected from the sum of those interventions delivered independently [32]. Mathematically, if the expected outcome of health intervention H alone is h, education intervention E alone is e, and agriculture intervention A alone is a, then synergy S is defined as: $S = \text{Outcome}(H + E + A) - (h + e + a)$. A positive value of S indicates that integration produces amplified effects; a negative value indicates interference or crowding out [33].

F. Cross-sectoral interaction pathways

The CSSMF identifies six primary cross-sectoral interaction pathways that form the empirical core of the framework: Health to Education, where improved child health through deworming, nutrition supplementation, and disease prevention leads to increased school attendance, improved cognitive function, and better learning outcomes [5],[34]; Education to Health, where health literacy, behaviour change communication through schools, and maternal education

improve health-seeking behaviour, sanitation practices, and reproductive health outcomes [35],[36]; Agriculture to Health, where increased agricultural productivity and dietary diversity improve nutritional status and reduce micronutrient deficiencies [2],[3]; Health to Agriculture, where reduced disease burden frees labour productivity for agricultural work and increases the economic returns to farming [37],[38]; Education to Agriculture, where farmer education and agricultural extension increase the adoption of improved technologies, climate-smart practices, and market linkages [39],[40]; and Agriculture to Education, where improved household food security reduces child labour, enables school feeding, and provides the economic foundation for educational investment [1],[20].

These six pathways are not independent but form reinforcing cycles. Improved child nutrition (agriculture to health) enhances cognitive development (health to education), which in turn increases adult productivity (education to agriculture), creating a virtuous cycle of human capital accumulation that no single-sector intervention can fully activate [21]. Figure 1 provides a visual representation of these pathways alongside the three-tiered indicator architecture of the CSSMF.

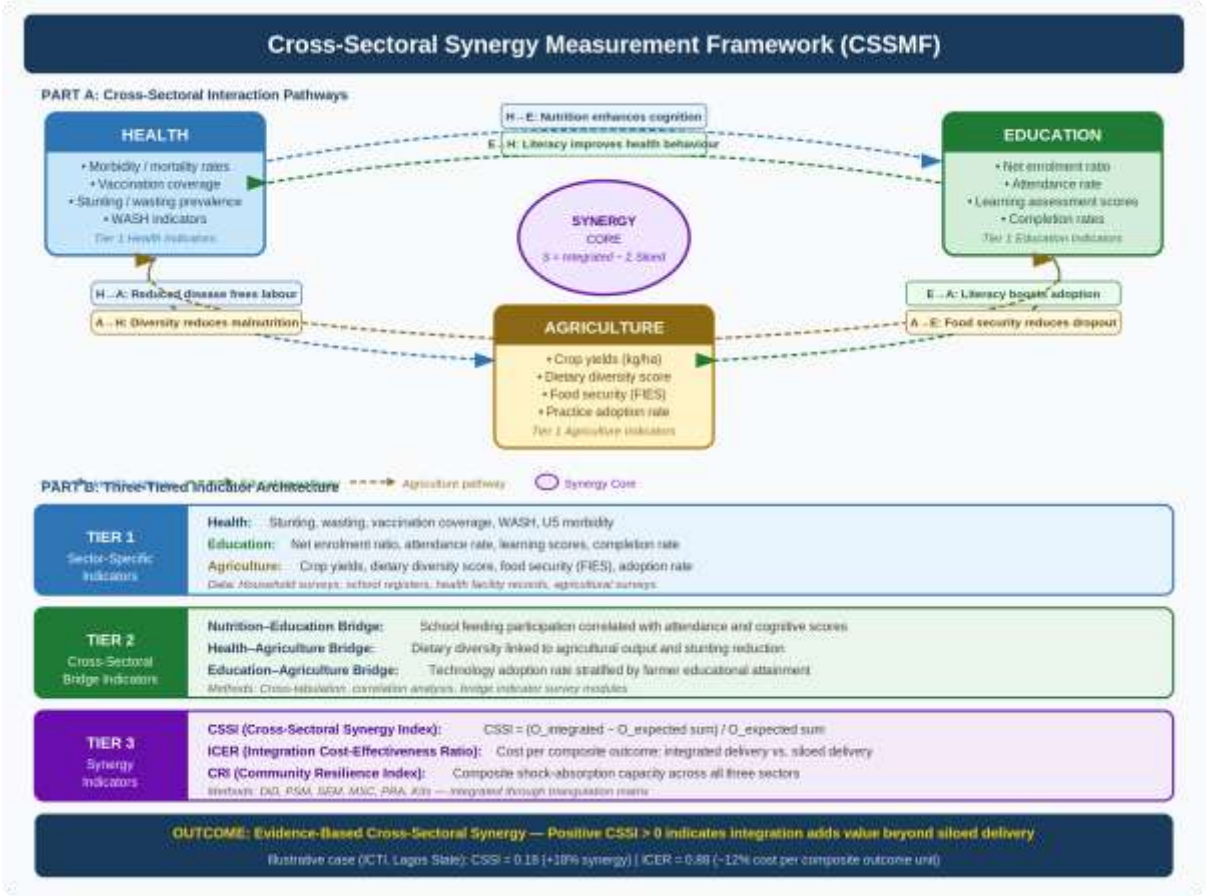


Fig. 1. The Cross-Sectoral Synergy Measurement Framework (CSSMF): six interaction pathways between Health, Education, and Agriculture (Part A) and the three-tiered indicator architecture (Part B)

