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Legal Informatics and Digital Land Governance in Indonesia and Uganda

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Abstract

Legal informatics is becoming an indispensable instrument for enhancing digital land governance through increased transparency, efficiency, and legal certainty in land administration. Nonetheless, Uganda is still facing several challenges emanating from manual land records, fraud in

transactions, lack of geospatial data integration, underdeveloped technological infrastructure, and coexistence of statutory and customary land tenure systems. This paper provides a comparative analysis of the legal and institutional frameworks of digital land governance in Indonesia and Uganda, with the aim of pinpointing Uganda's gaps in regulation and learning from Indonesia's successful reforms in this sphere. The research applies a doctrinal legal approach entailing the comparative analysis of legislation, government policies, judicial decisions, and academic literature. The results indicate that Indonesia's electronic land registry, One Map Policy, digital signature system, and data protection regime considerably contribute to improving land governance, while Uganda's digitalization process is hindered by implementation difficulties and poor institutional coordination. In conclusion, it is necessary for Uganda to improve its Land Information System through geospatial database integration, electronic authentication, data protection, and recognition of customary land rights.

Keywords

Informatics, Digital, Land Governance, Indonesia, Uganda

Introduction

In Indonesia, the land governance process comprises both formal legal structures and traditions, and this is controlled by Law No. 5 of 1960 on the Basic Principle of Agrarian Law (UUPA). It should be noted that the Ministry

of Agrarian and Spatial Planning (ATR/BPN) has developed a system where the legality of land ownership is determined by issuing of certificates¹, such as Hak Milik (Ownership) and Hak Guna Bangunan (Building Rights). In spite of these requirements, around 126 million plots of lands are registered there, but not all of them have been mapped or claimed under a negative steles system². Under this system, a party with the better claim can contest an already recognized right, which makes it complicated for both parties involved³. To resolve this issue, the government introduced the Complete Systematic Land Registration (PTSL) project in 2018 to make cadastral mapping across the country faster. Nevertheless, the transition from the regional to the more centralized approach still causes difficulties related to the alignment of local development goals and environmental sustainability⁴. Thus, land governance in Indonesia at the moment is a form of democratic decentralization.

¹ Fatemeh Jahani Chehrehbargh, et.al, "Current Challenges and Strategic Directions for Land Administration System Modernisation in Indonesia," *Journal of Spatial Science* 69, no. 4 (2024): 1097–1129. <https://doi.org/10.1080/14498596.2024.2360531>.

² Lydia Kisekka Namateefu and Mark Mugasha, "An Analysis of Challenges and Opportunities in Addressing Land Grabbing Conflicts Through the Law on Land Registration in Uganda: Case Study of Kayunga District," *The International Journal of Business Management and Technology* 10, no. 8 (2025): 54–63. https://www.theijbmt.com/archive/0968/2026178031.pdf?utm_source=chatgpt.com

³ Lydia Kisekka Namateefu and Mark Mugasha.

⁴ Walter T. de Vries, et.al, "Neo-Cadastral: Innovative Solution for Land Users without State-Based Land Rights, or Just Reflections of Institutional Isomorphism?" *Survey Review* 47, no. 342 (2015): 220–229. <https://doi.org/10.1179/1752270615Y.0000000002>

The land management framework of Uganda is characterized by a highly entrenched pluralism where both statutory and customary tenures exist and overlap with each other leading to disputes and controversies. The legal basis exists within the country's 1995 Constitution and the Land Act (Cap. 227), which recognize four types of tenures freehold, mailo, leasehold and customary⁵. Even with these legislations, many Ugandans do not hold land titles due to which they are prone to the threats of land grabs from influential persons and investors. Customary tenure, which is prevalent on the majority of land area in the country, is based on oral traditions where proof of occupation forms the evidence of holding the land. In order to solve tenure problems, the Ministry of Lands⁶, Housing and Urban Development (MLHUD) has started initiatives such as the Transforming Settlements of the Urban Poor in Uganda (TSUPU). However, due to structural deficiencies and corruption, customary holders are deprived of land justice.

The informatics and digitization of land governance in Indonesia refer to significant attempts at upgrading services with the help of advanced technologies. Important activities within this process involve launching of electronic signatures, the Electronic Land Mortgage Rights (HT-el) system and Electronic Land Certificates⁷. The National Land Information System (SIP) is an online database, which helps its users to deal with transactions and land status in a digital

⁵ Lorenzo Cotula, et.al, "Between Promising Advances and Deepening Concerns: A Bottom-Up Review of Trends in Land Governance 2015–2018," *Land* 8, no. 7 (2019): 106. <https://doi.org/10.3390/land8070106>

⁶ Lorenzo Cotula, et.al.

⁷ Lorenzo Cotula, et.al.

way. Currently, regional offices have achieved diverse degrees of digitalization, with some regions, such as Surabaya, reaching the stage of nearly 89% data computerization. According to the ATR/BPN roadmap, by 2024 there should be full digitalization in the form of shifting from the negative system, which stresses the necessity of confirming rights of property and possession of lands, into a positive system⁸. Nevertheless, this transition faces difficulties due to technical failures, such as delay of data synchronization in manual and online databases, as well as due to unreliable provision of electricity and internet access in distant territories. Ultimately, the success of digitalization depends on skills of people who can handle these databases and on the state's ability to establish trust among citizens regarding safety of digital non-tangible property⁹.

