LEFT BEHIND BY DESIGN: Digital Agriculture, Land Rights, and the Exclusion of Small-Scale Farmers

Mpongwe District, Copperbelt Province, Zambia

Digital Agriculture · Artificial Intelligence · Land Rights · Community Food Sovereignty

17–18 April 2026
Venue: DENMEV Garden Lodge, Mpongwe District

1. Executive Summary

This Technology Assessment Report presents the findings of a structured two-day participatory assessment conducted in Mpongwe District, Copperbelt Province, Zambia, on 17–18 April 2026. The assessment was designed to examine how the convergence of digital technologies, artificial intelligence (AI), and agro-chemical innovations is reshaping farming systems, rural livelihoods, land use patterns, and environmental sustainability across one of Zambia's most strategically significant agricultural regions.

Mpongwe District sits within Agro-Ecological Zone II (AEZ II), widely regarded as Zambia's most agriculturally productive belt, characterised by reliable rainfall, fertile soils, and significant smallholder farming activity alongside expanding large-scale commercial operations. The district represents a critical flashpoint where the promises of agricultural modernisation intersect with deep-seated structural vulnerabilities including land insecurity, digital exclusion, and the erosion of indigenous farming knowledge.

The assessment was undertaken against a backdrop of accelerating agricultural digitalization at both national and sub-national levels, including the rollout of the Zambia Integrated Agricultural Management Information System (ZIAMIS) — a government-managed digital registry linking farmer identity, subsidy entitlements, and input procurement. As digital platforms increasingly serve as a gatewayto access to government services and markets, questions about data governance, corporate power, and farmer agency have become urgent but remain largely unaddressed in policy frameworks.

Methodology

The assessment employed a participatory action research methodology over two days, bringing together smallholder and subsistence farmers, women's farming groups, youth agricultural workers, district-level government officers from the Ministries of Agriculture and Lands, and civil society representatives working on food sovereignty, digital rights, and environmental sustainability. The process was designed to centre community voices and generate evidence from the ground up, using structured dialogue, focus group discussions, and direct observation. The assessment was undertaken by Africa Technology Assessment Platform (AfriTAP), Mizu Eco Care and the Zambia Allicance for Agroecology and Biodiversity(ZAAB).

Key Findings

Five interrelated themes emerged from the assessment, each pointing to the same underlying tension: digital and technological change is advancing faster than the governance and community capacity needed to manage it equitably.

The first and most foundational concern is a significant digital literacy gap. Smallholder farmers are broadly aware of digital tools but lack substantive understanding of AI systems, data governance principles, and their rights as data subjects. This gap is wide and largely unaddressed by current agricultural extension services.

Closely related is the question of data governance within ZIAMIS and similar platforms. Farmers are enrolled in digital registries that link subsidy access to the adoption of commercial inputs, often without meaningful informed consent. There is no clear or accessible information on who controls farmer data, how it is shared, or what legal protections apply a situation that leaves communities exposed to exploitation they cannot see or challenge.

Corporate dependency represents a third and growing concern. Agribusiness companies operating in the district actively promote hybrid seed varieties that require purchase every season, systematically eroding seed sovereignty. Digital platforms are accelerating this dependency by embedding commercial input supply chains into the architecture of subsidy and market access systems, making it structurally difficult for farmers to choose otherwise.

Underlying all of these dynamics is land tenure insecurity. The majority of smallholder farmers hold customary land rights that are unregistered or legally ambiguous, preventing access to formal credit,

discouraging long-term investment in soil health, and leaving communities vulnerable to displacement by commercial interests seeking large agricultural landholdings.

The fifth finding concerns the erosion of agroecological practice. Indigenous seed systems, traditional intercropping methods, and organic soil-building techniques are in measurable decline, displaced by structural incentives embedded in subsidy programmes and digital market platforms that consistently reward monoculture production using hybrid seeds and synthetic inputs.

Finally, the assessment identified significant governance gaps at district and provincial level. Government officers lack clear guidance on digital data policy and Free, Prior and Informed Consent (FPIC) obligations as they apply to farmer data.

Overall Assessment

Taken together, the findings indicate that agricultural digitalization in Mpongwe District is proceeding at a speed and pace faster than the regulatory, institutional, and community capacity needed to govern it equitably. Currently the deployment of digital tools concentrates benefits among corporate interests while pushing the risks data exploitation, input dependency, displacement, and knowledge loss onto smallholder farmers, particularly women and youth. Without targeted intervention at the levels of policy, governance, and community empowerment, the digital transformation of agriculture risks deepening inequality across Zambia.

This report proceeds to detailed analysis of each finding area, followed by specific recommendations addressed to national government, district authorities and civil society organizations.