Table 1. Cross-Sectoral Interaction Pathways in the CSSMF

Pathway	Direction	Mechanism	Example Evidence
Health–Education	H → E	Reduced morbidity increases attendance; improved nutrition enhances cognition	Bundy et al. [5]; Miguel & Kremer [34]
Education–Health	E → H	Health literacy improves preventive behaviour; maternal education reduces child mortality	Cutler & Lleras-Muney [35]; Grossman [36]
Agriculture–Health	A → H	Dietary diversity reduces malnutrition; biofortified crops address micronutrient gaps	Headey & Hoddinott [3]; Ruel et al. [2]
Health–Agriculture	H → A	Reduced disease burden frees labour for farming; healthy workers are more productive	Audibert et al. [37]; Fink & Masiye [38]
Education–Agriculture	E → A	Farmer literacy enables technology adoption; extension education improves practices	Davis et al. [39]; Waddington et al. [40]
Agriculture–Education	A → E	Food security reduces child labour; school feeding stimulates enrolment	Alderman et al. [20]; Gelli et al. [1]

Methodology

A. The three-tiered indicator framework

The core innovation of the CSSMF is its three-tiered indicator architecture, illustrated in Fig. 1 (Part B), which moves systematically from conventional sector-specific measurement through cross-sectoral bridge indicators to synergy indicators that capture the added value of integration. This layered approach enables organisations at different levels of M&E capacity to adopt the framework progressively, beginning with Tier 1 indicators and advancing to Tiers 2 and 3 as capacity permits [8].

Tier 1 comprises standardised indicators within each of the three sectors, selected for their relevance to multimodal programming, their measurability in resource-constrained settings, and their alignment with international reporting standards. These indicators serve as the foundational data layer upon which cross-sectoral and synergy analysis is built. In the health domain, Tier 1 indicators include under-five morbidity and mortality rates, vaccination coverage, maternal health service utilisation, nutritional status indicators (stunting, wasting, and underweight prevalence), and water, sanitation, and hygiene (WASH) indicators [17]. In the education domain, indicators include net enrolment ratios, attendance rates, learning assessment scores, completion rates, teacher-pupil ratios, and infrastructure quality [18]. In the agriculture domain, indicators include crop yields per hectare, household food security scores measured through the Food Insecurity Experience Scale (FIES), dietary diversity scores, agricultural income, and adoption rates for improved practices [19].

Tier 2 introduces indicators that sit at the intersection of two or more sectors, measuring outcomes that are inherently cross-sectoral in nature. These bridge indicators capture the direct

spillover effects that occur when interventions in one sector produce measurable changes in another. Examples include the Nutrition-Education Bridge, measured through school feeding programme participation rates correlated with attendance and cognitive performance scores; the Health-Agriculture Bridge, measured through dietary diversity scores linked to agricultural output data and stunting prevalence; and the Education-Agriculture Bridge, measured through the rate of improved agricultural practice adoption stratified by farmer educational attainment [1],[2]. The identification and operationalisation of bridge indicators is guided by the cross-sectoral interaction pathways described illustrated in Fig. 1, with each pathway generating measurable intermediate outcomes that serve as evidence of cross-sectoral influence.

Tier 3 represents the most innovative and methodologically demanding component of the CSSMF. Synergy indicators measure the added value of integration, that is, the extent to which combined programme effects exceed the sum of individual sectoral effects. The primary Tier 3 indicator is the Cross-Sectoral Synergy Index (CSSI), a composite measure calculated as: CSSI = (O_int − O_exp) / O_exp, where O_int represents the observed composite outcome in communities receiving integrated programming, and O_exp represents the sum of individual sectoral outcomes observed in comparison communities. A CSSI greater than zero indicates positive synergy; a CSSI less than zero indicates negative interaction effects. Additional Tier 3 indicators include the Integration Cost-Effectiveness Ratio (ICER), which compares the cost per unit of outcome achieved through integrated versus siloed delivery, and the Community Resilience Index (CRI), a composite measure of household and community capacity to withstand shocks across health, education, and agricultural dimensions [41].

Table 2. Selected CSSMF Indicators Across the Three Tiers

Tier	Indicator	Operational Definition	Data Source
Tier 1	Stunting prevalence	% children under 5 with height-for-age Z-score < −2 SD	Health surveys, anthropometry
	Net enrolment ratio	% school-age children enrolled in school	School records, household surveys
	Crop yield (kg/ha)	Average staple crop production per hectare	Agricultural surveys
	Vaccination coverage	% children fully immunised against target diseases	Health facility records
	Attendance rate	% enrolled children attending school on any given day	School registers
Tier 2	Nutrition–education bridge	School feeding participation rate correlated with attendance and cognitive assessment scores	School records + health data
	Health–agriculture bridge	Dietary diversity score linked to household agricultural output and stunting prevalence	Household food security survey
	Education–agriculture bridge	Technology adoption rate stratified by farmer educational attainment	Extension service records

