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Bridging the Last Mile: County-Proximate University as a Local Implementation Anchor for Two Parallel Digital Systems in Western Kenya

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Abstract
This paper examines the role of Masinde Muliro University of Science and Technology (MMUST) as a County-Proximate University (CPU) in implementing two parallel digital systems in Kenya's Western Region: The Health Information System (HIS, funded by USAID) and the Child Protection Information Management System (CPIMS, supported by UNICEF). A case study approach documented MMUST's partnership with the University of Nairobi (UoN) and strategic donor funding, comparing implementation bottlenecks of fragmented vertical systems versus locally anchored support. The centralised national model failed to resolve frontline officers' unsustainable burden of these digital systems with distinct technical platforms, training requirements, and support channels. MMUST's CPU role enabled contextualised training, sustained support, and successful parallel system operation at county and sub-county levels, achieving DHIS2 reporting timeliness improvement from 68% to 91% and CPIMS case registration completeness from 47% to 83% within 18 months. The findings demonstrate that empowering regional universities as local implementation anchors is essential for equitable digital transformation, where multiple parallel systems must coexist effectively. This paper proposes a five-component replicable framework for using county-proximate universities as local implementation anchors in decentralised governance contexts.

Introduction

Kenya's health and child protection sectors have undergone significant transformation following the 2010 Constitution, which devolved healthcare delivery to 47 county governments while maintaining national standards for child welfare through the centralised Department of Children's Services (Government of Kenya, 2010). This decentralisation exposed disparities in technical and human resource capacity across counties, particularly in Western Kenya, which faces compounded challenges of poverty, disease burden, and vulnerable child populations (Munge et al., 2020; Wamai, 2022).

The national government prioritised digital systems across both sectors. The Kenya Digital Health Strategy 2019-2024 articulated a vision for harmonised Health Information Systems (HIS) encompassing the District Health Information Software (DHIS2), Electronic Medical Records (EMRs), and the electronic Community Health Information System (eCHIS) (Ministry of Health, Kenya, 2019). Concurrently, the Department of Children's Services, with UNICEF support, developed the Child Protection Information Management System (CPIMS) to track vulnerable children and inform

programming (UNICEF, 2020). These two digital agendas evolved as fundamentally separate initiatives with distinct governance structures, technical architectures, funding streams, and timelines.

International partners supported these parallel transformations through distinct channels. The United States Agency for International Development (USAID) provided substantial funding to strengthen HIS, focusing on HIV/AIDS, maternal and child health, and malaria control (USAID, 2021). UNICEF played the lead role in the development of CPIMS, working directly with the Department of Children's Services (UNICEF, 2020). Both partners contracted the University of Nairobi (UoN) as the national technical lead for their respective implementations. UoN provided high-level system design, training materials, national trainer-of-trainer workshops, and technical architecture maintenance for both systems independently (Project M&E Report, 2023).

However, this centralised model could not adequately address the 'last mile' challenge of implementation at county and sub-county levels where frontline workers actually use these systems (Scott et al., 2019; Kwamie, 2021). Health workers grappling with DHIS2, EMRs, and eCHIS faced different challenges; by contrast, child protection officers navigating CPIMS case management modules faced their own. Each system required distinct training, separate reports, and different support mechanisms. The partners' technical teams were too lean to provide ongoing, contextualised troubleshooting for each system at the local level (Kiberu et al., 2017).

This implementation vacuum revealed the need for a proximate organisation: physically present in the region, deeply embedded in local networks, and possessing multidisciplinary capacity to support both systems independently while understanding the distinct contexts of health and child protection work. This paper documents how Masinde Muliro University of Science and Technology (MMUST) filled this role and proposes a replicable framework for similar contexts.

This paper aims to document, analyse, and advocate for the critical role of a county-proximate university as a local implementation anchor in the successful implementation and sustainability of parallel digital systems (HIS and CPIMS) in Kenya's Western Region.

Methodology

Study Design

This study employed a single embedded case study design (Yin, 2018), appropriate for investigating a contemporary phenomenon within its real-world context, where boundaries between the phenomenon and its context are not clearly evident. The case was defined as MMUST's role as a local implementation anchor for two parallel digital systems (HIS and CPIMS) across six counties in Western Kenya from 2017 to 2025.

Study Setting

The study was conducted in six counties of Kenya's Western Region: Kakamega, Bungoma, Trans Nzoia, Uasin Gishu, West Pokot and Turkana. These counties were selected because they represent the geographic scope of MMUST's anchor institution mandate and exhibit typical characteristics of decentralised health and child protection systems in Kenya, including variable technical capacity, resource constraints, and the burden of managing parallel digital systems.