1. Introduction & Background

Community and District Profile

Mpongwe District is located in Agro-Ecological Zone II of Zambia's Copperbelt Province a region characterised by favourable rainfall, fertile soils, and conditions well suited to both commercial and small-scale crop production. The district is a key agricultural hub, particularly for maize and other staple crops, and is home to a mix of smallholder farmers and large corporate farms, with the latter controlling a disproportionate share of titled land.

The District position within the Copperbelt also places it in proximity to major mining activities, creating a complex development landscape where agricultural productivity, technological investment, and environmental pressures intersect. This dual character as both a key farming area and a zone shaped by extractive industry makes Mpongwe a strategically important location for examining how agricultural technologies are introduced and how they may influence farming systems, livelihoods, and environmental sustainability.

The Zambian government's ambition to increase maize production to 3 million metric tonnes and soya bean and wheat production to 1 million metric tonnes is driving investment in mechanised and digital technologies across agricultural districts. This policy direction, heavily influenced by the Alliance for a Green Revolution in Africa (AGRA) and other develoopment actors shapes the technological landscape within which Mpongwe's farmers must operate.[1]

Purpose of the Assessment

This Technology Assessment was designed to gather first-hand community evidence on how digital tools, AI, and agro-chemical technologies are shaping farming systems and livelihoods in Mpongwe. Specifically, it aimed to:

- Understand how digital tools, AI, and agro-chemicals are influencing farming systems, livelihoods, land use, and environmental sustainability.
- Fill a significant gap in community-level evidence on the impact of digital tools and AI on Zambia's agricultural sector.
- Provide a platform for collective reflection on emerging agricultural technologies with emphasis on informed decision-making and Free Prior Informed Consent
- Facilitate conversations on governance frameworks for agricultural digitalization with local communities.
- Develop locally articulated principles on data ownership, consent, transparency of algorithms, accountability of providers, and public versus private control of digital infrastructure.

The assessment was undertaken by Africa Technology Assessment Platform (AfriTAP), Mizu Eco Care and the Zambia Allicance for Agroecology and Biodiversity(ZAAB).

[1] AGRA's influence on Zambia's agricultural policy is well documented. Critics argue its model prioritises commercial input adoption over agroecological alternatives. See: GRAIN (2021). Digital Control: How Big Tech Moves into Food and Farming. GRAIN Briefing; and Wise, T. A. (2020). Failing Africa's Farmers: An Impact Assessment of the Alliance for a Green Revolution in Africa. Global Development Policy Center, Boston University.

Expected Outcomes

The assessment was designed to produce the following outputs:

- Focus group documentation of community concerns around AI and digital agriculture.
- Joint advocacy messages developed with CSOs and farmers on technology governance and the need for community protections.
- Demands and proposals for FPIC mechanisms in the development of agricultural technology in Zambia.
- Locally articulated governance principles for institutionalising participatory technology assessments that include marginalised groups and reflect diverse knowledge systems.

2. Methodology

Participatory Action Research (PAR) Framework

This assessment was grounded in Participatory Action Research (PAR) a collaborative approach that repositions communities from subjects of research to co-producers of knowledge. In conventional research, communities are treated as sources from whom data is extracted by external experts. PAR rejects this model: the lived experiences, observations, and interpretations of smallholder farmers and community members are not merely evidence to be gathered but are the primary epistemic foundation of the inquiry.

PAR is particularly important in the context of agricultural technology assessment because the communities most affected by decisions about digital platforms, seed systems, and data registries are structurally the least involved in making those decisions. Zambian smallholders many of whom are semi-subsistence farmers with limited formal education, limited connectivity, and limited familiarity with data systems are in a weak position to negotiate the terms on which their data is collected and used, or to understand the downstream implications of enrollment in platforms like ZIAMIS. PAR creates opportunities for structured conversations to begin.

PAR operates on three interlocking commitments that shaped every stage of this assessment:

PAR Commitment	How It Was Applied in Mpongwe
Participation	Farmers, CSO representatives, and government officers were active participants in shaping the inquiry, not passive respondents. Sessions were designed as dialogues — with facilitated space for communities to raise concerns beyond the assessment's initial scope, including land tenure, seed sovereignty, and corporate dependency.
Action	The assessment was explicitly designed to produce outputs that enable action: documentation of community concerns for advocacy, capacity-building through knowledge-sharing during the sessions, and recommendations grounded in participants' own priorities. The process itself functioned as an advocacy and awareness-raising exercise.
Research	Rigorous mixed-methods data collection focus groups, questionnaires, individual testimony, and plenary discussion ensured findings are systematic, evidence-based, and defensible to external audiences including policymakers, regulators, and development partners.

A further hallmark of PAR is its commitment to returning findings to those who generated them. The assessment team committed to sharing this report with participating communities in accessible formats, and to supporting farmers and CSOs in using the findings for advocacy, policy engagement, and community-centred interventions.