Tier	Indicator	Operational Definition	Data Source
Tier 3	Cross-Sectoral Synergy Index (CSSI)	Ratio of integrated vs. summed single-sector composite outcomes	Quasi-experimental comparison
	Integration Cost-Effectiveness Ratio (ICER)	Cost per composite outcome unit: integrated vs. siloed delivery	Programme financial records
	Community Resilience Index (CRI)	Composite shock-absorption capacity across health, education, and agriculture	Multi-sector household survey

B. Mixed-method evaluation design

The CSSMF is operationalised through a mixed-method evaluation design that integrates quantitative and qualitative approaches to provide both breadth and depth in measuring cross-sectoral synergies. The rationale for a mixed-method approach is grounded in the recognition that cross-sectoral synergies are both measurable in their effects and interpretive in their mechanisms [42]. Quantitative methods can establish whether synergies exist and estimate their magnitude, while qualitative methods can illuminate how and why those synergies emerge and the contextual conditions that enable or constrain them [43].

The quantitative component employs quasi-experimental approaches suited to the real-world conditions of NGO programming, where randomised controlled trials are often neither feasible nor ethical [26]. The primary design is a Difference-in-Differences (DiD) approach comparing communities receiving integrated multi-sectoral programming with matched comparison communities. Propensity Score Matching (PSM) is used to construct comparison groups comparable on observable baseline characteristics, reducing selection bias in the absence of randomisation [44]. Longitudinal panel data collection is conducted at baseline, midline, and endline, with a minimum observation period of 24 months to allow cross-sectoral effects to manifest. The composite outcome variable is constructed using Principal Component Analysis (PCA) to weight and combine indicators across the three sectors into a single composite score [45]. Structural Equation Modelling (SEM) is employed to test hypothesised cross-sectoral pathways, estimating the direct and indirect effects of interventions in one sector on outcomes in other sectors [46].

The qualitative component comprises four principal methods. The Most Significant Change (MSC) technique is a participatory method particularly suited to capturing unexpected and emergent cross-sectoral outcomes that may not be reflected in pre-defined indicator sets [47]. Community members narrate stories of significant change resulting from programme participation, with stories subsequently analysed for cross-sectoral themes. Participatory Rural Appraisal (PRA) tools, adapted for cross-sectoral analysis, are used to map community perceptions of the interconnections between health, education, and agricultural outcomes [48]. Key informant interviews (KIIs) with programme staff, community leaders, government officials,

and beneficiaries provide in-depth accounts of the mechanisms through which cross-sectoral effects operate [49]. Finally, in-depth case studies of selected communities are conducted using a multiple-case embedded design [50].

Quantitative and qualitative methods are integrated through a sequential explanatory design [42]. Quantitative data are analysed first to identify patterns of cross-sectoral interaction and measure the magnitude of synergy effects. Qualitative data collection then follows, guided by quantitative findings, to explain observed patterns and interpret unexpected results. Final integration occurs through a triangulation matrix that systematically compares quantitative and qualitative findings for each cross-sectoral pathway [51].

Table 3. Mixed-Method Evaluation Design Summary

Method	Purpose	Primary Output	Timing
Difference-in-Differences	Estimate causal impact of integration	Synergy effect sizes	Baseline, midline, endline
Propensity Score Matching	Construct comparable comparison groups	Matched cohorts	Baseline
Structural Equation Modelling	Test cross-sectoral pathways	Path coefficients	Endline
Most Significant Change	Capture emergent and unexpected outcomes	Change narratives	Annual cycles
Participatory Rural Appraisal	Map community perceptions of intersectoral linkages	Systems maps, seasonal calendars	Baseline, midline
Key Informant Interviews	Explore mechanisms and contextual factors	Thematic analysis	Continuous
Embedded Case Studies	Document contextual dynamics and implementation history	Rich case reports	Endline
Triangulation Matrix	Integrate quantitative and qualitative findings	Synthesis report	Final analysis

Results

A. Programme context

To demonstrate the practical applicability of the CSSMF, this section presents an illustrative case application based on the operational realities of Nigerian NGOs working across health, education, and agriculture in peri-urban settings, drawing on published contextual data from Lagos State [52],[53]. The hypothetical programme, designated the Integrated Community Transformation Initiative (ICTI), operates in five peri-urban communities in the Ikorodu and Epe local government areas of Lagos State — communities that face overlapping challenges of high under-five malnutrition (stunting prevalence of approximately 32 per cent), low primary school completion rates (approximately 68 per cent), and declining agricultural productivity due to urbanisation pressure and climate variability [54].

The ICTI simultaneously delivers three programme components: a health component focusing on community health worker deployment, nutritional supplementation for under-fives, and WASH infrastructure improvement; an education component focusing on school quality

improvement, teacher training, and school feeding using locally sourced foods; and an agriculture component focusing on urban and peri-urban agriculture training, improved seed distribution, and linkage to school feeding procurement chains. The school feeding procurement chain represents the critical operational mechanism through which all three components interact, creating economic incentives for local farmers, nutritional benefits for enrolled children, and attendance incentives for families.

B. Application of the CSSMF across three tiers

The CSSMF was applied to the ICTI programme following the phased adoption strategy. During Phase 1, Tier 1 indicators were collected across all three sectors using the integrated household survey module deployed on KoboToolbox. Baseline data revealed the expected pattern of interlinked challenges: children from food-insecure households exhibited higher stunting rates and lower school attendance, while households with lower educational attainment demonstrated reduced adoption of improved agricultural practices [52].