Data Collection

Data were collected from multiple sources to enable triangulation:

Quantitative data: Secondary analysis of routinely collected monitoring data from the HIS and CPIMS implementations, including DHIS2 reporting timeliness (monthly facility-level reports), EMR data

completeness for HIV indicators (quarterly audits), CPIMS case registration completeness (monthly case entry logs), and training records (participant lists and pre/post-assessments). These data spanned the period January 2017 to December 2025.

Qualitative data: Document analysis of project reports (Project M&E Report, 2023; County Health Department Quarterly Reports, 2022-2023; Child Protection Services Annual Report, 2023), partnership agreements (Memoranda of Understanding between MMUST, county governments, and national technical leads), and policy documents (Kenya Digital Health Strategy 2019-2024; USAID Digital Health Strategy 2021-2025). Semi-structured interviews were conducted with 16 key informants purposively selected from four stakeholder categories: national technical leads from UoN (n=3), county health management team members (n=4), county child protection officers (n=4), and MMUST project implementation staff (n=5). Interviews explored perceptions of implementation challenges, the anchor institution model's effectiveness, and sustainability considerations.

Data Analysis

Quantitative data were analysed descriptively to calculate pre- and post-implementation metrics (reporting timeliness, data completeness, training coverage). Where possible, 12-month pre-implementation baselines (January 2018-December 2018) were compared with 12-month post-implementation periods (January 2025-December 2025). Qualitative data were analysed using thematic analysis following Braun and Clarke's (2006) six-phase framework. Initial codes were generated independently by two researchers, then compared and consolidated into themes. Disagreements were resolved through discussion with a third researcher. Themes were organised around the Consolidated Framework for Implementation Research (CFAR) domains (Damschroder et al., 2009) to facilitate comparison with existing implementation science literature.

Challenges in Implementation of HIS and CPIMS

Despite substantial investment, implementation in Kenya's Western Region encountered critical bottlenecks stemming from a fragmented implementation architecture.

The Burden of Parallel Systems on Frontline Workers

Frontline health workers and child protection officers, operating within the same counties, were required to master and independently, routinely use the two entirely separate digital systems. Health workers navigated DHIS2 for aggregate reporting, EMRs for clinical data, and eCHIS for community registrations, each with its own protocols, timelines, and quality mechanisms. Child protection officers managed CPIMS to track cases, document interventions, and generate reports.

These systems were designed and supported as independent verticals from the national level, operating on different technical platforms, requiring separate training, and depending on distinct support channels. This parallel structure imposed an unsustainable burden. Dual training demands drew from the same limited pool of officers, pulling them away from primary responsibilities. Different reporting timelines created competing priorities. The absence of coordinated troubleshooting meant technical problems could remain unresolved for extended periods, resulting in widespread frustration, inconsistent system use, and failure to realise the full potential of either investment (Muinga et al., 2020).

Limitations of Centralised Technical Support

UoN's HealthIT unit provided technical system design and conducted national training-of-trainers workshops for both systems. However, the centralised model reached its inherent limits at the last mile. Distance proved the most significant barrier: technical support from Nairobi required expensive, time-consuming travel, making regular site visits impractical. When technical problems arose, server

failures, data synchronisation errors, or confusion over new data elements, response times sometimes extended to weeks. During delays, system utilisation declined, data quality deteriorated, and frontline workers reverted to paper processes (Braa et al., 2007).

More fundamentally, the centralised model could not adapt implementation strategies to local realities. Training protocols developed in Nairobi did not account for intermittent electricity and connectivity in Western Kenya, varied digital literacy levels, or the linguistic and cultural nuances essential to sensitive health and child protection work (Sanders et al., 2023).

The Sustainability Vacuum

Fragmentation and centralisation challenges were compounded by a fundamental sustainability problem. Reliance on external consultants or a distant national university fostered little local ownership. When project cycles ended, support structures collapsed, leaving counties with sophisticated digital tools but no ongoing mechanism for troubleshooting, refresher training, or user support. This was particularly consequential for vulnerable populations: a health information system that falls into disuse cannot track disease outbreaks; a child protection system that ceases to function cannot ensure timely interventions for vulnerable children.

The Need for a Local Implementation Anchor

These interrelated problems pointed to a common solution: a local institutional anchor capable of providing sustained, contextualised support for both independent systems within the county ecosystem (Peters et al., 2013). A permanent presence ensures support continues beyond project cycles. Multidisciplinary expertise spanning health informatics, child protection, IT, and capacity building strengthens implementation. Deep community relationships enable trust-based engagement. An academic mandate allows systematic documentation and integration of competencies into curricula. A student workforce provides a renewable source of talent for ongoing support. MMUST, by virtue of its location, mandate, and disciplinary breadth, possessed precisely these capabilities. The problem was not the absence of technical solutions, since both HIS and CPIMS existed as well-designed systems, but rather the absence of a local institutional mechanism for sustained last-mile implementation and support.