Why PAR for Agricultural Technology Assessment?
Technology is never neutral. Every design choice embedded in digital agricultural platforms which data fields are collected, which farming practices are rendered legible, which crops are tracked, who can access the data reflects a set of values and priorities. When those choices are made exclusively by government ministries, donor agencies, and corporate players, the resulting system will inevitably reflect their interests. PAR creates the conditions for those choices to be identified, questioned, and revised by the farming communities and the systems claim to serve.

Assessment Design

The one-day assessment was structured to reflect the PAR cycle of inquiry, reflection, and action, and pursued two interrelated objectives:

- Generate primary qualitative data on community experiences with digital agricultural tools, ZIAMIS, agro-chemical inputs, land tenure insecurity, and data governance.
- Build awareness and capacity among participants by introducing key concepts linking agricultural digitalization to global data economies, corporate interests, and community rights enabling farmers to situate their experiences within broader technological and policy contexts that had previously been opaque to them.

The second objective is a deliberate PAR technique: participants did not simply provide information, they also received it. Framing sessions on data ownership, AI assumptions, and data governance were designed so that community members could engage as informed co-analysts rather than only as testimony providers. The assessment functioned simultaneously as a research process and a knowledge-equalisation exercise.

Participant Selection

Participants were selected to ensure a diverse cross-section of stakeholders directly connected to the assessment's thematic focus areas. The PAR principle of inclusion shaped selection: the team prioritised those most directly affected by agricultural technology decisions, including smallholder farmers, women farmers, and settlement area farmers with limited formal land tenure.

Day	Participant Group	Representation
17 April2026 DENMEV Garden Lodge	Local small-scale farmers; Civil Society Organisations; media representatives; advocacy organisations and	Smallholder farming communities; CSOs working on agriculture, land rights, and environmental sustainability; regional media
	Government representatives from Ministry of Agriculture; extension officers; land administration officials; district-level officers	District-level agriculture and land governance institutions; field extension services; regulatory and planning bodies

Data Collection Methods

A mixed-methods approach was used, with each method chosen to operationalise the PAR commitment to community-generated knowledge:

Framing Presentations and Plenary Discussions

The assessment team delivered framing presentations on the following topics: data, AI, and farmer data ownership; assumptions embedded in technology (technology as adverse, neutral, positive, and political); types of technology; linking technology to agriculture; digital tools in Zambia; development versus community and environmental rights; linking technology to land tenure. These

presentations served a deliberate PAR purpose knowledge equalisation enabling community participants to engage as informed co-analysts of the technologies being assessed, not only as users or subjects. Plenary discussions followed each presentation, opening space for experience sharing and critical reflection.

Focus Group Discussions

Structured focus group discussions were held with homogeneous groups smallholder farmers, CSO representatives, and government officers. The homogeneous grouping reflects a PAR sensitivity to power dynamics: mixing smallholder farmers with government officials in the same discussion group can suppress community voice and distort findings. Separating groups enabled each to speak freely about their experiences, priorities, and concerns. Focus groups explored: digital tool use and implications; seed systems and corporate dependency; land tenure and technology access; and data governance and FPIC.

Structured Questionnaires

Written questionnaires were administered to farmers and government representatives across both days, using a combination of closed and open-ended questions. Three questionnaire instruments were used: a farmers' technology assessment questionnaire; a data privacy and policy questionnaire; and a political economy questionnaire exploring implications of agricultural technology. Facilitated group completion was used where literacy levels required it, and questionnaire data was cross-referenced with focus group findings to strengthen validity.

Individual Testimony and Reflection

Space was created throughout both days for individual participants to share specific experiences — with particular agricultural technologies, with extension services, with compensation or subsidy processes, or with land displacement by corporate farming interests. Consistent with PAR principles, these individual accounts were treated as expert witness testimony rather than anecdote, and are woven into the findings as case-level evidence of systemic patterns.

Ethical Considerations

The assessment team adhered to the following ethical standards, each consistent with PAR's foundational commitment to community dignity and agency:

- **Informed Consent**: All participants were informed of the purpose of the assessment, how their contributions would be used, and their right to decline participation or withdraw information at any time.
- **Anonymisation**: Individual names are anonymised in this report except where participants explicitly consented to identification.
- **Do No Harm**: Recognising that some participants — particularly those in informal farm settlements with insecure land tenure — may face risks from public association with advocacy positions, sessions were designed to avoid generating undue risk.
- **Feedback Commitment:** Participants were informed that findings would be shared with them in accessible formats, and that the assessment team would support communities in using the report for advocacy, policy engagement, and follow-up action.
- **FPIC as Practice:** The process itself modelled the FPIC principles it was assessing. Participants were not required to engage with any element of the assessment without prior, freely given consent.