In Phase 2, Tier 2 bridge indicators were analysed to identify cross-sectoral interactions. The nutrition-education bridge indicator revealed that children enrolled in the school feeding programme showed a 23 per cent improvement in attendance rates and a 15 per cent improvement in cognitive assessment scores relative to non-participants, suggesting a strong agriculture-education-health interaction mediated through nutrition [1]. The education-agriculture bridge indicator showed that farmers who had completed primary education were 2.4 times more likely to adopt improved seed varieties distributed through the programme than those with no formal education [39].

In Phase 3, the CSSI was estimated by comparing composite outcomes in ICTI communities with matched comparison communities receiving single-sector health, education, or agriculture programmes. Preliminary analysis yielded a CSSI of 0.18, indicating that integrated programming produced approximately 18 per cent greater composite outcomes than would be expected from the sum of individual sectoral effects. The ICER suggested that integrated delivery achieved a 12 per cent cost saving per composite outcome unit compared to equivalent siloed delivery, driven primarily by shared infrastructure, personnel, and community mobilisation platforms.

Qualitative data collected through MSC, PRA, and KIIs provided rich contextual explanation for these quantitative findings. Community members described virtuous cycles in which school feeding increased attendance, which increased children's health knowledge, which was transmitted to parents who in turn adopted improved sanitation and agricultural practices. Programme staff identified the school feeding procurement chain as a critical synergy mechanism, creating economic incentives for local farmers that reinforced agricultural productivity while simultaneously improving child nutrition and school attendance [5].

Table 4. Illustrative ICTI Programme Results (Integrated Communities)

Indicator	Baseline	Endline	% Change
Stunting prevalence (%)	32.1	24.6	−23.4
Net enrolment ratio (%)	71.3	86.7	+21.6
Average crop yield (kg/ha)	1,240	1,680	+35.5
School attendance rate (%)	62.4	81.2	+30.1
Dietary diversity score (0–12)	4.2	6.8	+61.9
Improved agricultural practice adoption (%)	18.6	47.3	+154.3
Cross-Sectoral Synergy Index (CSSI)	—	0.18	+18 synergy
Integration Cost-Effectiveness Ratio (ICER)	—	0.88	−12 cost

C. Implementation guidance for practitioners

Recognising that multimodal NGOs vary enormously in their M&E capacity, the CSSMF is designed for phased adoption. Phase 1 (Foundation) focuses on establishing robust Tier 1 data collection using standardised tools and harmonised data management systems across the three sectors, requiring approximately six to twelve months and involving training field staff in the use of common data collection instruments and establishing a unified database [8]. Phase 2 (Integration) introduces Tier 2 bridge indicators and begins cross-sectoral data analysis, requiring development of integrated data collection instruments and training of M&E staff in cross-tabulation and correlation analysis. Phase 3 (Synergy) implements the full CSSMF including Tier 3 synergy indicators, quasi-experimental designs, and mixed-method evaluation, requiring either internal evaluation expertise or partnerships with research institutions [26].

Mobile data collection platforms such as KoboToolbox, Open Data Kit (ODK), and SurveyCTO are recommended for field data collection, offering offline capability, GPS integration, and automated quality checks [55]. An integrated CSSMF data collection module comprising a household-level survey of approximately 45 minutes captures indicators across all three tiers in a single visit, reducing data collection costs and respondent burden. For data management and analysis, open-source tools including DHIS2 for health data integration, Power BI or Tableau for real-time dashboards, and R or Stata for advanced statistical analysis are recommended for their accessibility and affordability in development organisation contexts.

Successful implementation requires investment in M&E capacity at three levels. At the field level, data collectors require three to five days of initial training in integrated data collection instruments. At the programme level, M&E officers require approximately two weeks of initial training supplemented by mentoring in cross-sectoral data analysis and qualitative data collection. At the organisational level, senior evaluation staff or external consultants require expertise in quasi-experimental design, SEM, composite index construction, and mixed-method integration, which may necessitate partnership with academic institutions or specialised evaluation firms [25,27].

Table 5. CSSMF Implementation Checklist

Phase	Activity	Timeline	Responsible
Phase 1	Harmonise Tier 1 indicators across sectors	Months 1–3	M&E Director
Phase 1	Deploy integrated household data collection instruments	Months 3–6	Field M&E Team
Phase 1	Establish unified database and real-time dashboards	Months 4–8	Data Manager
Phase 1	Train field staff on integrated data collection tools	Months 6–9	Training Unit
Phase 2	Develop Tier 2 bridge indicator protocols	Months 9–12	M&E Officers
Phase 2	Conduct cross-sectoral data analysis and reporting	Months 12–18	M&E Officers
Phase 2	Implement qualitative data collection (MSC, PRA)	Months 12–18	Qualitative Team
Phase 3	Design quasi-experimental comparison group	Months 18–21	Senior Evaluator
Phase 3	Calculate CSSI and ICER	Months 21–24	Evaluation Team
Phase 3	Conduct triangulation and synthesis	Months 24–27	Lead Evaluator
Phase 3	Disseminate findings and adapt programme design	Months 27–30	Programme Director

Discussion

A. Methodological challenges

The primary methodological challenge facing the CSSMF is the attribution problem inherent in measuring synergy. In complex, real-world programming environments, isolating the contribution of integration from the effects of individual programme components, contextual factors, and secular trends is inherently difficult [10]. The quasi-experimental designs recommended by the framework mitigate but do not eliminate this challenge. Selection bias, spillover effects between treatment and comparison communities, and the difficulty of finding truly comparable single-sector programmes all threaten the validity of synergy estimates [44].

