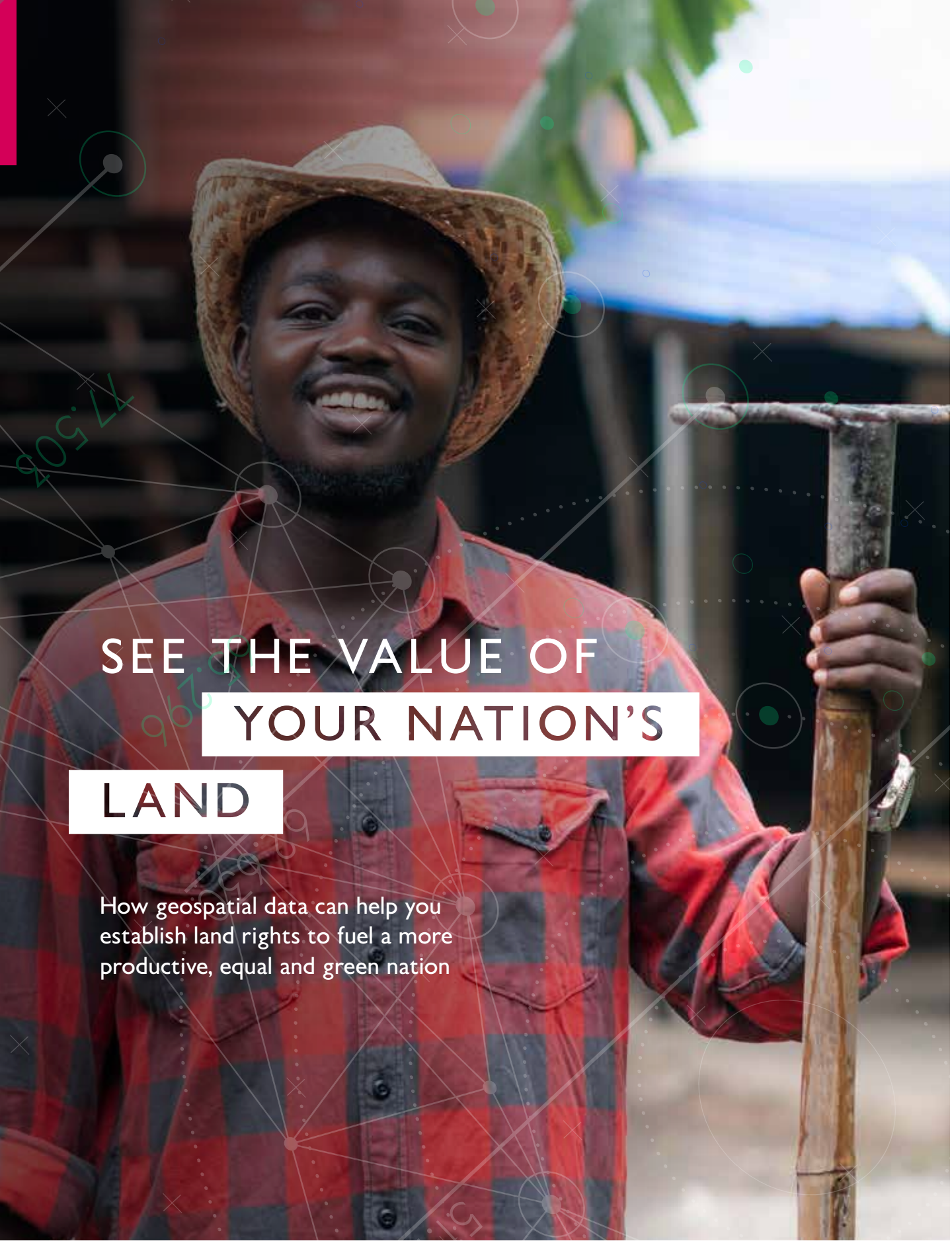


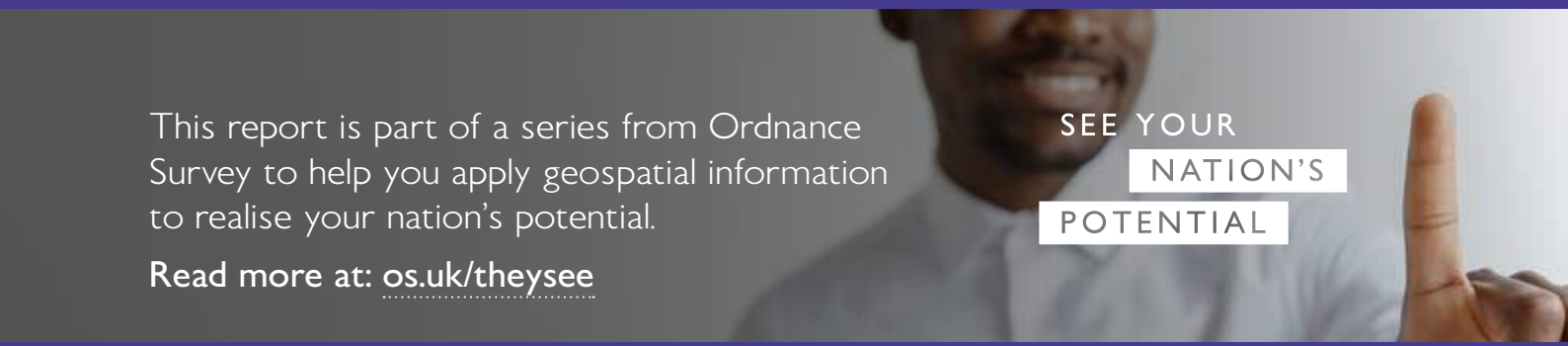
SEE THE VALUE OF YOUR NATION'S LAND

How geospatial data can help you establish land rights to fuel a more productive, equal and green nation