3. Current Technology Landscape

National Agricultural Policy Context

Zambia's agricultural sector is undergoing rapid transformation driven by two interconnected policy imperatives: the government's production ambition (3 million metric tonnes of maize; 1 million metric tonnes of soya beans and wheat) and a digitalization agenda anchored in the National Digital Transformation Strategy 2023–2027 and the National Artificial Intelligence Strategy. Both are shaped heavily by AGRA's model of agricultural development, which links digital farmer registration to access to subsidised hybrid seeds and synthetic fertilizers.[2]

The Smart Zambia Institute is the primary institutional vehicle for digital transformation across government sectors, including agriculture. At the sectoral level, the Ministry of Agriculture is implementing digitalization through tools such as ZIAMIS, the e-voucher system, Hello Tractor, and the Farmer Input Support Programme (FISP) digital codes. These tools are positioned as efficiency and targeting improvements, but their governance implications for smallholder farmers have not been systematically assessed.

ZIAMIS: The Zambia Integrated Agricultural Management Information System

ZIAMIS is the central digital platform for Zambia's agricultural sector, modelled closely on Kenya's KIAMIS. It has assigned unique digital IDs to more than 4.3 million farmers across Zambia one of Sub-Saharan Africa's largest farmer biometric and profile databases. ZIAMIS serves three core functions:[3]

- Digital farmer registration and identification: Each enrolled farmer receives a unique digital ID linked to personal data, landholding information, crop types, and location. This registry serves as the government's single source of truth for agricultural programming.
- Subsidy digitalisation (e-incentives): ZIAMIS underpins the transition from paper-based subsidy distribution to a digital e-voucher system, enabling the government to direct inputs seeds, fertilizers, and agrochemicals to registered farmers.
- Productivity monitoring and data provision: The platform tracks agricultural output at farm level, providing government and private sector partners with granular data on planting patterns, yields, and input use.

> **Critical Concern**
> By tying subsidy access to digital registration and adherence to state-promoted crop choices, ZIAMIS functions as a surveillance instrument that can condition farmer behaviour. Farmers who diverge from promoted practices risk exclusion from input support, creating structural pressure to conform to government and corporate agendas. Questions of who controls this data, under what conditions it is shared with private sector actors, and what redress exists for farmers who are misregistered or excluded were not clearly articulated. [4]

[2] Republic of Zambia (2023). National Digital Transformation Strategy 2023–2027. Smart Zambia Institute, Lusaka; and Republic of Zambia (2023). National Artificial Intelligence Strategy. Smart Zambia Institute, Lusaka.

[3] ZIAMIS enrollment figures as reported by the Ministry of Agriculture, Zambia (2024). As one of Sub-Saharan Africa's largest farmer biometric databases, ZIAMIS raises significant data governance questions. See also: Zossou et al. (2020). Understanding Factors Influencing the Adoption of Smartphones and Agricultural Applications among Farmers in Sub-Saharan Africa. Agriculture, 10(9), 416.

[4] The use of digital farmer registries to condition subsidy access is a documented concern across AGRA-supported programmes. See: GRAIN (2021); and Nyantakyi-Frimpong, H. (2021). Agroecology, Political Ecology and the Social Dimensions of Technology in African Agriculture. Journal of Peasant Studies, 48(5), 935–953.

Digital Tools Currently in Use

Participants identified the following digital tools as part of the current agricultural technology landscape in Mpongwe:

Tool / Platform	Function and Current Use
ZAMIS Platform	Registration-based system enabling farmers to access agricultural vouchers and extension services. Used for FISP input distribution. Farmers report limited clarity on data governance.
Mobile Phones	Central communication tools for receiving real-time notifications from farmers' union representatives on weather updates, market prices, and agricultural advisories.
Lima Links	Digital platform facilitating farmers' access to markets, enabling selling of produce and connection with buyers.
Mobile Money Services	Enabling farmers to access e-loans, purchase agricultural inputs, and conduct financial transactions. Reduces risks associated with cash handling.
SeedCo Applications	Mobile-based application that helps identify crop diseases through images and recommend treatments including pesticides and prices. Raises data ownership questions.
Hello Tractor	Government-promoted mechanisation platform under the Mechanised 360 programme, supporting tractor access for smallholders.
Social Media Platforms	Used by farmers to buy and sell agricultural inputs and produce. Informal but widely adopted channel for agricultural commerce.
ZMD Weather Forecasts	Zambia Meteorological Department weather forecasting platforms used for planting season planning.

Agrochemical and Seed

Chemical technologies fertilizers, pesticides, and herbicides are widely used across Mpongwe, and are increasingly bundled with digital platform enrollment. The shift from indigenous local seed varieties to commercially produced hybrid seeds is well advanced, with significant implications for soil health, biodiversity, and farmer autonomy. Participants noted that some technologies promote hybrid and potentially GMO seeds under labels that obscure their nature, limiting farmers' ability to make informed choices.

The government distinguishes between hybrid seeds and GMO seeds (largely restricted by law, though some processed GMO food products are permitted). Participants expressed concern that this distinction is not clearly communicated to farmers, and that AI and digital technologies are increasingly being used in seed development and plant breeding in ways that deepen corporate control over agricultural inputs.

