Harnessing Technology to Advance Citizen-Centric Land Administration in Rwanda

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ABSTRACT

Rwanda is recognized as a global land governance leader due to the success of its Land Tenure Regularisation Program (LTRP), which resulted in the registration of over 11 million parcels and the issuance of 7 million certificates of title, and the establishment of the Land Administration Information System (LAIS). These notable achievements have contributed to land market viability, reductions in land disputes, and increased land-based revenue. However, some land administration challenges persist, including high costs and delays for buyers and sellers, as well as the double selling of land, identity fraud, and repudiation associated with land transfers.

In recognition of the need for innovative solutions to these persistent challenges, Rwanda Land Management and Use Authority (RLMUA), Rwanda Information Society Authority (RISA), and Medici Land Governance (MLG) developed Ubutaka App, a paperless, secure, and fully interoperable land administration system. The system uses emerging technology to simplify land transactions by voluntary sale and prevent double selling of land, identity fraud, and repudiation. Designed for use by Land Notaries and Registrars in Rwanda, and currently being piloted in Gasabo District, Ubutaka requires only one visit to a notary through the use of biodata, Public Key Infrastructure (PKI), and blockchain. The web-based application integrates seamlessly with existing Rwandan systems, including Irembo, LAIS, and Rwanda National Identification Agency (NIDA) to securely transmit citizens' information. Authorizations and approvals by users are completed using PKI. Finally, for added transparency and security, key components of the process are recorded on blockchain.

The adoption of advanced land governance systems enhanced by emerging technologies, such as Public Key Infrastructure and blockchain, enables the Government of Rwanda to solve modern land sector problems and better protect the country's land heritage. This paper demonstrates how technologies such as Ubutaka App provide opportunities for positive transformation in citizen-centric land administration.

Keywords

Land Administration, Land Tenure, Technology, Customer Service, Blockchain, Public Key Infrastructure, Biodata

1. INTRODUCTION

Building a culture of technologically enhanced, citizen-centric land governance services will help protect Rwanda's land heritage now and into the future. With a foundation of extraordinary advances in land governance, the Government of Rwanda is focused on technology and innovation to help solve modern problems in the land sector, including double selling of land, identity fraud, and repudiation. This paper presents a case study on the development of a paperless, secure, and fully interoperable land administration system called 'Ubutaka App' through a partnership between Rwanda Land Management and Use Authority (RLMUA), Rwanda Information Society Authority (RISA), and Medici Land Governance (MLG).[1] The paper demonstrates how technologies such as Ubutaka App, which leverages emerging technologies including Public Key Infrastructure,[2] blockchain, [3] and biodata, provide opportunities for positive transformation in citizen-centric land administration. However, to be successful, the technology must be supported by collaboration across public and private institutions, investment in digital literacy at all levels, consistent training, and user support.

2. BACKGROUND

Promoting a culture of technology-enabled citizen-centered services delivery is critical to land administration. Rwanda is already recognized as a global land governance leader due to the success of its Land Tenure Regularisation Programme (LTRP), implemented from 2009 to 2013, which included the demarcation, digitization, and recordation of more than 11.4 million parcels and issuance of 7.1 million of certificates of title to landowners (Schreiber, 2017). Just 26,338 square kilometers in size and with a growing population, Rwanda realized that registering land rights nationwide would increase tenure security for both women and men, reduce land-based conflict, and foster economic growth.

The Land Administration Information System (LAIS) was deployed in 2012 to maintain the land register, which includes 43 land transaction types. Irembo, a platform for electronic government services, was adopted in 2015 to fast-track citizen-centric service delivery. Since then, LAIS has been integrated with Irembo – the country's one-stop-shop platform for e-government services – and land governance services have been transferred to the platform (Hilhorst, 2015). The current version of

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[1] Medici Land Governance was established as a public benefit corporation to use advanced technology including blockchain to improve trust in information and institutions while helping individuals secure their land rights and improve their economic situation.

[2] Public Key Infrastructure (PKI) is a technology for digitally authenticating users and devices. PKI allows one or more trusted parties to digitally sign documents certifying that a particular cryptographic key belongs to a particular user or device. The key can then serve as an identity for the user in digital networks. In 2015, the Government of Rwanda established a PKI infrastructure used for authentic access of information on online platforms. Once all the relevant institutions are on board for e-signature, it is expected to replace most manual processes and promote efficient paperless processes.