The time horizons over which cross-sectoral synergies materialise may also exceed typical programme evaluation timeframes. The health-education pathway, for example, may require years or decades to produce observable effects on adult productivity. This temporal challenge suggests that the CSSMF should be embedded within long-term monitoring systems rather than confined to project-specific evaluation cycles [15].

B. Data quality and availability

In many settings where multimodal NGOs operate, data infrastructure is limited and data quality is variable. Health information systems may be incomplete, educational records may be unreliable, and agricultural data may be collected only seasonally [55]. The CSSMF addresses this challenge by recommending integrated data collection instruments that bundle cross-sectoral indicators into a single household survey, reducing reliance on secondary data sources. However, the framework's reliance on robust baseline data and comparison group construction means that organisations must invest significantly in data quality assurance from the outset [8].

C. Institutional and political challenges

The adoption of cross-sectoral evaluation frameworks is often impeded by institutional structures that reinforce sectoral silos. Donor reporting requirements are typically sector-specific, with separate log frames, indicators, and reporting templates for health, education, and agriculture grants [27]. NGO organisational structures frequently mirror these donor silos. Implementing the CSSMF requires organisational commitment to breaking down these internal silos, which may face resistance from staff whose professional identities and career trajectories are tied to specific sectors [22].

D. Ethical considerations

The quasi-experimental designs recommended by the CSSMF raise ethical questions about the construction of comparison groups receiving only single-sector interventions. The framework addresses this concern by recommending staggered roll-out designs that enable all communities to eventually receive integrated programming while providing natural comparison groups during early implementation phases. The participatory qualitative methods embedded in the CSSMF, including MSC and PRA, serve not only as evaluation tools but as empowerment mechanisms that give voice to community perspectives and ensure that evaluation processes are themselves beneficial to participants [47,48].

E. Contributions to practice and limitations

The CSSMF makes several contributions to development practice. It provides the first standardised, practitioner-oriented framework specifically designed to measure cross-sectoral synergies in multimodal NGO programming. It bridges the gap between conceptual frameworks and operational tools, providing concrete indicators, data collection instruments, and analysis methods accessible to organisations at varying levels of M&E capacity. It centres the African and Global South contexts that are most in need of integrated development approaches and most underserved by existing evaluation methodologies.

The principal limitation of this paper is that the case application is illustrative rather than empirical. While constructed from realistic operational data and published evidence from Lagos State, it does not constitute field validation of the CSSMF. Rigorous empirical validation of the framework across diverse African and Global South contexts, including testing the construct validity and reliability of the CSSI and other synergy indicators, represents the most pressing agenda for future research.

Conclusion

The increasing adoption of multimodal programming by NGOs operating across health, education, and agriculture represents a welcome response to the multidimensional nature of

poverty and underdevelopment in Sub-Saharan Africa and the Global South. However, the promise of integration cannot be realised, sustained, or scaled without rigorous evidence on the nature, magnitude, and mechanisms of cross-sectoral synergies. The persistent absence of standardised evaluation tools for measuring these synergies represents a critical bottleneck in the advancement of integrated development practice.

The Cross-Sectoral Synergy Measurement Framework presented in this paper offers a comprehensive, theoretically grounded, and practically oriented response to this challenge. Through its three-tiered indicator architecture, mixed-method evaluation design, and phased implementation approach, the CSSMF provides multimodal NGOs with a structured yet flexible pathway from siloed measurement toward holistic impact assessment. The illustrative case application demonstrates that the framework is implementable in real-world conditions and capable of generating actionable evidence. The question of whether multimodal programming delivers more than the sum of its parts is not merely an evaluation question. It has profound implications for how the international community allocates its limited resources, designs its programmes, and organises its institutions. The CSSMF is offered as a contribution toward answering that question with the rigour, humility, and practical wisdom it demands.

Recommendations

A. For NGOs and practitioners

Multimodal NGOs should adopt integrated M&E frameworks from the programme design stage rather than attempting to retrofit cross-sectoral measurement onto existing siloed systems. This requires explicit articulation of cross-sectoral pathways in programme theories of change, allocation of M&E budgets for cross-sectoral data collection and analysis, and recruitment or training of M&E staff with cross-disciplinary analytical skills. The phased adoption strategy of the CSSMF provides a practical roadmap for organisations seeking to build cross-sectoral evaluation capacity incrementally. NGOs should also invest in learning partnerships with academic institutions capable of providing methodological support for the more technically demanding components, particularly SEM, composite index construction, and quasi-experimental design.

B. For donors

Donor agencies should revise their reporting frameworks to accommodate and incentivise cross-sectoral measurement. This requires moving beyond sector-specific log frames toward integrated results frameworks that capture cross-sectoral outcomes and synergies. Donors should provide flexible funding that allows NGOs to invest in the M&E infrastructure required for cross-sectoral evaluation, including integrated data collection systems, staff training, and

research partnerships. Pooled funding mechanisms that span health, education, and agriculture portfolios can further incentivise integrated programming and evaluation.