Ordnance Survey

SEE > BETTER PLACE

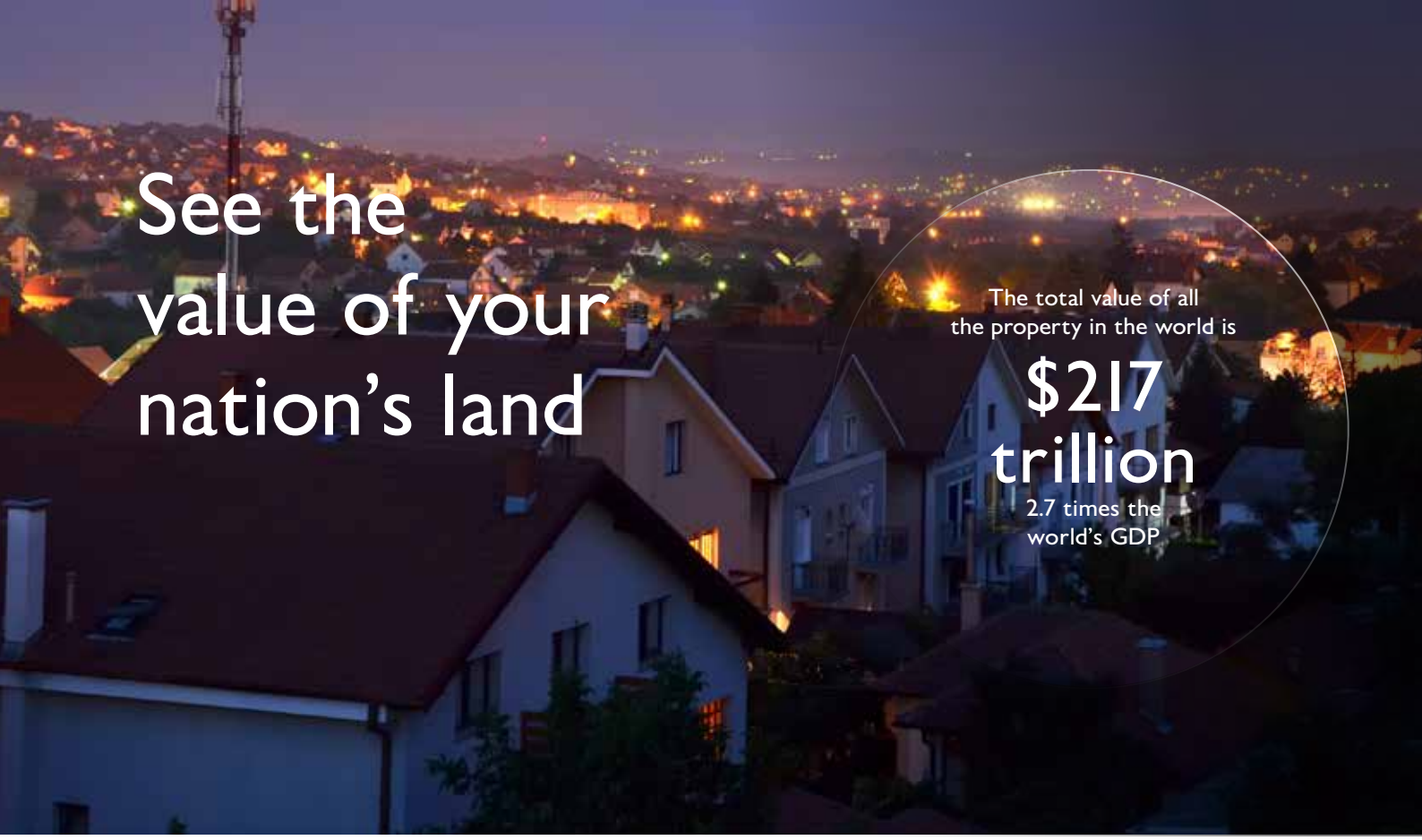
Contents



This report is part of a series from Ordnance Survey to help you apply geospatial information to realise your nation's potential.

Read more at: os.uk/theysee

INTRODUCTION



Land accounts for a significant proportion of total financial value worldwide. In 2018, the total value of companies listed on the London Stock exchange was around $5.4 trillion[1]*, while the value of the UK's land in the same year was estimated to be $6.8 trillion[2]. The International Office for Cadaster and Land Records (OICRF) has published material that suggests land accounts for 75% of global GDP[3]. Real estate company Savills has estimated that real estate accounts for 60%[4] of the world's mainstream assets, and that the total value of all the property in the world is $217 trillion – 2.7 times the world's GDP[5]. Whichever way you choose to look at it, land is big business, and accounts for a significant proportion of both value being generated as GDP and value being stored in assets.

The value held in land is an important concept in international development. It has been suggested by Peruvian economist Hernando de Soto and others that providing the world's poor with titles for their land, homes and unregistered businesses would unlock $9.3 trillion in assets[6]. According to this theory, providing people with legal land rights is one of the surest ways of lifting people out of poverty, as it provides people with a source of capital that they can use as collateral in order to secure loans to improve the land or start businesses. While there is some debate about how much "dead capital" there is, or whether land tenure alone is enough to enfranchise the world's poor and lift communities out of poverty, most economists would agree that there is great value held in land, and that secure land rights can stimulate economic activity.

Land rights are important for development in other ways besides providing a potential

1. https://www.statista.com/statistics/324578/market-value-of-companies-on-the-london-stock-exchange/
2. https://www.ons.gov.uk/economy/nationalaccounts/uksectoraccounts/bulletins/nationalbalancesheet/2018
3. https://www.oicrf.org/documents/40950/0/233_03-11-Kedar-284_paper.pdf/67e3c234-e095-0cff-6e04-937fcbbb3ad2?t=1563273603509
4. https://www.savills.co.uk/insight-and-opinion/savills-news/198559-0/world-real-estate-accounts-for-60--of-all-mainstream-assets
5. https://www.cityam.com/the-total-value-of-all-the-property-in-the-world-is-217-trillion-27-times-the-worlds-gdp/
6. https://www.reuters.com/article/us-global-landrights-desoto-idUSKCN10C1C1