Uganda has adopted digitalization through the use of fit-for-purpose (FFP) technologies such as the Social Tenure Domain Model (STDM). This technological innovation is meant to surmount the difficulties posed by the traditional, costly land administration by recording both the formal and informal rights¹⁰. STDM has been implemented in secondary cities such as Mbale where participatory mapping has been

⁸ Monica Lengoiboni, et.al, "Cross-Cutting Challenges to Innovation in Land Tenure Documentation," *Land Use Policy* 85 (2019): 21–32. <https://doi.org/10.1016/j.landusepol.2019.03.033>

⁹ Erma Rusdiana, et.al, "Augment Legal Efforts through Artificial Intelligence in Curtailing Economic Fraud in Nigeria: Issues and Challenges," *Indonesian Journal of Criminal Law Studies* 10, no. 1 (2025): 115–148. <https://doi.org/10.15294/ijcls.v10i1.22865>

¹⁰ Christopher Huggins and Natasha Frosina, "ICT-Driven Projects for Land Governance in Kenya: Disruption and E-Government Frameworks," *GeoJournal* 82, no. 4 (2017): 643–663. <https://doi.org/10.1007/s10708-016-9711-0>

done with the help of handheld GPS and satellite images to map the land parcels. Through this process, over 181,000 households in informal settlements have been mapped, and this data is useful in lobbying for provision of basic amenities such as water and sanitation¹¹. In addition to this, the Ministry of Lands, Housing and Urban Development has made a ruling in 2019 to issue digital certificates of customary ownership (CCOs) using the STDM, and this is a very important move in terms of documentation of undocumented rights holders. It is not just the technical part but it also makes the youths and women capable enough to document their own land rights, thus, helping in avoiding boundary disputes and forcible evictions. The objective of NLIS is to cover the whole city but at least to make these digital innovations affordable for the urban area.

The interaction between law and technology in such regions exposes a deeply problematic issue the continuation of land grabbing due to institutional failures and corruption. In the case of Uganda, the emphasis on paper-registered land titles over the long-standing customary tenure system makes the rural populace vulnerable to being dispossessed, since the judiciary considers "the paper" more convincing than the historical facts¹². Likewise, in Indonesia, there appears to be a notable mismatch between the regulatory frameworks concerning mortgages and the implementation of such regulations on the land that lacks certification. Additionally,

¹¹ Winahyu Erwiningsih, "Enhancing Legal Certainty in Land Collateral: Bridging Regulatory Gaps, Mitigating Vulnerabilities, and Promoting Credit Access in Indonesia," *Croatian International Relations Review* 29, no. 93 (2023): 26–49. <https://doi.org/10.37173/cirr.29.93.2>

¹² Winahyu Erwiningsih.

the lack of legal literacy among the citizens of districts such as Kayunga prevents them from challenging illegal activities as well as from comprehending the complicated succession laws¹³. The use of digital technologies to address this situation is itself faced with certain legal challenges. For example, the introduction of electronic certificates in Indonesia has resulted in discussions about the necessity of withdrawing physical deeds and in the fear of data breach. In the absence of proper mechanisms to protect personal data and hold digital errors accountable, the use of digital governance might turn into elite capture¹⁴.

The existing literature on land administration modernization, problems with land registration and neo-cadastrals is written by Chehrehbargh et al.¹⁵, Namateefu and Mugasha¹⁶, and de Vries, Bennett, and Zevenbergen¹⁷. However, legal informatics as a regulatory approach of digital land governance that involves digital technologies, law and governance in Indonesia and Uganda is not comprehensively

¹³ Erma Rusdiana, et.al, “Enhancing Phyto-Conservation through Legal Frameworks for Climate Change Mitigation in Uganda and Indonesia,” *Journal of Law and Sustainable Development* 14, no. 1 (2026): e04583. <https://doi.org/10.55908/sdgs.v14i1.4583>

¹⁴ Jaap Zevenbergen, et.al, “Pro-Poor Land Administration: Principles for Recording the Land Rights of the Underrepresented,” *Land Use Policy* 31 (2013): 595–604. <https://doi.org/10.1016/j.landusepol.2012.09.005>

¹⁵ Chehrehbargh et al., “Current Challenges and Strategic Directions for Land Administration System Modernisation in Indonesia,” 1097–1129. <https://doi.org/10.1080/14498596.2024.2360531>

¹⁶ Namateefu and Mugasha, “An Analysis of Challenges and Opportunities in Addressing Land Grabbing Conflicts Through the Law on Land Registration in Uganda,” 54–63. <https://www.theijbmt.com/archive/0968/2026178031.pdf>

¹⁷ de Vries, Bennett, and Zevenbergen, “Neo-Cadastrals: Innovative Solution for Land Users without State-Based Land Rights, or Just Reflections of Institutional Isomorphism?” 220–229. <https://doi.org/10.1179/1752270615Y.0000000002>

analyzed. The literature review shows that there is a crucial issue in the current discussion: although the dual nature of land registration as a safeguard and a facilitator of land grabbing is understood, there is still no analysis of how effectively the approach of "Legal Informatics" works in these particular circumstances¹⁸. The vast majority of researches concentrate on either customary tenure issues or make international comparisons; however, the role of local digital instruments such as STDM and HT-el in conjunction with statutory law is overlooked. Therefore, the aim of the present research is to fill this gap by researching the problems and possibilities of "Legal Informatics and Digital Land Governance in Indonesia and Uganda". Hence, the study seeks to answer in what ways can legal informatics contribute to digital land governance through transparency, security, interoperability and access to justice in the land administration systems of Indonesia and Uganda?

Concerning this, the main task of the study will be to assess whether digital approaches, institutional responsibility, and community-based informatics could help in solving land issues and preventing dispossession. Through studying the introduction of the Land Administration Domain Model (LADM) and the Framework for Effective Land Administration (FELA) in both countries, the study will show how to modernize the land service system. Thus, the present research brings novelty as it analyses the socio-technical transition from paper-based to digital governance in both Indonesia and Uganda. Both countries have been selected since they are modernizing land

¹⁸ de Vries, Bennett, and Zevenbergen.

administration through the use of digital technologies and experience similar problems in terms of law and governance.