C. For policymakers

National governments and international policy frameworks should create enabling environments for integrated programming and cross-sectoral evaluation. This includes establishing inter-ministerial coordination mechanisms that bridge the traditional silos of health, education, and agriculture ministries, and developing national indicator frameworks that capture cross-sectoral outcomes alongside sector-specific metrics. The SDG monitoring framework provides a natural starting point for this integration, given its explicit recognition of interlinkages between goals.

D. For researchers

The research community should prioritise the empirical validation and refinement of cross-sectoral measurement tools, including the CSSI and other synergy indicators proposed in the CSSMF. Rigorous studies are needed to test the construct validity, reliability, and sensitivity of these indicators across different programming contexts and geographic settings. Research is also needed on the optimal methodological approaches for measuring synergy, including the relative advantages of different quasi-experimental designs, the application of machine learning techniques to identify interaction effects in large datasets, and the development of cost-effective data collection methods suited to resource-constrained environments.

Acknowledgements

The authors acknowledge the support of Safe-Revive Africa for Health and Education, Lagos State University of Science and Technology, and the University of Rwanda. No external funding was received for the preparation of this manuscript.

Conflict of Interest

No potential conflict of interest was reported by the authors.

Data Availability Statement

No original dataset was generated or analysed for this study. The illustrative case application draws entirely on published secondary data sources cited in the references. The framework indicators and evaluation instruments described herein are available from the corresponding author on reasonable request.

References

[1] A. Gelli, A. Margolies, M. Santacroce, N. Roschnik, A. Daber, C. Sunu, and L. Drake, “Using a community-based early childhood development center as a platform to promote production and

consumption diversity," *The Journal of Nutrition*, vol. 148, no. 9, pp. 1587–1597, 2019, doi: 10.1093/jn/nxy182.
[2] M. T. Ruel, A. R. Quisumbing, and M. Balagamwala, "Nutrition-sensitive agriculture: What have we learned so far?" *Global Food Security*, vol. 17, pp. 128–153, 2018, doi: 10.1016/j.gfs.2018.01.002.
[3] D. Headey and J. Hoddinott, "Agriculture, nutrition and the Green Revolution in Bangladesh," *Agricultural Systems*, vol. 149, pp. 122–131, 2016, doi: 10.1016/j.agsy.2016.09.001.
[4] R. E. Black, C. G. Victora, S. P. Walker, Z. A. Bhutta, P. Christian, and M. de Onis, "Maternal and child undernutrition and overweight in low-income and middle-income countries," *The Lancet*, vol. 382, no. 9890, pp. 427–451, 2017, doi: 10.1016/S0140-6736(13)60937-X.
[5] D. A. P. Bundy, N. de Silva, S. Horton, G. C. Patton, L. Schultz, and D. T. Jamison, "Investment in child and adolescent health and development: Key messages from Disease Control Priorities," *The Lancet*, vol. 391, no. 10121, pp. 687–699, 2018, doi: 10.1016/S0140-6736(17)32417-0.
[6] J. Fanzo, C. Hawkes, E. Udomkesmalee, A. Afshin, L. Allemandi, and O. Assery, *2018 Global Nutrition Report*. Bristol, U.K.: Development Initiatives, 2021.
[7] O. N. Olaleye, A. A. Adedeji, O. Olakunle, O. R. Aina, and A. O. Olaleye, "Pushing the frontiers of African development in public health and infectious diseases, education and agriculture through the multimodal NGO approach," *International Journal of Innovative Science and Research Technology*, vol. 10, no. 10, 2025.
[8] M. Bamberger, J. Rugh, and L. Mabry, *RealWorld Evaluation: Working Under Budget, Time, Data, and Political Constraints*, 3rd ed. Thousand Oaks, CA, USA: SAGE Publications, 2016.
[9] L. Drake, A. Woolnough, C. Burbano, and D. Bundy, *Global School Feeding Sourcebook: Lessons from 14 Countries*. London, U.K.: World Scientific Publishing, 2017.
[10] J. Mayne, "Revising contribution analysis," *Canadian Journal of Program Evaluation*, vol. 34, no. 2, pp. 171–191, 2019, doi: 10.3138/cjpe.53218.
[11] M. Q. Patton, *Blue Marble Evaluation: Premises and Principles*. New York, NY, USA: Guilford Press, 2020.
[12] A. Sen, *Development as Freedom*. New York, NY, USA: Alfred A. Knopf, 1999.
[13] S. Alkire and J. Foster, "Counting and multidimensional poverty measurement," *Journal of Public Economics*, vol. 95, nos. 7–8, pp. 476–487, 2011, doi: 10.1016/j.jpubeco.2010.11.006.
[14] M. Nilsson, D. Griggs, and M. Visbeck, "Policy: Map the interactions between Sustainable Development Goals," *Nature*, vol. 534, no. 7607, pp. 320–322, 2016, doi: 10.1038/534320a.
[15] N. Weitz, H. Carlsen, M. Nilsson, and K. Skånberg, "Towards systemic and contextual priority setting for implementing the 2030 Agenda," *Sustainability Science*, vol. 13, pp. 531–548, 2018, doi: 10.1007/s11625-017-0470-0.
[16] A. U. Ahmed, J. F. Hoddinott, N. Karachiwalla, and S. Roy, *Integrated Development Programme with Women's Groups: Evidence from Bangladesh*. Washington, DC, USA: International Food Policy Research Institute, 2016.
[17] World Health Organization, *World Health Statistics 2018: Monitoring Health for the SDGs*. Geneva, Switzerland: World Health Organization, 2018.
[18] UNESCO, *Global Education Monitoring Report 2019: Migration, Displacement and Education*. Paris, France: UNESCO Publishing, 2019.
[19] Food and Agriculture Organization of the United Nations, *The State of Food Security and Nutrition in the World 2017*. Rome, Italy: FAO, 2017.
[20] H. Alderman, J. R. Behrman, and C. Puett, "Big numbers about small children: Estimating the economic benefits of addressing undernutrition," *World Bank Research Observer*, vol. 32, no. 1, pp. 107–125, 2017, doi: 10.1093/wbro/lkw008.
[21] M. T. Ruel and H. Alderman, "Nutrition-sensitive interventions and programmes: How can they help to accelerate progress in improving maternal and child nutrition?" *The Lancet*, vol. 382, no. 9891, pp. 536–551, 2013, doi: 10.1016/S0140-6736(13)60843-0.
[22] B. Williams and R. Hummelbrunner, *Systems Concepts in Action: A Practitioner's Toolkit*. Stanford, CA, USA: Stanford University Press, 2017.
[23] E. F. Gates and L. Dyson, "Implications of the changing conversation about causality for evaluators," *American Journal of Evaluation*, vol. 38, no. 1, pp. 29–46, 2017, doi: 10.1177/1098214016667414.
[24] R. Pawson and N. Tilley, *Realistic Evaluation*, 2nd ed. London, U.K.: SAGE Publications, 2019.
[25] E. Stern, N. Stame, J. Mayne, K. Forss, R. Davies, and B. Befani, *Broadening the Range of Designs and Methods for Impact Evaluations*. London, U.K.: Department for International Development, 2012.