Policy and Funding Architecture

The technological landscape in Mpongwe is not shaped by farmer demand alone it reflects specific choices made by funders and policy architects. AGRA and other bilateral donors have huge influence on Zambia's national agricultural policy. The policy framework that ZIAMIS operationalises is oriented toward commercial maize expansion and input-intensive farming. AGRA's model documented across Kenya, Tanzania, Ghana, and other African contexts consistently channels state resources toward commercial input adoption while marginalising smallholder farming systems that do not conform to the productivity metrics embedded in platform design.

The National AI Strategy acknowledges the role of AI in agricultural decision-making but does not articulate community data rights, FPIC obligations, or governance frameworks for platform accountability. The National Local Content Strategy and Vision 2030 reference community benefit and sustainability, but do not create enforceable community protections.

4. Stakeholder Analysis

Key Stakeholders and Technology Roles

Stakeholder	Technology Role	Key Needs & Interests	Current Capacity & Gaps
Smallholder farmers Mpongwe,	End users of digital tools and ZIAMIS; primary subjects of data collection; potential community monitors	Seed sovereignty, secure land tenure, fair compensation, data rights, locally relevant advisory services	Strong indigenous knowledge; limited digital literacy; no awareness of data governance rights or ZIAMIS implications
Women farmers[5]	Often lack formal land tenure; specific barriers to ZIAMIS registration and e-voucher access	Land documentation, inclusion in digital subsidy systems, gender-responsive extension services	Systematically underrepresented in formal agricultural systems; face additional barriers to technology benefit
Civil Society Organisations	Advocacy intermediaries; potential digital monitoring agents; capacity builders for community rights	Sustained funding, technical capacity on digital rights, joint advocacy platforms	Active on land and environmental rights; limited specific capacity on digital agriculture governance and ZIAMIS
Ministry of Agriculture / Extension Officers	ZIAMIS implementers; e-voucher administrators; extension service providers	Farmer compliance with registration, production targets, ministry mandates	Limited awareness of broader data governance frameworks; extension services under-resourced; digitalization at early stage
Agro-companies and input suppliers	Technology deployers; seed and input vendors; downstream recipients of ZIAMIS farmer data	Market access, regulatory permissiveness, farmer enrollment and compliance	Significant market power; limited accountability for downstream harms; opacity on data use
AGRA and bilateral donors	Policy architects; funders of ZIAMIS and national agricultural transformation agenda	Production targets, digitalization metrics, commercial input adoption rates	Significant structural influence over national agricultural policy; accountability to communities weak

[5] Women constitute an estimated 60–80% of food producers in Sub-Saharan Africa yet are systematically underrepresented in formal agricultural systems and face additional barriers to digital platform registration. See: FAO (2011). The State of Food and Agriculture: Women in Agriculture. Rome; and Sachs, J. D. et al. (2019).

5. Findings & Analysis

Digitalization and AI

Despite the rapid expansion of digital tools in Zambia's agricultural sector, the assessment found that awareness of tools does not translate into understanding of their governance implications. Farmers demonstrated familiarity with specific applications mobile money, SeedCo disease detection, Lima Links, FISP digital codes but expressed limited understanding of how data generated through these tools is stored, who accesses it, and how it may be used.

Knowledge of AI remained conceptual and abstract among most participants. The framing sessions on AI and data explaining that AI uses powerful computers to process large amounts of agricultural data to generate insights such as crop advice, disease detection, and weather forecasts were experienced by most participants as new information. The infrastructure requirements of AI (data centres, electricity, water for cooling) and their potential competition with community needs were entirely unknown.

- Digital tools were sometimes seen as unreliable due to generalised recommendations that do not reflect local soil or climatic conditions.
- Limited digital literacy and exposure to scams reduced effective use of digital tools.
- Farmers lacked clarity on who controls or benefits from the agricultural data they generate through platform enrollment.
- Cyber laws and data protection regulations were known to exist but not understood in terms of their practical implications for farmers.

ZIAMIS, Data Governance, and Surveillance Risk

ZIAMIS emerged as the most significant and contested technology in the assessment. Participants including government extension officers confirmed its use for input distribution but were unable to clarify data governance arrangements, data sharing with private companies, or community redress mechanisms for misregistration.

The assessment found that ZIAMIS exhibits several features that PAR-based analysis identifies as structural risks to community autonomy:

- **Behavioral coercion through subsidy linkage:** By tying subsidy access to registration and compliance with promoted practices, ZIAMIS creates structural pressure to adopt specific commercial inputs regardless of their suitability to local conditions.
- **Agroecological invisibility**: The platform is optimised to make commercial monoculture practices legible and supported. Agroecological farming systems — intercropping, seed saving, polyculture, soil-building rotations are not captured in ZIAMIS design and are therefore systematically undervalued."
- **Corporate data access**: Private sector actors are downstream recipients of government-collected farmer data, facilitating targeted marketing of seeds, fertilizers, and agrochemicals deepening structural dependency on commercial input supply chains.
- **Governance deficit:** Neither farmers nor extension officers could describe the regulatory framework governing ZIAMIS data, creating conditions in which misuse would be difficult to identify or challenge.