Method

The present study applies doctrinal research methodology, which is essentially a normative qualitative method with a focus on descriptive analysis of the legal informatics relating to the land administration in Indonesia and Uganda. Doctrinal sources were gathered by adopting the statutory approach involving the review of statutes such as UUPA in Indonesia and Land Act (Cap. 227) in Uganda as well as some newer electronic rules and regulations such as HT-el mandates in Indonesia. The study systematically analysed Uganda's Land Act (Cap. 227), Electronic Transactions Act, Indonesia's Basic Agrarian Law (UUPA), and ITE Law, focusing on provisions governing land registration, electronic transactions, digital records, legal validity, institutional responsibilities, and data governance to evaluate digital land administration frameworks.

Secondary sources of research comprised of scientific papers published in peer-reviewed journals such as ScienceDirect and OICRF and some reports from World Bank and UN-Habitat. Searches used keywords where "digital land governance," "legal informatics," "electronic land registration," and "Indonesia Uganda," covering 2010–2026, retrieving approximately 95 sources. Analysis of the collected materials is done by using content and discourse analysis to find out how prepared the respective legal systems are in terms of DGRA and FELA. This descriptive study is intended at

identifying the gaps and inconsistencies in the existing regulation and institutional framework that hinders digital transformation and, consequently, at suggesting the roadmap for the effective coordination of the statutory provisions and the socio-technical reality. The limitation of this study is its reliance on a purely doctrinal methodology, which does not incorporate empirical evidence from stakeholders. Consequently, it cannot assess the practical implementation, institutional effectiveness, user experiences, or operational challenges associated with digital land governance in Indonesia and Uganda.

Land Governance and Administration System in Uganda and Indonesia

The main land governance in Indonesia is based on Law Number 5 of 1960 (Agrarian Principle Laws) where formal statutory laws and indigenous laws are combined together¹⁹. There are various land titles in this system such as Hak Milik (Ownership) and Hak Guna Bangunan (Building Rights) under the control of Ministry of Agrarian and Spatial Planning (ATR/BPN). But Indonesia follows a "Negative Steles" system, where having a certificate is a good evidence of owning it but can be challenged legally by someone else on

¹⁹ Ikhtiyor Djuraev, et.al, "The Impact of Digitization on Legal Systems in Developing Countries," *Qubahan Academic Journal* 5, no. 1 (2025): 81–117. <https://doi.org/10.48161/qaj.v5n1a1246>

the grounds of having better rights²⁰. Legal uncertainty is one of the major reasons behind conflicts involving the country's approximately 126 million land parcels. According to reliable sources, this system needs high levels of transparency in order to avoid any sort of manipulation of land mafia²¹. Thus, the Indonesian government has moved towards digitizing the records to avoid losing them physically since paper records can easily be lost or tampered with, and the government wants to achieve a "Positive System" of land management like the rest of the world by 2024. Despite efforts for a positive land registration system in Indonesia to be fully realized by 2024, this has not been the case because of problems like the existence of cadastral inaccuracies and inadequate institutional framework.

Uganda has a system of tenure pluralism recognized by the Constitution of Uganda of 1995 and the Land Act (Cap. 227) which recognizes four forms of tenure including freehold, mailo, leasehold and customary²². A huge share of land in the country consisting of 23 million pieces belongs to customary tenure system which continues to remain largely unregistered and regulated by informal customary norms where one can claim ownership on basis of occupation alone. Such dualism results in a situation where the conflict occurs between statutory laws and history where "the paper" of title

²⁰ Agnes Nakakawa and Flavia Namagembe, "Requirements for Developing Interoperable E-Government Systems in Developing Countries: A Case of Uganda," *Electronic Government, an International Journal* 15, no. 1 (2019): 67–90. <https://doi.org/10.1504/EG.2019.096098>

²¹ Agnes Nakakawa and Flavia Namagembe.

²² Muwaffiq Jufri, et.al, "Non-Penal Conflict Resolution and Islamic Legal Culture: Evidence from Sunni–Shia in Indonesia," *UNNES Law Journal* 12, no. 1 (2026): 42–82. <https://doi.org/10.15294/ulj.v12i1.48337>

takes priority over customary tenure which has been there for generations²³. It is the responsibility of the Ministry of Lands, Housing and Urban Development (MLHUD) to manage such an infrastructure but the weak performance of the institutions leaves rural communities in danger. The reports of the World Bank and the International Land Coalition show that even though the protection is available by laws, its implementation is sporadic and favors the political elite at the expense of poor people in urban and rural areas respectively²⁴.

This is done through a process of digitalization through the PTSL Program, initiated in 2018 to fast-track cadastral mapping. It is part of the "One Map Project," which is funded by the World Bank, aimed at harmonizing various geospatial data across government departments. Success can be seen from the performance of certain regional offices; for example, Surabaya I has recorded a digitization rate of close to 89%. Some of the informatics legal tools used include the National Land Information System (SIP) and Electronic Land Mortgage Rights (HT-el) system, which has been adopted countrywide since 2019²⁵. The PTSL and One Map policies have proven to be successful in increasing land registration

²³ F. S. Omweri, "A Systematic Literature Review of E-Government Implementation in Developing Countries: Examining Urban-Rural Disparities, Institutional Capacity, and Socio-Cultural Factors," *International Journal of Research and Innovation in Social Science* 8, no. 8 (2024): 1173–1199. <https://doi.org/10.47772/IJRISS.2024.808088>