[3] Blockchain is a computer network designed to store short sequences of data, validate shared rules, and exchange economic value transparently and resiliently. A blockchain distributes the balance of power equally among all participants, such that no single entity can unfairly take advantage of the others. Blockchain technology enables the creation of an open, distributed ledger that records transactions efficiently in a verifiable, accessible, transparent, auditable, and permanent manner.

LAIS is also integrated with services that require land ownership information, including banks through the E-Mortgage Registration Systems (e-MRS), the revenue collection system, the building permit management information system, the national identity database (NIDA), the agricultural land information system, the land valuation system, and emerging systems such as Ubutaka App (detailed in this paper).

Completion of the LTRP and adoption of the LAIS have improved land tenure security and land administration, promoting strong land governance in Rwanda. Today, Rwanda ranks first in registering property in Africa and third worldwide, following Qatar and New Zealand (World Bank, 2020). In addition to widespread land registration and transparent property ownership, the time taken to process a property transfer was reduced from 365 days to 7 days[4] (Ibid). Using the LAIS, citizens can initiate 43 types of transactions on their property. These include land transfer by voluntary sale[5], subdivision, merging, and succession, among others. Accessibility and citizen trust in the system can be measured by the drastic increase in land transfers by voluntary sale over seven years: In 2013, there were 10,865 transfers by sale; this increased to 97,961 transfers by sale in 2020 (RLMUA, 2021). In total, land transactions increased from 963,519 in 2013 to 2,392,877 in 2020 (Ibid). These notable achievements have contributed to land market viability, a reduction in land disputes, and increased land-based revenue.

However, since completion of the LTRP and launch of LAIS, occasional land administration challenges have arisen. In addition to tenure security, trust in the system, and accessibility of services, the sustainability of Rwanda's land administration system depends on institutional, political, and socioeconomic factors including the management skills of service providers, customer orientation of activities, clarity and simplicity of processes, and timeliness and cost effectiveness, among other success criteria (UNHABITAT, 1990) (Henssen, 2010). Rwanda's Land Policy (2019) highlights that the land registration process can be tedious, costly, and subject to delays (Min19 l 1033). Some citizens have reported delays in service delivery by Land Notaries. Land Notaries fulfill multiple mandates, including staffing the front desk of land services at the sector level, which requires them to physically transport paper-based applications from the Sector to the District office, then later bring certificates of title from the district office back to the Sector. Citizens also report that the process is costly, which is due in part to the cost incurred by the Land Notary for transport between the Sector and District offices,[6] as well as the cost of the printed title. For some citizens, the cost associated with land registration makes the process inaccessible. Other land administration challenges also persist, including the double selling of land, identity fraud, and repudiation associated with land transfers. A citizen-centric, technology-based service is needed to enhance the land administration system, reduce time and costs to landowners, and prevent double selling, identity fraud, and repudiation.

In response to these challenges, the Government of Rwanda is building a culture of innovation and

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[4] The time required to process a commercial property transaction in Rwanda is only one day.

[5] Transfer by voluntary sale is one of the most common transaction types initiated by citizens on their property in Rwanda. This transaction involves a willing transfer of title from the seller (or sellers) to the buyer (or buyers).

[6] In some cases, this requires more than two visits to the district office to check whether an application has been approved.

citizen-centered service delivery, enabled by the legal framework governing land and a government-wide digital transformation. The Constitution of the Republic of Rwanda and its Amendments Revised in 2015, stipulates that every person has a right to private property, whether personal or owned in association with others, and that private property is inviolable (article 34).[7] The Land Policy (2019) calls for the simplification of land registration processes, facilitation of easy access to land administration services, and promotion of ICT-based solutions to land administration services (Min19 l 1033). These solutions should reduce land transaction costs related to the transfer of rights to prevent informal transactions; maximize the benefits associated with the LTRP, especially the use of land for collateral and investment; and identify and decentralize other land-related services at the Sector-level; capacitate the Sectors to fulfill their responsibilities through ICT-based solutions; and define the role of the private sector in land administration services. It is important to note that the law emphasizes equal rights to land for all, including women. In addition, when land is owned jointly by both spouses, all transfers must be approved by husband and wife.