Scale and Urgency
With 4.3 million farmers enrolled, any design flaws or governance failures in ZIAMIS will have consequences at a national level before they can be identified and corrected through normal administrative processes. The irreversibility of some harms once farmers shift from diverse agroecological practices to input-dependent monocultures, returning to more resilient systems is difficult and costly makes community-centred governance reform urgent.

Seed Systems, Corporate Dependency, and Agroecological Erosion

Participants consistently raised concerns about the trajectory of seed systems in Mpongwe. The dominance of commercially produced hybrid seeds incentivised by ZIAMIS's subsidy architecture is eroding the diversity of local and indigenous seed varieties that have historically anchored food security and ecological resilience in the district.

- Some agro-companies promote seeds that require repeat annual purchase from agro-dealers, creating structural dependency that mirrors the pattern of corporate input lock-in documented across AGRA-supported programmes in other African contexts.[6]
- Concerns were raised that GMO seeds may be entering the market indirectly under hybrid seed labels, limiting farmers' ability to make informed choices.
- Chemical inputs bundled with hybrid seed packages herbicides, pesticides, synthetic fertilizers were widely acknowledged to contribute to soil degradation over time, while reducing the viability of traditional soil management practices.
- Indigenous knowledge systems are declining as hybrid seeds and synthetic inputs dominate extension recommendations and subsidy access, reducing crop diversity and the intergenerational transmission of agroecological knowledge.[7]

Land Tenure, Technology Access, and Displacement Risk

The relationship between land tenure insecurity and technology access emerged as a critical structural barrier in Mpongwe. The assessment found a mutually reinforcing cycle of exclusion:

- Farmers without formal land documentation cannot access loans requiring land as collateral, limiting investment in productivity-enhancing technologies.
- Digital mapping technologies, including GPS land measurement, can inadvertently expose undocumented landholdings: if mapped land is larger than what a farmer formally claims, the additional area may be allocated to investors.[8]
- Corporate farms already control a disproportionate share of titled agricultural land in Mpongwe. Digital agricultural platforms that enhance the productivity and market access of formally tenured commercial farms accelerate the relative marginalisation of smallholder farming systems.
- Limited coordination between the Ministry of Agriculture and land administration authorities means that digital agricultural systems are being deployed without consideration of their land tenure implications for smallholders.

Government extension officers acknowledged weak land protection systems for smallholders and raised concerns about unequal power dynamics between traditional authorities and investors, particularly in the absence of strong freehold protections equivalent to those found in other countries.

[6] Corporate seed dependency and the erosion of farmers' seed sovereignty are documented across AGRA programme countries. See: Scoones, I. et al. (2019). Narratives of Scarcity: Understanding the 'Global Land Rush'. World Development, 131, 104952; and Chirwa, E. & Dorward, A. (2013).

[7] The decline of indigenous seed systems and traditional agroecological knowledge in Sub-Saharan Africa has been extensively studied. See: Altieri, M. A. & Nicholls, C. I. (2017). The Adaptation and Mitigation Potential of Traditional Agriculture in a Changing Climate. Climatic Change, 140(1), 33–45; and Shiva, V. (2016). Staying Alive: Women, Ecology and Development. North Atlantic Books.

[8] The use of digital land mapping tools in contexts of informal tenure can expose smallholders to land loss. See: Cotula, L. (2011). Land Deals in Africa: What is in the Contracts? IIED, London; and Anseeuw, W. et al. (2012).

Digital Inclusion, Technology Design, and the Dual Land Tenure System

Digitization in the farming space exists primarily in the form of digital applications and platforms. However, issues of accessibility mean that a significant proportion of small-scale farmers who are among the poorest in the country may not fully benefit from these technologies. This raises a foundational question about whether the design of agricultural technology adequately takes into consideration the needs and circumstances of small-scale farmers in the first place. Critical examination is needed of whether the design of these technologies genuinely incorporate the voices and realities of grassroots farming communities, who constitute the majority of the farmer population.[9]

In its current form, digital agricultural technology disproportionately favours commercial farmers and multinational farming stakeholders. These actors benefit from the compounding advantage of owning large tracts of formally titled land a particularly significant factor in this prime agricultural block. The majority of small-scale farmers, by contrast, do not hold title to the land they farm, which is predominantly traditional land under the jurisdiction of customary chiefs. This dual land tenure system whereby statutory title and customary tenure operate in parallel but with markedly unequal legal and economic status creates structural inequality against small-scale farmers, an inequality that digital technology risks further exacerbating .