²⁴ Paul Atagamen Aidonjje, et.al, "Legal and Socio-Economic Issues of Automated Islamic Banking in Uganda: Lesson from Indonesia," *Diponegoro Law Review* 9, no. 2 (2024): 204–222. <https://doi.org/10.14710/dilrev.9.2.2024.204-222>

²⁵ Stig Enemark, et.al, "Fit-for-Purpose Land Administration Providing Secure Land Rights at Scale," *Land* 10, no. 9 (2021): 972. <https://doi.org/10.3390/land10090972>

speed, accuracy of cadastral data, integration of spatial data, and land administration transparency. These policies have improved legal certainty, evidence-based decision-making, avoided land overlaps, and helped make digital land administration more efficient. Even with all these facts, there is the issue of human resource competency and data safety, as mentioned by the Center for Digital Society (CfDS). There is an observed "incongruence" between the mortgage laws and practice on the uncategorized land, which denies small-scale farmers access to bank financing. To create a world-class organization, Indonesia needs to fix the legislative discrepancies and make sure that signatures and certificates can withstand any form of hacking and data leaks²⁶.

Uganda is among those that have taken the lead in the adoption of the Social Tenure Domain Model (STDM), which is a cutting-edge informatics system developed by GLTN and UN-Habitat. This bespoke system has been designed in such a way that it facilitates the recording of "social tenure relationships" that were not captured by previous systems, for example, informal occupation in slums²⁷. The TSUPU initiative has used the STDM to map more than 181,000 households, which gave the community leverage to lobby for basic amenities such as water and sanitation services in Mbale City. Additionally, in 2019, the MLHUD passed a directive to adopt the STDM to issue digital Certificates of Customary Ownership (CCOs). It is

²⁶ Stig Enemark, et.al.

²⁷ Muwaffiq Jufri, et.al, "Legal and Socio-Economic Issues of Islamic Banking System in Uganda: Learning from the Indonesian Experience," *Al-Mazaahib: Jurnal Perbandingan Hukum* 14, no. 1 (2026): 1–28. <https://doi.org/10.14421/al-mazaahib.v14i1.4348>

clear that there is a shift towards legal informatics since the digital platform offers an evidence-based way of registering the communal ownership. Empirical results from Chamuka Chiefdom show that there was a reduction of conflicts since it provided community-endorsed maps. However, scaling up the adoption at a national level will require capacity building of local land committees and safeguarding of digital information from institutional malpractice. The Social Tenure Domain Model in Uganda has helped resolve land disputes through digital recording of customary and informal rights but faces difficulties in implementation because of poor coverage of the country, technical inadequacy, and inadequate institutional framework.

Combining the governing mechanisms of both countries shows that there is a similar tendency towards the Framework for Effective Land Administration (FELA). While Indonesia prioritizes modernization of infrastructure that allows achieving a positive title system and mortgage service, Uganda concentrates on recordation of the disadvantaged through participative mapping²⁸. Well-reputed sources highlight that FFP approach makes the focus shift from accurate surveys to affordable and upgradable spatial information framework. The data from Mozambique, Benin, and Nepal confirm the discovery that generalized boundaries and aerial imagery is much cheaper than the ground-based one, which reduces parcels costs down to only USD 7-15. UN specialists believe that for the success of such digital approaches, it is essential to

²⁸ Mekonnen Tesfaye Metaferia, et.al, "Fit-for-Purpose Land Administration and the Framework for Effective Land Administration: Synthesis of Contemporary Experiences," *Land* 12, no. 1 (2023): 58. <https://doi.org/10.3390/land12010058>

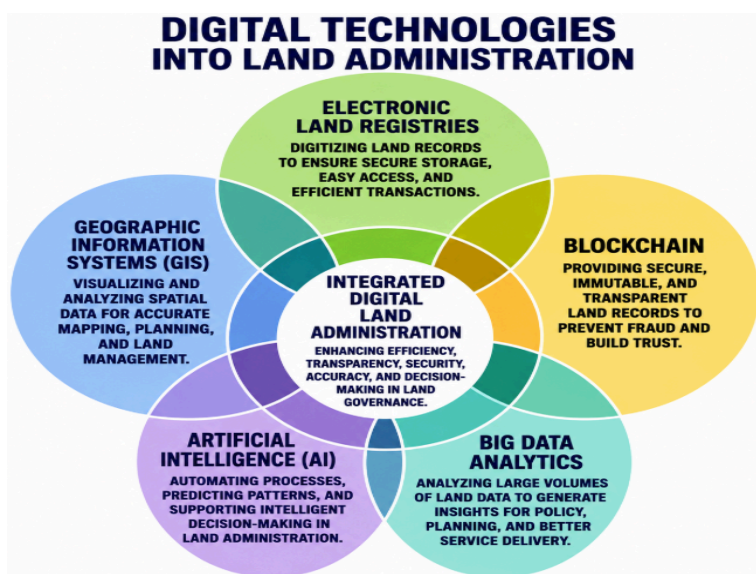
have reliable governance (FELA Pathway 1) and appropriate legal policies (Pathway 2)²⁹. At the end of the day, legal informatics plays an intermediary role between frameworks and the practical implementation of tenure security, if only both countries continue developing cybersecurity and legal literacy of their citizens.

Informatic and Digital Transformation of Land Governance in Uganda and Indonesia

Modern land administration is being revolutionized by digital technologies such as Electronic Land Registries, Geographic Information Systems (GIS), Blockchain, Big data analytics and Artificial Intelligence (AI) for automated feature extraction, UAVs, and the Social Tenure Domain Model (STDM) provide affordable, participatory frameworks to enhance transparency and global tenure security.