The Government of Rwanda has adopted a commitment to digital transformation to promote citizen-centric land governance. Rwanda has distinguished itself as a country that is deeply committed to leveraging digital transformation as indispensable for development and a means to accelerate economic growth and reduce poverty. This commitment dates to 2000, when the country began to chart a policy and a long-term plan to achieve full digitization, through a series of five-year plans, namely the National Information Communications Infrastructure (NICI). The first stage (2000-2005) laid the groundwork for digital transformation, including establishing institutional, legal, and regulatory frameworks, as well as establishing various institutions to drive implementation of the digital policies. The second (2006-2010) and third (2010-2015) stages focused on accelerating infrastructure development and e-services and putting in place the basic building blocks needed to support government digitization.

These developments have allowed Rwanda to digitize public records, enabling greater data exchange between government entities and the rapid scaling of e-services offerings. Several back-end systems that support core government functions have also been rolled-out in areas such as LAIS, the national population registry, and tax collection. Other flagship initiatives include Irembo, the launch of which represented an important milestone for citizen-centered online service provision in the country.

While these policies have resulted in individual successes, the combined effect of digital technology and its transformative impact on development goals in terms of boosted productivity, expanded opportunities and improved public service delivery (World Bank, 2016) (Rose, 2018) has yet to be fully realized in Rwanda. The true measure of policy success will be when public services are aggregated and are designed and accessed using multiple digital technologies (Panagiotopoulos, 2019). In such a case, citizens will place value on the aggregated services rather than an individual service (Corletta, 2018). Therefore, to maximize the potential of digital technology, it is important to understand the other factors that are contingent and complementary to technology. The fourth stage policy (2016-present), known as the Smart Rwanda Master Plan was introduced to with the aim of diffusing and maximizing the benefits of digital transformation across the core sector of the economy

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[7] Prior to 2003, with few exceptions, all land in the country was owned by the Government of Rwanda.

namely land, agriculture, education, health, governance, finance, trade, and industry (Ministry of ICT, 2015).

3. INTERVENTION

In recognition of the need for innovative solutions and in support of Rwanda's ICT policy goals, Rwanda Information Society Authority (RISA) and Rwanda Land Management and Use Authority (RLMUA) entered a Memorandum of Understanding with Medici Land Governance (MLG), a public benefit corporation, in November 2018 to develop a paperless, secure, and fully interoperable land administration system. This partnership resulted in the development of a technology solution called 'Ubutaka App',[8] which uses emerging technology to simplify land transfers by voluntary sale and prevent double selling of land, identity fraud, and repudiation.

Ubutaka App is a web-based application designed for use by Land Notaries and Registrars in Rwanda. The application integrates seamlessly with existing Rwandan systems, including Irembo, LAIS, and the Rwanda National Identification Agency (NIDA) to securely receive, process, and transmit citizens' information for the purpose of buying and selling land. Ubutaka App utilizes biodata, Public Key Infrastructure, and a public blockchain to ensure that citizens selling and buying land need make only one visit to the Land Notary after submitting their application. The legal framework permitting, Ubutaka App has the potential to support secure zero-visit land transactions across Rwanda.

Officially launched in April 2021, Ubutaka App is being piloted by RLMUA, RISA and MLG in Gasabo District by the Registrar for Kigali Province and Land Notaries operating in 15 Sectors. Gasabo is an urban district which includes Kigali City, the capital of Rwanda, and has an active land market, high frequency of registered land transfers, high literacy rates, internet usage, and skilled Irembo agents. The Registrar and each Land Notary have been trained to use Ubutaka App. Land Notaries have been equipped with a RISA PKI CA (Public Key Infrastructure Certificate Authority) issued private key installed on the platform to digitally sign land transactions, a web camera for photos, a signing pad to capture buyer and seller signatures, and a fingerprint scanner to record buyer and seller fingerprints. A technical team provides ongoing support to the users, as they learn to use the system.

When a seller initiates a transfer by voluntary sale in Irembo, the data flows directly to Ubutaka App, negating the need for paper-based applications. The Land Notary schedules a single appointment with the seller and buyer[9] at the notary's office, where the seller and buyer complete the transfer in person. At the appointment the Ubutaka system allows the Land Notary to view all registered identity information for the seller and buyer in the NIDA database, including seller and buyer photos, to confirm the identity of those present and requires that Land Notaries capture seller and buyer biometric data, including photos, electronic signatures, and fingerprint. This supports prevention of double selling of land, identity fraud, and repudiation.