Implementation of the Anchor Institution Model

The "anchor institution" model was operationalised through MMUST serving as the embedded, local implementation hub for both independent systems across six Western Kenya counties.

Implementation Structure

MMUST's role was organised into six core pillars.

Project Leadership and Institutional Anchoring: MMUST served as the primary anchor for both the USAID/UoN-funded HIS project and the UNICEF/UoN-supported CPIMS implementation. A designated Project Coordinator, with the support of Project Activity Leads and Project Technical Assistants based at MMUST, assumed sole responsibility for oversight, execution, and accountability for both systems. While maintaining separate work plans and reporting lines to UoN for each system, housing coordination within a single university office created efficiencies in stakeholder engagement, logistical management, and resource.

Strategic Liaison and Stakeholder Engagement: The Project Coordinator served as the critical liaison among UoN, the MMUST administration, and two distinct sets of county stakeholders: County Health Management Teams (CHMTs) for HIS and County Departments of Children's Services (DCS) for

CPIMS. This dual role required navigating different governance structures, professional cultures, and reporting hierarchies, a competency single-sector organisations would not possess.

Contextualised Capacity Building: Moving beyond one-off training, MMUST developed comprehensive, sustainable capacity building for both systems, guided and led by the UoN, the technical lead. For HIS, this included competency-based training for DHIS2, EMRs, and eCHIS, tailored to different health worker cadres; integration of HIS modules into key university schools' programmes; short courses for in-service workers; and online learning platforms. For CPIMS, parallel activities included training for child protection officers and case workers; integration into Sociology, Social Work, and Community Development programmes; specialised materials on confidentiality and case tracking; and refresher training with ongoing mentorship. While content streams remained separate, they benefited from shared institutional infrastructure.

Technical Implementation and Digital Systems Strengthening: MMUST played a hands-on role in rollout and scale-up. For HIS, this included strengthening DHIS2 and the Kenya Health Information System (KHIS) through on-site support; providing EMR implementation assistance including configuration, data migration, and user support; supporting eCHIS with community health volunteers; offering technical assistance for Early Infant Diagnosis/Viral Load platforms for HIV monitoring; and strengthening digital systems for malaria control campaigns including long-lasting insecticidal net (LLIN) distribution tracking. For CPIMS, parallel activities included training programmes, curriculum integration, specialised materials, and ongoing mentorship.

Embedded Technical Assistance and Ecosystem Support: MMUST deployed integrated faculty-student teams through an internship programme, placing computing and informatics students directly into county health facilities and children's offices, providing hands-on support under faculty supervision. MMUST conducted rapid ICT infrastructure assessments at health facilities and child protection offices across six counties, documenting the status of electricity, connectivity, hardware, and peripherals. Faculty actively participated in County Health Management Team meetings and child protection technical working groups. MMUST faculty provided direct technical assistance for system configuration, complex troubleshooting, data quality audits, and county-level digital strategies.

Research, Advocacy, and Journey to Self-Reliance: MMUST documented implementation experiences through evidence summaries shared with county governments, national policymakers, and development partners. The team championed USAID's Journey to Self-Reliance (J2SR) philosophy, working deliberately to foster county ownership while positioning MMUST as a long-term partner, not permanent operator. MMUST also supported the incubation of innovative solutions from student hackathons and research projects.

Results and Outcomes

Health Information System Outcomes: Health facilities under MMUST's support model demonstrated markedly faster uptake and more consistent use. DHIS2 reporting timeliness improved from 68% to 91% across supported facilities within 18 months. EMR data completeness for key HIV indicators increased from 54% to 87%. Digital recording of malaria interventions became timelier and more accurate (County Health Department Quarterly Reports, 2022-2023). MMUST, in collaboration with UoN-HealthIT, trained over 450 health workers across six counties and credentialed a cohort of County Health System Champions as peer mentors.

Child Protection Information Management System Outcomes: Child protection offices receiving MMUST support demonstrated significant improvements. Case registration completeness increased from 47% to 83%. Average lag between service delivery and documentation reduced from 21 days to 6 days.

Fifteen of 21 sub-county offices began producing quarterly data summaries to inform planning (Child Protection Services Annual Report, 2023). MMUST trained 127 child protection officers, case workers, and data clerks, and credentialed 16 County CPIMS Champions. CPIMS modules were integrated into the Bachelor of Social Work and Bachelor of Sociology programmes.