²⁹ Rohan Mark Bennett, et.al, "Land Administration Maintenance: A Review of the Persistent Problem and Emerging Fit-for-Purpose Solutions," *Land* 10, no. 5 (2021): 509. <https://doi.org/10.3390/land10050509>

Figure 1: Digital Technologies in Land Administration



Source: Design by authors based on data obtained

According to Figure 1 above, GIS, electronic land registries, blockchain, artificial intelligence, and big data analytics operate as complementary technologies for digital land governance. The efficacy of all these technologies relies upon legal provisions regulating electronic transactions, data protection, digital evidence, land registries, institutional accountability, and interoperability in Indonesia and Uganda.

Within Indonesia, the Ministry of Agrarian and Spatial Planning (ATR/BPN) is in charge of an informatic revolution through the ministry's ambitious plan of becoming a "world-standard institution" by 2024. The application of information technologies to legal systems, known as legal informatics, is implemented in the National Land Information System (SIP), which is an electronic centralized database responsible for managing land

ownership, land status and geospatial data³⁰. Some of the key digital technologies applied are Electronic Land Mortgage Rights (HT-el), which is functional since 2019 and the Electronic Land Certificate. Statistics show successful implementation on the regional level, such as Surabaya I office having 88.77% digitization rates of their datasets. Nevertheless, the Grand Design Team discovered 96 separate applications in use, showing the necessity of the unified technology infrastructure to avoid creating separate databases. Although these electronic records increase transparency, the process of transformation is hindered by the negative steles system, as certificates serve as clear evidence but remain disputable³¹. Thus, the synchronization of manual and digital databases is crucial to prevent land mafia's intrusion.

The digital transformation in Uganda involves FFP technology, specifically the Social Tenure Domain Model (STDM), an informatics platform used to address the challenge of registration through the creation of social tenure relationships. Whereas conventional approaches in Sub-Saharan Africa capture less than 30 percent of parcels, STDM facilitates the capture of "social tenure relationships," which include customary rights³². Through STDM, more than 181,000 households have been registered in Mbale city

³⁰ Habibi Hasbi Sidiq, et.al, "Web-Based Village Land Information System Development for Optimizing Regional Land Administration," *International Journal of Advances in Data and Information Systems* 6, no. 1 (2025): 46–61. <https://doi.org/10.25008/ijadis.v6i1.1702>

³¹ Nurul Huda, et.al, "The Strategic Development of Quality Improvement Land Data Incrementally Using Integrated PESTEL and SWOT Analysis in Indonesia," *Land* 13, no. 10 (2024): 1655. <https://doi.org/10.3390/land13101655>

³² Nurul Huda, et.al.

in informal settlements, thus allowing them to advocate for water and sanitation using the informatics evidence. As per the 2019 directive, there was adoption of STDM to issue digital Certificates of Customary Ownership (CCOs)³³. The directive symbolized a shift from informal rules to computational law that gives young people and women the opportunity to be grassroots surveyors without fear of eviction and boundary conflicts. With the integration of National Land Information System (NLIS), there will be a harmonization of these participatory maps with statutory law³⁴.

The incorporation of sophisticated technology, including GIS, Blockchain, and Artificial Intelligence (AI) is significantly transforming the laws governing the agricultural sector. Automated feature extraction through artificial intelligence techniques that employ machine learning to automatically extract visible parcel boundaries from high resolution satellite images has been found to be promising for quick data collection in rural environments³⁵. Blockchain (Digital Ledger Technology) is being considered in efforts to shift the responsibility of land record management in order to prevent any possible manipulation of the land records since blockchain provides a digitally immutable record. In addition, the use of Unmanned Aerial Vehicles (UAVs) or drones provides a cheaper alternative to aerial photography and

³³ Nurul Huda, et.al.

³⁴ Pamela Durán-Díaz, "Sustainable Land Governance for Water–Energy–Food Systems: A Framework for Rural and Peri-Urban Revitalisation," *Land* 12, no. 10 (2023): 1828. <https://doi.org/10.3390/land12101828>

³⁵ Dima Todorovski, et.al, "Assessment of Land Administration in Ecuador Based on the Fit-for-Purpose Approach," *Land* 10, no. 8 (2021): 862. <https://doi.org/10.3390/land10080862>

enables the timely updating of rapidly urbanizing regions³⁶. The combination of the use of digital technologies, along with big data analytics, provides an effective tool for monitoring land use and ensuring sustainability. This was exemplified in the application of informatics in Punjab, Pakistan, where the land transaction period was reduced from two months to 50 minutes using this technology.

Technology-enabled governance analyzed through the Framework for Effective Land Administration (FELA) becomes a necessity to curb the problem of land fraud and corruption. With the manual system being susceptible to being manipulated in which case paper documents can be altered or even lost through corruption, there exists the need to use technology such as the NLIS in order to facilitate transparency³⁷. Through the Land Administration Domain Model (LADM), the countries ensure that their information systems are interoperable and help in achieving aims of synchronizing different geospatial datasets. This technology facilitates the compliance with land use laws and provides the people with the digital evidence required to prove their entitlements. These information systems are also characterized by inclusiveness because the process entails the

³⁶ Edgar Napoleon Asimwe and Nena Lim, "Usability of Government Websites in Uganda," *Electronic Journal of E-Government* 8, no. 1 (2010): 1–12. Accessed 22nd of May, 2026 https://www.researchgate.net/publication/228671594_Usability_of_Government_Websites_in_Uganda

³⁷ Karin M. Krchnak, "Improving Water Governance through Increased Public Access to Information and Participation," *Sustainable Development Law & Policy* 5, no. 1 (2011): 9–13. https://eprints.bournemouth.ac.uk/38717/1/KAUR%20BAINS%2C%20Jaspreet_Ph.D._2022.pdf

involvement of the stakeholder thus helping the traditional leaders solve the conflicts at a small scale³⁸. Overall, any contemporary framework should balance between technological efficiency and legal adequacy in order to protect property rights and position agrarian law for the digital age.