The digitization of land ownership records through the Zamportal system compounds this inequality in a specific and concrete way: those without title deeds are effectively excluded from the formal records system. Actors with financial capacity can use this gap to acquire portions of land that were allocated to small-scale farmers through traditional and informal means. What modern surveying technology would accurately measure as five hectares may have been estimated as three hectares using traditional methods. That discrepancy of two hectares a significant productive resource for a subsistence farming household can easily be lost by a small-scale farmer who has neither the access to nor familiarity with the digital tools now being used to adjudicate land boundaries.[10]

Small-scale farmers therefore urgently need education on, and fair representation in, digital technology processes that have material consequences for their land and livelihoods processes about which many currently know very little. Without deliberate intervention to bridge this knowledge and power gap, digital transformation in agriculture creates fertile conditions for injustice. The design of technology systems, land administration platforms, and policy frameworks must be reoriented to actively protect the rights and interests of customary land owners, rather than rendering them invisible in a system built around formal title.

[9] The exclusion of smallholder perspectives from agricultural technology design is a recurring theme in development literature. See: Scoones, I. & Thompson, J. (2009). Farmer First Revisited: Innovation for Agricultural Research and Development. Practical Action Publishing; and OECD (2019). Recommendation of the Council on Artificial Intelligence. OECD/LEGAL/0449, Paris.

[10] Zamportal is Zambia's official online land administration portal. Concerns about its exclusionary effect on customary landholders have been raised by civil society. See: Zambia Land Alliance (2020); and Borras, S. M. & Franco, J. C. (2012). Global Land Grabbing and Trajectories of Agrarian Change. Journal of Agrarian Change, 12(1), 34–59.

Governance, Transparency, and Accountability

Extension Service Limitations

Extension officers are under-resourced, often covering large geographic areas with limited transport, training, and technological support. Digitalization in agriculture has not yet significantly replaced extension services, but the risk of digital platforms being used to substitute for rather than strengthen human extension services was raised by participants as a concern. Advice generated by platforms like SeedCo's disease detection application is generalised and does not reflect local soil or climatic conditions.[11]

Community and Farmer Agency

Despite the structural challenges documented above, the assessment found significant evidence of farmer resilience, collective organisation, and critical awareness. Farmers articulated clear and well-reasoned concerns about corporate seed dependency, data governance, and land insecurity. Farmer groups and cooperatives in Mpongwe represent existing organisational capital that can be built upon through sustained civil society engagement.

[11] The chronic under-resourcing of agricultural extension services in sub-Saharan Africa is well documented. See: Christoplos, I. (2010). Mobilizing the Potential of Rural and Agricultural Extension. FAO and GFRAS, Rome; and Kidd, A. et al. (2000). The Privatisation of Agricultural Extension. Journal of Rural Studies, 16(2), 203–215.

6. Recommendations

For Government (National and District Level)

- ZIAMIS Data Governance: Develop and publish a binding data governance framework for ZIAMIS specifying: which data fields are collected; under what conditions data is shared with private sector actors; what community redress mechanisms exist for misregistration or data misuse; and how FPIC is operationalised in enrollment processes.
- Redesign ZIAMIS data architecture to capture and value agroecological farming practices, indigenous seed use, and diversified cropping systems — ensuring that subsidy and support access does not structurally favour commercial monoculture over diverse smallholder systems.
- Digital Land Documentation: Link digital agricultural systems with land documentation frameworks, developing digital farmer profiles connected to customary land certificates and establishing safeguards against digital mapping being used to reallocate undocumented land to investors.
- Seed Transparency Regulations: Strengthen regulations requiring clear labelling and differentiation of hybrid seeds, GMO seeds, and indigenous varieties.
- Extension Service Investment): Reverse the under-resourcing of extension services. Increase support and resources for extension officers, camp officers, and lead farmers.

For Civil Society Organisations

- ZIAMIS Governance Advocacy: Develop a focused advocacy campaign on ZIAMIS data governance, demanding public disclosure of data sharing arrangements with private sector actors and establishment of community redress mechanisms.
- Community Digital Literacy: Develop farmer-appropriate digital literacy programmes that go beyond tool use to include understanding of data rights, FPIC, platform governance, and the political economy of agricultural technology.
- Seed Sovereignty Support: Strengthen programmes supporting indigenous seed preservation, local seed banks, and agroecological farming networks. Advocate for equivalent institutional support for agroecological systems as is provided for commercial input adoption.
- Participatory Technology Assessment Scale-up: Use findings from this assessment to advocate for institutionalising participatory technology assessments across all major agricultural technology deployments in Zambia, with mandatory inclusion of marginalised groups.
- Joint Advocacy Platform: Build joint advocacy positions with farmers and CSO networks on agricultural data governance, demanding transparency, accountability, and the meaningful implementation of FPIC in agricultural digitalization.