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[8] 'Ubutaka' means land in Kinyarwanda.

[9] By law, all property owners (often, a husband and wife) and all buyers must physically appear before the Land Notary (or be represented by a Power of Attorney). In alignment with the law, Ubutaka App supports multiple sellers and multiple buyers, and accepts Power of Attorney documents.

When the Land Notary is ready to authorize the transfer, they digitally sign the transfer data with a secure signing key (using Public Key Infrastructure), which generates a Sales Agreement and securely send the complete application to LAIS. This provides proof of the authorization and identity of the approving Land Notary.

In LAIS, the Registrar reviews and approves the application, also using Public Key Infrastructure, and digitally signs the transfer data using a digital wallet. For added transparency and security, key components of the process – including the Unique Parcel Identifier (UPI), Registrar's cryptographic signature, and exact time of transfer approval – are recorded on blockchain. Enhancing Rwanda's land administration system with blockchain provides a permanent, auditable, and immutable record of the transfer time and proof of transfer details for independent verification.[10]

With its robust security features, Ubutaka App provides certainty of ownership and prevents common types of fraud in land transfers by voluntary sale. Integration with NIDA provides certainty that the buyer and seller present at the Land Notary office are not imposters. The permanent capture of buyer and seller photos, fingerprints and signatures support repudiation and confirms that all parties to the transfer were present and willing participants. Digital signatures of the transfer data by the Land Notary and the Registrar prove the identity and authorization of the transfer by relevant authorities. Blockchain recording provides a permanent, independently verifiable, and tamper proof record of the time and details of the transfer for all involved. The combination of these features delivers end-to-end digital security for the transfer process and a permanent, immutable record.