While digital technologies facilitate land administration systems to be more efficient, there arise a number of legal issues such as data privacy, cybersecurity, ownership of digital information, admissibility of digital evidence, accountability of algorithms, and institutional responsibility. Hence, for their successful use, there is a need for proper legal protections in Indonesia and Uganda.

Legal Informatics and Digital Land Governance in Uganda and Indonesia

Legislations that define the legal framework of the digitization processes in Indonesia and Uganda include comprehensive statutory enactments that recognize electronic communications. For instance, the most relevant legislation in Indonesia is Law No. 11 of 2008³⁹ revised by Law No. 1 of 2024 on Electronic Information and Transactions (ITE)⁴⁰, which confirms in Article 5 that the information and documents presented electronically are legal proofs. This is facilitated by Presidential Regulation No. 95 of 2018 on the

³⁸ Karin M. Krchnak.

³⁹ Law No. 11 of 2008

⁴⁰ Law No. 1 of 2024 on Electronic Information and Transactions (ITE),

Electronic-Based Government System (SPBE)⁴¹, which stipulates the need to have a clear and transparent governance through the optimization of ICT. In the same vein, Uganda introduced the Electronic Transactions Act, 2011⁴² and Electronic Signatures Act, 2011⁴³ to remove obstacles that inhibit digital transactions. Section 5 of the Electronic Transactions Act makes it mandatory that information should not be rendered inadmissible simply because it has been transmitted in an electronic medium whereas Section 22 allows government agencies to receive electronic filings. This creates a coherent digital space in which advanced electronic signatures, uniquely tied to the person signing through Uganda's Signature Act, have equal legal standing with the autographic signatures. Both countries place emphasis on "non-repudiation" as their security standard.

The digital land governance system is regulated to make property management more advanced and convenient. In Indonesia, the Regulation of the Minister of Agrarian Affairs Number 1 of 2021⁴⁴ requires the implementation of electronic land registration, leading to the issuance of "Sertipikat-el" (Electronic Certificates). The regulation enables the processing and presentation of the data on land rights in electronic form, where legal documents are secured by digital signatures certified by the government. The implementation helps to maximize the efficiency of the National Land Agency's (BPN) efforts to digitize about 90

⁴¹ Presidential Regulation No. 95 of 2018 on the Electronic-Based Government System (SPBE)

⁴² Uganda Electronic Transactions Act, 2011

⁴³ Uganda Electronic Signatures Act, 2011

⁴⁴ Indonesia, the Regulation of the Minister of Agrarian Affairs Number 1 of 2021

million parcels of lands. On the contrary, the Uganda National Land Policy (2013)⁴⁵ considers manual accounting as one of the main sources of fraud and forgery and recommends implementing the computerized Land Information System (LIS). The system should be developed to ensure transactional security and reduce registration costs by creating digital cadastral geodatabases. While the One Map Policy of Indonesia seeks to create a common national geospatial reference system, the policy of Uganda prioritizes decentralizing LIS to sub-counties to enable the recording and certification of various types of land rights.

One of the key elements of this framework is that there is an incorporation of various tenure systems in the modernized digital registry. For instance, while the Ugandan National Land Policy has acknowledged the customary tenure as “at par” with other tenure systems, it calls for the formation of the customary land registry for the first time. This is a great step towards resolving the issues caused by many overlapping interests that were left as a result of the colonial period wherein the Mailo and native freehold tenures did not give much weight to the pre-existing customary interests. In the same way, Indonesia has its own Basic Agrarian Law (Law No. 5 of 1960)⁴⁶, which stipulates that the national registration of the land must be carried out in order to ensure legal security for all right holders. It allows the first-time registration of the land that has never been registered before, including those related to management and waqf rights, thereby securing physical and juridical information in one

⁴⁵ Uganda National Land Policy (2013)

⁴⁶ Indonesia Basic Agrarian Law (Law No. 5 of 1960)

place. Importantly, both nations have gone further and decided to transfer the ultimate land sovereignty to the citizens as per Article 237 of the Ugandan Constitution and Article 1 of the Indonesian UUPA.

The importance of institutional oversight and data protection cannot be overlooked in ensuring the validity of digital land governance mechanisms. The Indonesian law concerning the Protection of Personal Data (Law No. 27 of 2022)⁴⁷ establishes an effective legal framework for the protection of constitutional rights of data subjects, providing the obligations of Personal Data Controllers for processing data in a secured manner. According to Article 39, personal data controllers are required to process data using reliable and secured electronic means to ensure that sensitive data related to the land is not subject to any unauthorized access. In the case of Uganda, the NITA-U is the "Controller" under the Electronic Signatures Act, which monitors the certification service providers and keeps a public record of their operations. This institutional control allows to ensure that digital signatures are secure and can identify the signatories during the process of land transactions. NITA-U improves the security of electronic signatures through Public Key Infrastructure (PKI), digital certificate, encryption technology, authentication processes, and certification services. Both countries have established performance audits to make sure that certification service providers follow the prescribed standards. In this case, Indonesia's Law No. 27 of 2022 on Personal Data Protection is applicable to land data in terms of the collection, processing, storage, disclosure, and

⁴⁷ Protection of Personal Data (Law No. 27 of 2022)

protection of personal information owned by land owners in the context of digital land administration.