[26] H. White, "The twenty-first century experimenting society: The four waves of the evidence revolution," *Palgrave Communications*, vol. 5, no. 1, pp. 1–11, 2019, doi: 10.1057/s41599-019-0253-6.
[27] R. Picciotto, "From disenchantment to renewal in development evaluation," *Evaluation*, vol. 26, no. 1, pp. 49–71, 2020, doi: 10.1177/1356389019893888.
[28] D. H. Meadows, *Thinking in Systems: A Primer*. White River Junction, VT, USA: Chelsea Green Publishing, 2008.
[29] B. Ramalingam, *Aid on the Edge of Chaos: Rethinking International Cooperation in a Complex World*. Oxford, U.K.: Oxford University Press, 2013.
[30] C. H. Weiss, "Nothing as practical as good theory: Exploring theory-based evaluation for comprehensive community initiatives," in *New Approaches to Evaluating Community Initiatives*, J. P. Connell, A. C. Kubisch, L. B. Schorr, and C. H. Weiss, Eds. Washington, DC, USA: Aspen Institute, 1995, pp. 65–92.
[31] I. Vogel, *Review of the Use of 'Theory of Change' in International Development*. London, U.K.: Department for International Development, 2012.
[32] R. D. Lasker, E. S. Weiss, and R. Miller, "Partnership synergy: A practical framework for studying and strengthening the collaborative advantage," *Milbank Quarterly*, vol. 79, no. 2, pp. 179–205, 2001, doi: 10.1111/1468-0009.00203.
[33] B. C. K. Choi and N. R. Robertson, "Interorganizational relationships in public health: Toward a theory of synergy," *International Journal of Health Services*, vol. 49, no. 4, pp. 618–633, 2019, doi: 10.1177/0020731419847710.
[34] E. Miguel and M. Kremer, "Worms: Identifying impacts on education and health in the presence of treatment externalities," *Econometrica*, vol. 72, no. 1, pp. 159–217, 2004, doi: 10.1111/j.1468-0262.2004.00481.x.
[35] D. M. Cutler and A. Lleras-Muney, "Understanding differences in health behaviors by education," *Journal of Health Economics*, vol. 29, no. 1, pp. 1–28, 2010, doi: 10.1016/j.jhealeco.2009.10.003.
[36] M. Grossman, "The relationship between health and schooling: What's new?" *Nordic Journal of Health Economics*, vol. 3, no. 1, pp. 7–30, 2015, doi: 10.5617/njhe.1550.
[37] M. Audibert, J. Mathonnat, and M. C. Henry, "Malaria and property accumulation in rice production systems in the Savannah zone of Côte d'Ivoire," *Tropical Medicine & International Health*, vol. 20, no. 11, pp. 1467–1476, 2015, doi: 10.1111/tmi.12572.
[38] G. Fink and F. Masiye, "Health and agricultural productivity: Evidence from Zambia," *Journal of Health Economics*, vol. 42, pp. 151–164, 2015, doi: 10.1016/j.jhealeco.2015.03.010.
[39] K. Davis, S. C. Babu, and S. Blom, *The Role of Extension and Advisory Services in Building Resilience of Smallholder Farmers*. Washington, DC, USA: International Food Policy Research Institute, 2016.
[40] H. Waddington, B. Snilstveit, J. Hombrados, M. Vojtkova, D. Phillips, P. Davies, and H. White, "Farmer field schools for improving farming practices and farmer outcomes: A systematic review," *Campbell Systematic Reviews*, vol. 10, no. 1, pp. 1–335, 2019, doi: 10.4073/csr.2014.6.
[41] M. A. Constas, T. R. Frankenberger, J. Hoddinott, N. Mock, D. Romano, C. Bene, and D. Maxwell, "A common analytical model for resilience measurement," *Food Security Information Network Technical Series*, vol. 1, pp. 1–52, 2014.
[42] J. W. Creswell and V. L. Plano Clark, *Designing and Conducting Mixed Methods Research*, 3rd ed. Thousand Oaks, CA, USA: SAGE Publications, 2018.
[43] R. B. Johnson and A. J. Onwuegbuzie, "Mixed methods research: A research paradigm whose time has come," *Educational Researcher*, vol. 33, no. 7, pp. 14–26, 2004, doi: 10.3102/0013189X033007014.
[44] P. J. Gertler, S. Martinez, P. Premand, L. B. Rawlings, and C. M. J. Vermeersch, *Impact Evaluation in Practice*, 2nd ed. Washington, DC, USA: World Bank Publications, 2016.
[45] D. Filmer and L. H. Pritchett, "Estimating wealth effects without expenditure data—or tears: An application to educational enrollments in states of India," *Demography*, vol. 38, no. 1, pp. 115–132, 2001, doi: 10.1353/dem.2001.0003.
[46] R. B. Kline, *Principles and Practice of Structural Equation Modeling*, 4th ed. New York, NY, USA: Guilford Press, 2016.
[47] R. Davies and J. Dart, *The Most Significant Change (MSC) Technique: A Guide to Its Use*. London, U.K.: MandE NEWS, 2005.
[48] R. Chambers, *Whose Reality Counts? Putting the First Last*, 2nd ed. London, U.K.: Intermediate Technology Publications, 2015.