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[10] Key components from transfers by voluntary sale completed using Ubutaka App are visible on the Mediciland blockchain recorder (note: 'Search the Blockchain' using the acronym TVS): https://landrecords.mediciland.com/search/rwanda/rlmua/land.
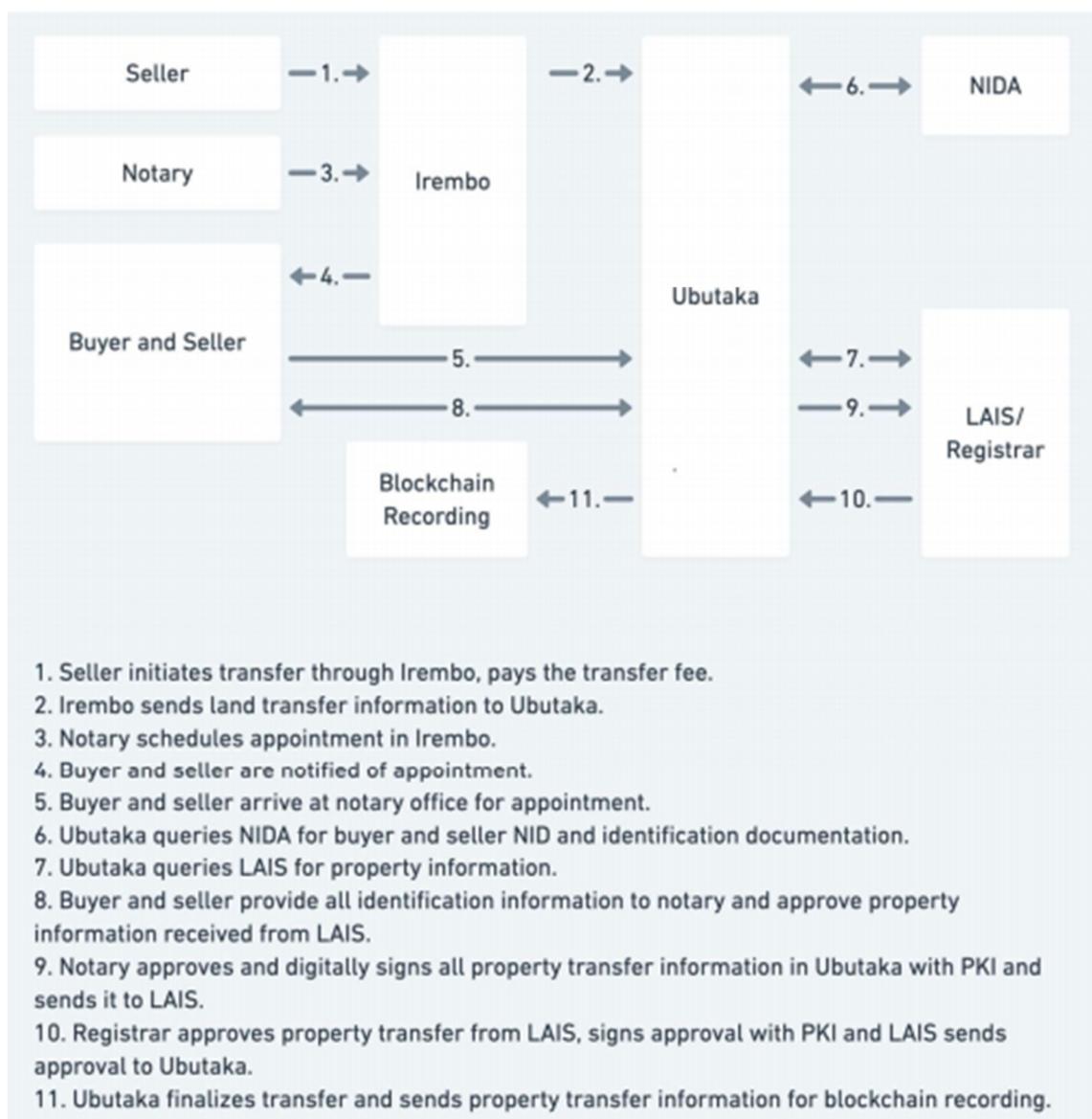
1. Seller initiates transfer through Irembo, pays the transfer fee.
2. Irembo sends land transfer information to Ubutaka.
3. Notary schedules appointment in Irembo.
4. Buyer and seller are notified of appointment.
5. Buyer and seller arrive at notary office for appointment.
6. Ubutaka queries NIDA for buyer and seller NID and identification documentation.
7. Ubutaka queries LAIS for property information.
8. Buyer and seller provide all identification information to notary and approve property information received from LAIS.
9. Notary approves and digitally signs all property transfer information in Ubutaka with PKI and sends it to LAIS.
10. Registrar approves property transfer from LAIS, signs approval with PKI and LAIS sends approval to Ubutaka.
11. Ubutaka finalizes transfer and sends property transfer information for blockchain recording.

Fig. 1. Ubutaka App process flow and integrations

4. RESULTS

Ubutaka App has brought positive outcomes in the pilot area. It is predicted that, overall, implementation of Ubutaka App will increase the speed of transferring a land title from seven days to one or two days (theoretically, the end-to-end process could be completed in a single day). The time and financial burden on citizens will be reduced, as the system requires only one visit to the Land Notary, which can be completed in under an hour. Sellers do not need to spend money printing various application documents to be presented to the Notary, as all necessary documentation is contained in Ubutaka App. Additionally, the costs involved in the provision of land services will be reduced because the system eliminates the need to transport land documents between sector and district offices, makes obsolete the printing and scanning of documents, and removes the need to manually complete documents.

Implementation of Ubutaka App has encountered several challenges. The COVID-19 pandemic and efforts to mitigate its spread have slowed the use of the system. As described above, sellers and

buyers must physically present themselves to the Land Notary; however, only a few weeks after the launch of Ubutaka App, a total lockdown was imposed in Kigali and no land transactions were made during this period. This reduced the momentum for Land Notaries in familiarizing themselves with the system.

In general, barriers to technology diffusion and adoption in Rwanda include low digital literacy (8.4 percent); the high cost of local data hosting; low device and internet penetration (39.8 percent), with a higher geographical divide between rural and urban areas; low electricity penetration (27 percent); and the high cost of broadband and smart devices (RISA, 2019). These barriers have also presented challenges to adoption and use of Ubutaka App. Though the project team provided a one-day training to all Land Notaries, followed by one-on-one training in each Land Notary's office prior to the launch of the pilot project, repeated user trainings are needed to improve the technology adoption. Some Land Notaries are unfamiliar with the software and the hardware used in the system. To tackle this issue, a technical team is in place to provide assistance whenever needed. There is also an issue with computers and internet reliability. Most Land Notaries have old and underperforming computers, many of which are not compatible with the hardware, or have chronic technical issues. Lastly, some Land Notaries do not have stable internet connectivity in their workplace, yet the system is internet-based. With these challenges in mind, use of Ubutaka App and similar technology-based initiatives needs to be paired with investments in digital literacy at all levels, consistent training and support to users, access to the internet, and quality equipment.