However, a critical evaluation of these two legal regimes shows the existence of common problems, especially concerning infrastructure and tenure dualism. Even though the two nations have developed laws that promote digitization, Indonesia experiences "the IT infrastructure gap," where demand for geospatial and land data surpasses the amount of bandwidth and connectivity available⁴⁸. Similarly, in Uganda, digitizing of land information system is hampered by the existence of customary marking of boundaries based on memory and folklore, which are incompatible with modern surveying technology⁴⁹. Also, incorporation of customary institutions within the state-led digital regime remains difficult since according to Uganda's policy, these customary mediators should be legalized and supported with enough resources to act as tiers of first instance in the management of land affairs⁵⁰. Adjudication, survey, and registration are also very expensive and unaffordable by most citizens, thus making it impossible for some vulnerable groups to fall within the digital governance ambit. Hence, the success of legal informatics in these two countries relies not only on technology, but on the development of harmonious

⁴⁸ P. Tim H. Unwin, *ICT4D: Information and Communication Technology for Development* (Cambridge: Cambridge University Press, 2009). <https://doi.org/10.1017/CBO9780511805266>

⁴⁹ Alex Kihehere Mukiga, et.al, "Perceived Public Participation and Health Delivery in Local Government Districts in Uganda," *International Journal of Environmental Research and Public Health* 21, no. 7 (2024): 820. <https://doi.org/10.3390/ijerph21070820>

⁵⁰ Alex Kihehere Mukiga, et.al.

digital laws with policies of social justice that safeguard the interests of the poor.

The following table provides a comparative analysis of the legal and institutional frameworks for legal informatics and digital land governance in Indonesia and Uganda.

Table 1: Comparing Both Countries Legal Framework

Feature	Indonesia	Uganda
Primary Digital Law Framework	Law No. 1 of 2024 (Second Electronic Transactions Act, Amendment to the ITE Law) 2011 provides legal certainty for electronic information and the base for e-government and transactions.	Electronic Signatures Act, 2011 provide digital validation.
Land-Specific Digital Regulation	Regulation of the Minister of National Land Policy (2013) Agrarian Affairs No. 1 of 2021 mandates the implementation of an electronic land (LIS) to replace manual registration system.	Land Information System records.
Digital Land Title Form	Sertipikat-el (Electronic Certificate) issued as a data records via the LIS to reduce message, replacing physical land books.	Transitioning to digital land records, though manual systems historically dominated.
Electronic Signatures	Validated via authorized officials and used to legalize electronic documents (Tanda Tangan Elektronik).	Categorizes Advanced Electronic Signatures which have equal legal weight to autographic signatures.
Geospatial Strategy	One Map Policy (Presidential Reg No. 9/2016) creates a unified geospatial database and sub-county levels to record reference system.	LIS strategy focuses on decentralization to customary land rights.

Institutional Oversight	Electronic-Based Government National Information System (SPBE) framework Technology (Presidential Reg No. Authority-Uganda (NITA-U) 95/2018) for interoperability. serves as the "Controller" for electronic signature services.
Data Privacy & Protection	Law No. 27 of 2022 on Generic protections for data Personal Data Protection subjects are embedded within specifically protects the rights the Electronic Transactions of data subjects in digital Act. systems.
Tenure Recognition	Facilitates electronic Policy prioritizes recognizing conversion of various rights, customary tenure in the LIS including freehold, to ensure it is at par with management, and waqf rights. other tenure systems.
Infrastructure Challenges	Faces an "IT infrastructure Manual record-keeping gap" where demand for history makes the transition geospatial data exceeds to a digital LIS slow, internet bandwidth. cumbersome, and prone to forgeries.

Source: Researcher's Analysis, 2026.

According to Table 1, both Indonesia and Uganda have made commitments towards the digitalization of land administration through legislation and technology. Yet, Indonesia has made higher levels of institutional integration and digitalization compared to Uganda, which continues to develop its legal, technological, and administrative capacity in digital land governance.

Challenges and Improvement of Legal Informatics and Digital Land Governance

The process of managing Uganda's land through digital platforms has been highly challenged due to an existing culture of using manual methods, which according to the National Land Policy (2013)⁵¹ has been identified as one of the major causes of frauds and forgeries in Uganda. The process of using paper records not only slows down the process of transacting lands but also increases its risks, hence making it difficult for people to have confidence in the security of their properties. In addition, the land administration system is not sufficiently endowed with the required technical skills and equipments that can help in supporting the process of digitizing land⁵². The problem of having inadequate numbers of surveyors coupled with too many untrained surveyors has made this process highly challenging. Despite the existence of a computerized land information system (LIS) in the country, there still exist vulnerable paper systems, thus facilitating the "grabbing" of land, especially in highly investable zones like Albertine Graben.

One of the challenges in Uganda lies in the dual nature of land management where statutory laws tend to conflict with customary systems. The duality gives rise to institutional

⁵¹ National Land Policy (2013)

⁵² Gandhi Prasad Subedi, *Land Administration and Its Impact on Economic Development* (Reading: University of Reading, 2016). Accessed 2nd May, 2026 <https://centaur.reading.ac.uk/65923/>

conflicts and confusion of mandates since the traditional mediators involved in land dispute resolution may not be legally mandated to fulfill their governance roles⁵³. Another important factor to consider in the context of land rights and tenure in Uganda is the multi-tier nature of rights, particularly the intermingled interests of registered proprietors and occupants of Mailo or native freehold land. Customary tenure, which dominates land ownership in Uganda, is perceived to be subordinate, not codified or even entered in any formal register, leaving communities vulnerable to exploitation by private individuals⁵⁴. Incorporation of these traditional institutions in a computerized LIS would prove to be difficult due to the nature of customary rights which is often defined in terms of "memory and folklore" rather than geodetic information.

