Transforming Land Administration in Uganda: The Block Chain and Artificial intelligence Land Registry Project

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SUMMARY

The AlphaX and Ministry of Lands, Housing and Urban Development Land Registry Project in Uganda revolutionizes land administration, enhancing tenure security and advancing sustainable development beyond the Sustainable Development Goals (SDGs). In a country where over 70% of land remains untitled, contributing to poverty, gender inequality, and environmental degradation, this initiative addresses critical governance gaps. The project's primary objectives are to fully digitize fragmented land records, reduce disputes, and empower vulnerable communities, particularly women, through innovative technology integration.

The AlphaX system employs blockchain to establish a tamper-proof, distributed ledger for ownership records, ensuring transparency and reducing fraud. Artificial intelligence (AI), trained on satellite imagery and historical data, automates boundary detection with 85% accuracy, predicting land use changes to support sustainable planning. Geospatial technologies, including GNSS and GIS, enable real-time mapping of 3D/4D cadastral models, facilitating dynamic monitoring of environmental factors such as soil erosion and climate impacts. Zero-knowledge proofs (ZKPs) enhance privacy by allowing secure, anonymous verification of ownership or data validity without exposing sensitive information. Additionally, IoT-enabled mobile applications empower local communities to contribute data via participatory mapping, fostering inclusivity and equity.

Pilot implementations in three rural Ugandan districts from January to June 2025 analyzed 500 parcels, yielding a 60% reduction in land disputes, a 25% increase in local government revenue, and support for carbon offset programs that protect biodiversity. These results demonstrate scalability across Africa, addressing challenges like data privacy through ZKPs and encryption, and interoperability with national spatial data infrastructures (NSDIs), and support the establishment of Integrated Geospatial Information Framework

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The project aligns with SDGs 1 (No Poverty) by securing tenure, 5 (Gender Equality)

by enhancing women's land access, 13 (Climate Action) through resilient data for adaptation, and 15 (Life on Land) by promoting biodiversity. It prepares for post-2040 agendas by offering a model for equitable, climate-resilient governance. In conclusion, AlphaX's significance lies in its potential to transform land management globally, reducing fraud, enhancing stewardship, and providing a blueprint for inclusive innovation in the face of climate and social challenges.