Cross-Cutting Institutional Outcomes: MMUST signed Memoranda of Understanding with all six county governments and regional Department of Children's Services offices, formalising ongoing partnerships and including county budget commitments for ongoing support. The implementation has fundamentally transformed MMUST's community relationships, with the university becoming recognised as a practical partner rather than an ivory tower institution. Computing and informatics students who participated in the internship programme demonstrated significantly higher employment rates and faster job placement than peers who did not participate, with many securing positions in ICT, IT, and digital health organisations.

Discussion

The experience of implementing HIS and CPIMS as parallel digital transformations through a shared local anchor institution yields important insights that resonate with and extend existing implementation science literature.

Comparison with Similar Studies

Our findings align with studies from other decentralised health systems in Sub-Saharan Africa. Braa and Sahay (2012) documented similar challenges with fragmented health information systems in South Africa and Mozambique, noting that centralised technical support consistently fails at the district level where infrastructure is weakest and user capacity most variable. However, their proposed solution emphasised technical standardisation (the "flexible standards strategy") rather than institutional anchoring. Our study suggests that technical solutions alone are insufficient without permanent local institutional capacity.

Kiberu et al. (2017) reported parallel challenges in Uganda's District Health Information Software implementation, where the distance from the national technical team in Kampala led to prolonged system downtime and data quality issues. Their evaluation recommended decentralised technical support but did not specify an institutional mechanism. Our MMUST case provides concrete evidence that a proximate university can effectively fill this role.

More recently, Sanders et al. (2023) argued that implementation science in African health systems has underemphasized the importance of context, particularly the institutional infrastructure for last-mile support. Our findings empirically validate this claim, demonstrating that context is not merely a moderating variable but the central determinant of implementation success when technical solutions are otherwise sound.

The J2SR philosophy guiding our model finds precedent in the work of Peters et al. (2013), who advocated for implementation research that deliberately builds local capacity and ownership. Our experience suggests that J2SR is most effective when interpreted as "support for self-reliance" rather than "withdrawal of support", a distinction with implications for donor strategy design.

The Last Mile as a Governance and Stewardship Challenge

This case illuminates that the persistent "last mile" challenge is fundamentally a governance and stewardship gap, not a technical or financial one. Both systems were technically well-designed with substantial investment and clear national strategies. Implementation faltered because the governance architecture for last mile support was missing. The national technical lead could not provide ongoing,

contextualised support. Counties lacked specialised technical staff. Private contractors could not offer permanent presence and community embeddedness.

MMUST succeeded in filling this governance vacuum, creating a unified, locally accessible support structure for both parallel systems. The university's permanent presence, academic mandate, and community relationships enabled a role no other organisational type could replicate (Braa & Sahay, 2012). Effective implementation requires permanent local institutions capable of ongoing stewardship: coordinating stakeholders, troubleshooting, refreshing skills, adapting to change, and advocating for resources.

The Tripartite Model: Clarity of Roles and Complementarity

Success rested on clear role differentiation. International funders (USAID, UNICEF) provided strategic frameworks, financial resources, and accountability. Their flexibility in allowing resources to be channelled through a shared local anchor benefited both systems without compromising distinct identities. UoN, as the shared national technical lead, ensured technical fidelity to national standards for both systems, maintaining system integrity and alignment with national policies. MMUST, as the local implementation anchor, owned contextualisation and adoption, translating national designs into locally appropriate practices, providing ongoing support, and building local capacity for self-reliance.

The model's strength lay in complementarity. No single partner could have played all three roles effectively. The model created a complete implementation ecosystem.

Parallel Systems, Shared Infrastructure, and Economics of Last Mile Support

Maintaining separate support structures for HIS and CPIMS would have been prohibitively expensive. Each would have required its own training programmes, technical assistance teams, and support hotlines, duplicative investments neither funder could sustain, and counties could not coordinate.

By anchoring both systems within MMUST, partners achieved significant economies of scope. The same institutional infrastructure (project coordination office, training facilities, student internship programme, faculty expertise) supported both implementations with marginal additional costs for the second system. These economies did not require merging systems or compromising distinct identities. What was shared was the local institutional mechanism for last-mile support, the "delivery infrastructure" rather than the systems themselves. This suggests a generalisable principle: establishing a shared local implementation anchor can dramatically reduce costs and complexity while preserving each system's integrity.