Uganda needs to emulate the aggressiveness that Indonesia has shown in shifting to an electronic system of registration of land, governed by Ministerial Regulation No. 1 of 2021. As opposed to Uganda's problems of paper filing, Indonesia requires the issuance of "Sertipikat-el" (Electronic Certificates) that substitute for the physical land books with messages of digital data. The electronic documents, after being validated by the authorized officers via their digital signatures (Tanda Tangan Elektronik), make a good source of evidence in procedure law. In the case of Indonesia,

⁵³ Dodik Ridho Nurrochmat, et.al, "Transformation of Agro-Forest Management Policy under the Dynamic Circumstances of a Two-Decade Regional Autonomy in Indonesia," *Forests* 12, no. 4 (2021): 419. <https://doi.org/10.3390/f12040419>

⁵⁴ Praditha Dewa Gede Edi, et.al, "The Future of Bali's *Kerauhban* Tradition: Legal Pluralism, Reforms, and Conflict Adjudication Challenges," *Journal of Sustainable Development and Regulatory Issues (JSDERI)* 4, no. 1 (2026): 118–37. <https://doi.org/10.53955/jsderi.v4i1.421>

"non-repudiation" is ensured through trusted third party certifying agencies, which is what Uganda is trying to achieve via its Electronic Signature Act, but hasn't been achieved yet in the management of land transactions. With a similar system of "Electronic System Database" as employed by Indonesia⁵⁵, Uganda can manage the storage of physical and juridical data in secure large-memory arrays from different terminals, thus doing away with the weaknesses that the country has in its manual archives system.

The One Map Policy of Indonesia, formulated by the Presidential Regulation No. 9 of 2016⁵⁶, provides a model that can help solve the problem of conflicting spatial data in Uganda. The One Map Policy is intended to develop a geospatial standard and reference system that will be consistent throughout the archipelago in order to overcome overlapping problems related to land-use data in the country. Currently, Uganda is experiencing fragmentation of spatial information by different government agencies, which results in poor land-use planning and non-implementation of regulations⁵⁷. Adopting the policy of Indonesia, Uganda may unify its digital cadastral geodatabases through one national portal, like the "Ina-Geoportal" in Indonesia, that would allow exchanging data between ministries and the general public. Moreover, adopting modern technologies used by Indonesia such as high-resolution images taken from satellites would allow moving from the old-fashioned system of

⁵⁵ Praditha Dewa Gede Edi, et.al.

⁵⁶ Presidential Regulation No. 9 of 2016

⁵⁷ Try Widiyono and Md Zubair Kasem Khan, "Legal Certainty in Land Rights Acquisition in Indonesia's National Land Law," *Law Reform* 19, no. 1 (2023): 128–47. <https://doi.org/10.14710/lr.v19i1.53053>

marking borders. The use of a unified geospatial framework will give the transparency necessary for the management of conflicting interests concerning human habitation, production, and preservation of the environment⁵⁸.

Finally, Uganda should consider the way Indonesia protects the personal data of its citizens and how it oversees such operations. Indeed, Indonesia's Law No. 27 of 2022⁵⁹ guarantees the protection of rights for data subjects and obligates data controllers to use secure electronic systems for processing their information. It becomes critical for digital land administration, where the collection of private and financial information takes place. Although Uganda has the basics in its Electronic Transactions Act, having a specialized law on data protection will build more confidence in the use of computer-based LIS. Furthermore, the SPBE Framework of Indonesia guarantees the interoperability and security of information within government agencies with the support from special units responsible for it and accountable to the President. In Uganda, a similar top-down approach to such issues will help in making the transition to the new digital system much easier for the country. The delegation of authority in the digital registration to local land authorities, which works in Indonesia, will solve Uganda's problems with decentralization. Such coordinated planning is necessary for achieving balanced development of various regions.

⁵⁸ Sulistyowati, et.al, "Issues and Challenges of *Waqf* in Providing Healthcare Resources," *Islamic Economic Studies* 30, no. 1 (2022): 2–22. <https://doi.org/10.1108/IES-08-2021-0033>

⁵⁹ Indonesia's Law No. 27 of 2022

Conclusion

The paper shows that legal informatics acts as an enabling tool towards enhanced digital land governance through the combination of law, information technology, and institutional governance to ensure greater transparency, legal certainty, accountability, and efficiency in land administration. Using a comparative examination of Indonesia and Uganda, the paper proves that digital land governance is not only determined by the level of technological innovation, but it requires well-formulated legal frameworks, proper institutional cooperation, and effective implementation of regulations. While Indonesia has achieved considerable success using the One Map Policy, Complete Systematic Land Registration (PTSL) Program, e-land certificates, and extensive data protection laws, Uganda keeps on making strides towards digitalization through the introduction of Land Information System (LIS), Electronic Signatures Act, and NITA-U projects despite challenges posed by institutions and technology. The comparative assessment of Indonesia and Uganda helps enhance legal scholarship because it highlights the role of legal informatics in the evaluation of digital land governance.

The innovation in this study is the use of comparative land law and legal informatics, which has not been widely studied in the African and Southeast Asian context. While previous studies focused either on technology innovations or reforms in land administration separately, the present study considers the intersection of technologies, legal institutions, and regulations for ensuring accountability and security of

land governance. However, the study is hampered by the lack of empirical data about the practices of land administrators, policymakers, technology providers, and land users since it is conducted using the method of doctrinal analysis and secondary sources only. Thus, future research should conduct empirical studies about the implementation of the Land Information System and STDM in Uganda, evaluate the legal effectivity of the electronic land certification system in Indonesia, and analyze the practical application of artificial intelligence, blockchain, and interoperable land registry. In terms of legislation, Uganda needs to develop the data protection regulation, introduce nationwide interoperability of land information systems, extend the practices of secure electronic certification through NITA-U, and implement some aspects of the One Map Policy in Indonesia.

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