* **$ references throughout this report at USD.**

avenue to access credit. Because men typically have greater access to land rights than women, issuing tenure can be an effective way of empowering women, an important component of achieving the UN's sustainable development goals. There is strong evidence that issuing land rights to indigenous peoples and local communities can slow deforestation, providing a vital tool in the fight against climate change and biodiversity loss[7].

The issue is that only an estimated 30% of the world's population has a legally registered title to their land[8]. This lack of secure land and property rights makes it harder to lift communities out of poverty and provide them with basic services, holds women back from becoming economically empowered, and hastens the destruction of the environment.

Every nation faces a unique landscape when it comes to land administration, which is heavily shaped by each country's history in regards to land ownership. Customary lands, where tenure is collectively owned by indigenous communities, is often the norm in parts of Africa. These systems have traditionally been viewed as an impediment to delivering tenure to individuals[9], thereby stymying agricultural development, although more recent research shows a more nuanced picture, with customary lands holding the potential to be both adaptable and progressive[10]. The varied and unique nature of traditional customary land systems does however complicate drives to extend tenure, and as a result there is no one-size-fits all approach to land tenure. At the other end of the spectrum, there are highly sophisticated digital systems of land administration that use 3D cadastres, which are most applicable to high-density urban environments with a high proportion of high-rise residential real estate, for example in city states like Singapore[11].

Considering that the majority of humanity does not enjoy secure land rights, to create sustainable and inclusive societies there is a need to accelerate efforts to document, record and recognise people to land relationships in all forms, according to the United Nations Committee of Experts on Global Geospatial Information Management (UN-GGIM) Framework for Effective Land Administration (FELA)[12]. FELA acts as an overarching policy guide for nations to make progress towards the UN's Sustainable Development Goals, utilising land administration underpinned by geospatial information. FELA directly relates to the overarching Integrated Geospatial Information Framework (IGIF) as adopted by the UN-GGIM at its eighth session in August 2018. FELA implements the IGIF for the land sector[13] [14].