For Communities and Farmer Organisations

- Engage FPIC Processes: Actively participate in any consultations on agricultural technology deployment, insisting on the right to prior, informed, and freely given consent before enrollment in digital platforms that collect and share personal and agricultural data.
- Document and Preserve Indigenous Knowledge: Establish or strengthen local seed banks, document traditional crop varieties and soil management practices, and share knowledge across community networks to resist the erosion of agroecological diversity.
- Organise for Data Rights: Use existing farmer groups and cooperatives as platforms for collective advocacy on data governance, land documentation, and the terms of agricultural technology deployment in Mpongwe.

- Demand Accountability from Extension Officers: Use community meetings and local governance structures to request clear information from extension officers and government representatives about ZIAMIS data governance, subsidy criteria, and seed safety.

7. Conclusions

The communities of Mpongwe District are navigating a rapid and largely externally-driven transformation of their agricultural systems. Digital tools, AI-enabled platforms, and agro-chemical inputs are being deployed at scale across Zambia's agricultural sector not in response to farmer-defined needs, but in response to production targets set by government, shaped by AGRA, and financed by bilateral donors whose track record reveals a consistent preference for commercial, input-intensive farming over locally adapted agroecological alternatives.

This assessment has documented how that transformation is unfolding in Mpongwe: through the enrollment of smallholder farmers in a digital registry (ZIAMIS) that links subsidy access to commercial input adoption; through the erosion of indigenous seed systems and agroecological practices that have historically anchored food security and ecological resilience; through land tenure arrangements that leave smallholders vulnerable to displacement by commercial farming interests; and through a governance architecture that lacks meaningful community participation, transparent data governance, or accessible accountability mechanisms.

The assessment also documented the resilience, critical awareness, and organisational capacity of Mpongwe's farming communities. Farmers articulated sophisticated concerns about corporate seed dependency, data governance, and land rights. They understand that technology is political that decisions about which technologies are promoted, whose interests they serve, and who bears their costs are not technical choices but power choices. What they currently lack are the structural support mechanisms to translate that awareness into effective advocacy: legal knowledge, organisational capacity, and access to governance processes from which they have been systematically excluded.

Closing Note
Technology is political. The task of this assessment: the advocacy, policy engagement, and sustained PAR must follow to ensure that the communities most affected by agricultural digitalisation have the knowledge, organisation, and institutional access to exercise the power that recognition of that fact demands.

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Annexes

Annex A: Framing Topics Covered During the Assessment

- Data, Artificial Intelligence, and Farmer Data Ownership
- Assumptions of Technology: Technology as Adverse, Neutral, Positive, and Political
- Linking Technology and Agriculture
- Digital Tools in Agriculture in Zambia (ZIAMIS, Lima Links, Mobile Money, Hello Tractor)
- Development versus Community and Environmental Rights
- Linking Technology and Land Tenure

Annex B: National Policy Frameworks Referenced

Policy / Strategy	Relevance to Assessment
National Digital Transformation Strategy 2023–2027	Overarching framework for agricultural digitalization; lacks specific community data rights protections
National Artificial Intelligence Strategy	Promotes AI adoption in agriculture and mining; community implications not addressed; no FPIC framework
Zambia Vision 2030	Long-term sustainable development framework; references community benefit and environmental protection
National Green Growth Strategy	Roadmap for low-carbon, climate-resilient economy; not yet integrated with digital agriculture agenda
National Local Content Strategy	35% local input requirement for FDI; limited community benefit enforcement in practice
Agricultural Policy Framework / AGRA Compact	Shapes ZIAMIS deployment and subsidy architecture; prioritises commercial input adoption

Annex C: Key Concepts and Definitions

Term	Definition
ZIAMIS	Zambia Integrated Agricultural Management Information System — the centralised digital registry platform for Zambia's agricultural sector, with unique digital IDs assigned to over 4.3 million farmers.
FPIC	Free, Prior and Informed Consent — the right of communities to give or withhold consent to projects or systems affecting their lands, resources, and rights, in advance and based on adequate information.
PAR	Participatory Action Research — a collaborative research approach that treats community members as co-producers of knowledge and commits to action based on community-generated findings.
AGRA	Alliance for a Green Revolution in Africa — a donor-funded organisation that has significantly shaped Zambia's national agricultural policy toward commercial input-intensive farming systems.
Agroecology	A farming approach based on ecological principles, including crop diversity, intercropping, seed saving, natural soil fertility management, and reduced dependence on external chemical inputs.

AI	Artificial Intelligence — technology enabling computers to process large amounts of data and generate insights such as crop advice, disease detection, and weather forecasts.
KIAMIS	Kenya Integrated Agricultural Management Information System. The Kenyan model on which ZIAMIS is based.
ZICTA	Zambia Information and Communications Technology Authority the national regulatory body for digital and telecommunications services, including oversight of data protection.