5. DISCUSSION

Protecting Rwanda's land heritage means putting in place instruments and systems that will continue to guarantee security of tenure for citizens and promote the optimal use of land long into the future. Article 3 of the law governing land in Rwanda states that land is part of the common heritage of all Rwandans, the ancestors, present and future generations. The land reforms initiated in 2004 recognized rights over land to all and put in place instruments, processes and procedures that ensure the protection of these rights and support the rational use of land by promoting land-based investment. The LTRP recognized and clarified rights to land for citizens. However, land is dynamic; the owner of the land today is not necessarily the owner tomorrow.

The ongoing success of the LTRP relies on the maintenance of Rwanda's land administration system. Following initial registration, maintenance requires constant evolution and reform to ensure that data is securely managed and that the formal system is upheld. A critical component of this is the infrastructure and staff to keep records up-to-date and accurate after first registration: Land information must be reliable and current. In Rwanda, citizens can now access their land information from their mobile phone, via a mobile application – an important step which supported the active land market and efficient business practices at a national level.

The Government of Rwanda intends to have a more transparent, secure, and paperless land registry by 2024. By leveraging emerging technologies such as PKI and blockchain, Ubutaka App is helping make that goal achievable. Ubutaka App promotes security of tenure, as it allows different steps of verification before transferring and buying land. These verifications assure new owners that transactions are free of fraud and thereby prevent future disputes arising from conflicting claims to

the land. In the near future, Ubutaka App could also enable citizens to securely transfer a land title in one day, with zero visit, which will further engender confidence in the land registry and the land administration system overall.

To be successful new technologies like Ubutaka App require collaboration among institutions. For Ubutaka App, this includes local government as the service provider, RLMUA as the system owner, RISA for technical support, Land Notaries as the frontline and main users, and MLG as the private-sector partner. Institutions must work together to achieve the intended goal of the system: Strengthening citizen-centric land governance to promote the optimal use of Rwanda's land heritage by the country's citizens; not only for themselves, but also for future generations.

6. CONCLUSION

This paper presented Ubutaka App as a case study on the development of a paperless, secure, and fully interoperable land administration system under a partnership between Rwanda Land Management and Use Authority (RLMUA), Rwanda Information Society Authority (RISA), and Medici Land Governance (MLG). Ubutaka App and similar technologies have the potential to make land service delivery faster, more efficient, and cheaper. The paper showed that adoption of advanced land governance systems enhanced by emerging technologies, such as Public Key Infrastructure and blockchain, enables the Government of Rwanda to solve modern land sector problems and better protect the country's land heritage.

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Ms. Ailey Kaiser Hughes was the editor and a contributing writer of this paper.

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Mr. Sylvain Muyambano was a contributing writer.

Mr. Jethro Jones was a contributing writer.

Mr. Kieran McGowan was a reviewer.

Mr. Nicholas Tagliarino contributed thought leadership to this paper.

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12.   KEY TERMS AND DEFINITIONS

Public Key Infrastructure (PKI): A technology for digitally authenticating users and devices. PKI allows one or more trusted parties to digitally sign documents certifying that a particular cryptographic key belongs to a particular user or device. The key can then serve as an identity for the user in digital networks. In 2015, the Government of Rwanda established a PKI infrastructure used for authentic access of information on online platforms. Once all the relevant institutions are on

board for e-signature, it is expected to replace most manual processes and promote efficient paperless processes.

Blockchain: A computer network designed to store short sequences of data, validate shared rules, and exchange economic value transparently and resiliently. A blockchain distributes the balance of power equally among all participants, such that no single entity can unfairly take advantage of the others. Blockchain technology enables the creation of an open, distributed ledger that records transactions efficiently in a verifiable, accessible, transparent, auditable, and permanent manner.