Limitations of the Study

Several limitations warrant attention. First, this was a single-region study conducted in six counties of Western Kenya. While the findings are theoretically generalisable, the specific implementation context, MMUST's pre-existing institutional capacity, the particular configuration of donor partnerships, and the historical timing may limit direct replicability without adaptation. Second, the absence of a control group or comparator sites without MMUST's anchor support means we cannot definitively attribute observed improvements to the anchor model rather than other concurrent investments. Third, our data relied partly on routine programme monitoring systems whose data quality, while audited, may contain unmeasured biases. Fourth, we did not conduct a cost-effectiveness analysis; although we argue that the model achieves economies of scope, we cannot quantify the marginal cost of adding a second system to existing anchor infrastructure.

Future research should evaluate CPU anchor models across multiple regions with varying institutional capacities; conduct longitudinal studies that extend beyond project cycles to assess true sustainability; perform rigorous cost-effectiveness analyses comparing anchor models to alternative support mechanisms; and investigate the minimum institutional capacity threshold required for successful anchor functioning.

A Replicable Framework for Local Implementation Anchors

Based on the MMUST experience and informed by existing implementation science frameworks (Damschroder et al., 2009; Peters et al., 2013), we propose a five-component framework for establishing county-proximate universities as local implementation anchors in decentralised governance contexts.

Component One: Institutional Selection and Capacity Assessment

Selection criteria should include physical proximity to implementation sites; relevant academic programmes spanning technical and social science disciplines; established community relationships with county governments, health facilities, and social service offices; functional infrastructure, including reliable internet access, training facilities, and administrative systems; leadership commitment; and experience with external grants. Where candidate institutions lack certain capacities, an initial investment phase should address gaps before full implementation.

Component Two: Formal Partnership Architecture

Essential elements include Memoranda of Understanding between the anchor institution and each funding partner specifying scope, resources, and accountability; agreements with national technical leads defining the relationship between central technical authority and local implementation responsibility; county-level partnership agreements with health and child protection departments formalising the anchor's role; and governance structures including steering committees, technical working groups, and regular review meetings. These agreements should be explicit about distinct treatment of each parallel system while enabling shared local infrastructure.

Component Three: Multi-Layered Capacity Building

Essential elements include pre-service integration embedding system competencies into relevant university curricula; in-service training programmes tailored to different user roles and delivered through formats appropriate to each context; champion development identifying and credentialing outstanding users as peer mentors and first-line support; supervisor engagement ensuring managers understand systems and can support staff; and sustainability planning anticipating staff turnover with mechanisms for orienting new users without waiting for formal training cycles.

Component Four: Embedded Technical Support Infrastructure

Essential elements include help desk functions accessible via phone, messaging, or email for routine queries; site visit schedules to ensure periodic in-person support; student internship programmes that deploy trainees for hands-on assistance; troubleshooting protocols and escalation pathways for problems beyond local capacity; and knowledge management systems that document common problems and solutions.

Component Five: Transition and Sustainability Planning

Essential elements include county ownership milestones specifying when responsibility for different functions will transfer to county staff; resource commitments from county governments embedded in MoUs and budget processes; champion networks providing peer-based support independent of the anchor institution; alumni tracking, maintaining relationships with trained users; and periodic reassessment of the anchor's role as county capacity grows.

Conclusion

The effective implementation of parallel digital systems in decentralised settings is fundamentally dependent on strong local ecosystems that provide sustained, contextualised support. This paper has demonstrated that a county-proximate university can serve as an indispensable local implementation anchor for multiple independently funded systems, such as HIS and CPIMS.

The last mile is primarily a governance challenge, not a technical one. Filling the governance vacuum with a permanent local institution proved essential. Universities possess unique capabilities for the anchor role: permanent presence, academic mandate, multidisciplinary expertise, community relationships, and a renewable student workforce. Parallel systems can benefit from shared local infrastructure without compromising their independence, achieving economies of scope while preserving each system's integrity. The tripartite model of international funder, national technical lead, and local implementation anchor offers a replicable architecture for digital transformation.

For Kenya and similar countries pursuing digital transformation in decentralised contexts, explicit policy and funding to empower regional universities as implementation anchors should be a priority. The alternative—continued reliance on distant national technical support or short-term external consultants—will perpetuate fragmented implementation, unsustainable gains, and unrealised potential. The ultimate beneficiaries are vulnerable populations: when health workers have reliable information systems, quality of care improves; when child protection officers have functional systems, vulnerable children receive more timely support. The MMUST experience demonstrates that regional universities, when intentionally empowered and adequately resourced, can become powerful engines of equitable digital transformation, bridging the last mile, building sustainable capacity, and ensuring that investments yield lasting returns for communities.

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