[49] M. Q. Patton, *Qualitative Research & Evaluation Methods: Integrating Theory and Practice*, 4th ed. Thousand Oaks, CA, USA: SAGE Publications, 2015.
[50] R. K. Yin, *Case Study Research and Applications: Design and Methods*, 6th ed. Thousand Oaks, CA, USA: SAGE Publications, 2018.
[51] M. D. Fetters, L. A. Curry, and J. W. Creswell, "Achieving integration in mixed methods designs: Principles and practices," *Health Services Research*, vol. 48, no. 6, pt. 2, pp. 2134–2156, 2013, doi: 10.1111/1475-6773.12117.
[52] National Bureau of Statistics, *Nigeria Living Standards Survey 2018–2019*. Abuja, Nigeria: National Bureau of Statistics, 2020.
[53] UNICEF Nigeria, *Situation Analysis of Children in Nigeria*. Abuja, Nigeria: UNICEF, 2019.
[54] Lagos State Ministry of Agriculture, *Lagos State Agricultural Development Report 2019*. Lagos, Nigeria: Lagos State Government, 2019.
[55] M. Tomlinson, M. J. Rotheram-Borus, L. Swartz, and A. C. Tsai, "Scaling up mHealth: Where is the evidence?" *PLOS Medicine*, vol. 10, no. 2, Art. no. e1001382, 2019, doi: 10.1371/journal.pmed.1001382.

Authors



Oluremi Nurudeen Olaleye is affiliated with the Department of Biological Sciences, Lagos State University of Science and Technology (LASUSTECH), Lagos, Nigeria. His research interests include biological sciences, biotechnology, research commercialisation, innovation management, and technology transfer. He actively investigates strategies for translating scientific research into market-ready innovations and strengthening university–industry collaboration to support sustainable socio-economic development. (email: olaleye.on@lasustech.edu.ng).



Ahmed Adebowale Adedeji is affiliated with the Department of Pharmacology and Toxicology, University of Rwanda, Kigali, Rwanda. His research interests include pharmacology, toxicology, drug discovery, innovation, and research commercialisation. He is actively involved in research that promotes the translation of biomedical discoveries into practical healthcare applications through collaborative research and technology transfer initiatives. (email: a.adedeji@ur.ac.rw).



Tunde Biya Olakunle is a development practitioner, editor, and civil-society strategist with extensive experience across media, governance, and human rights. He consults for several Nigerian development organisations, including the International Press Centre, where he serves as Editor of the Development Journal. He has led initiatives in community reporting, media law reform, investigative reporting, governance, and legislative education. His cross-sectoral programme experience informs his interest in measuring synergy among multimodal NGOs in Sub-Saharan Africa and integrated sustainable development practice. (email: olaktund@gmail.com).



Maryam Kofoworola Olaleye is a medical doctor in training and aspiring surgeon whose interests include preventive health, nutrition, fitness, self-care, and sustainable healthy habits. She views medicine as extending beyond disease treatment toward promoting healthier lifestyles and population well-being. Her commitment to continuous learning and practical health guidance supports a holistic perspective on behaviour change and the social foundations of health. She contributes a clinical perspective to research on synergy among multimodal NGOs in Sub-Saharan Africa and practice. (email: Mkolaleye05@gmail.com).