Success factors in secure land-tenure policy include robust collection of geospatial, anthropological and sociological data, acknowledging customary rights and land

7. https://www.wri.org/insights/4-ways-indigenous-and-community-lands-can-reduce-emissions
8. https://www.worldbank.org/en/news/feature/2017/03/24/why-secure-land-rights-matter
9. https://www.sciencedirect.com/science/article/pii/S0264837717310207#bib0120
10. https://sarpn.org/documents/d0002678/Land_policy_Cousins_Jul2007.pdf
11. https://lidarmag.com/2019/04/01/singapore-smart-nation-embraces-3d-land-management/
12. http://ggim.un.org/meetings/GGIM-committee/10th-Session/documents/E-C.20-2020-29-Add_2-Framework-for-Effective-Land-Administration.pdf
13. https://ggim.un.org/documents/FELA_Consultation_Draft.pdf
14. https://ggim.un.org/IGIF/

rights of women and the poor, and law enforcement capable of penetrating urban and rural areas and avoiding conflicts between statutory and customary law[15].

The key to delivering effective land administration, whether it is in the context of customary rural lands or high-density urban environments, is accurate digital geospatial records. Geospatial data is a vital component for building modern and reliable land administration systems. Effective land administration reduces land disputes, thereby relieving pressure on the justice system. Investing in geospatial data and techniques supports effective cadastral land reform which is an intrinsic element of modern practice. Ordnance Survey has over 200 years of experience in surveying, mapping and holding authoritative records. Partnering with Ordnance Survey can help you digitise records and produce authoritative land-use maps to form the basis of modern cadastral registration systems, helping your nation overcome its land rights challenges.

15. https://www.gim-international.com/content/article/secure-land-tenure

What is geospatial information?

'Geospatial information', also referred to as 'geospatial data', or 'location data', is information about location. Geographers and cartographers have worked with geospatial information for centuries, plotting maps and charts to represent the world around us.

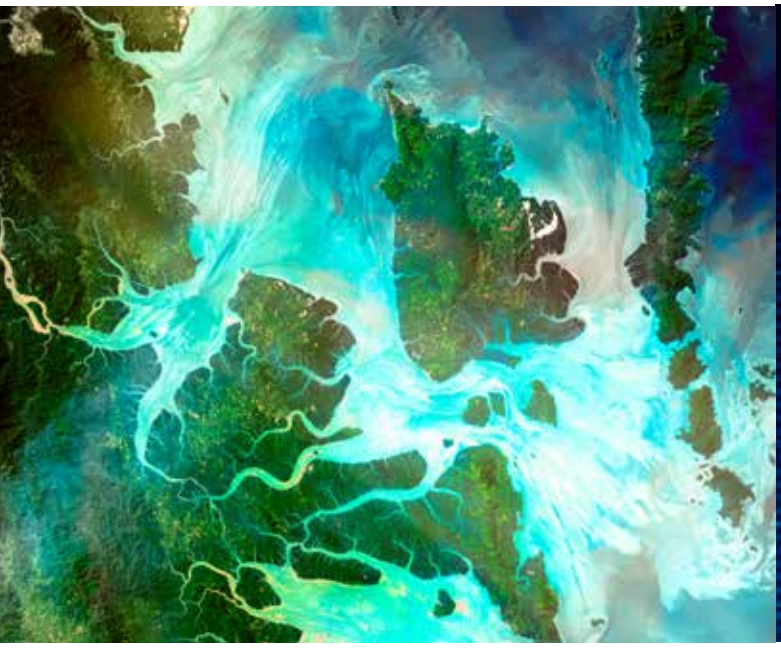
In the 21st century, digital geospatial information is generated constantly, from locations derived from our mobile phones, to remote sensing of the Earth's surface from space, to global navigation satellite systems (GNSS) like GPS.

Geospatial information serves an important role in linking different data sets that would be otherwise unconnected, through their shared location and place. A Spatially Enabled Society is one that benefits from a wide array of spatial data and services[16].

Enhancing and linking other data-driven initiatives, geospatial information is a critical enabler for nations seeking to grow their economies, drive sustainable development, support evidence-based decision making and policy setting, and enable new and innovative uses of government data to solve problems and provide new services.

Every country is at a different stage of implementation in their approach to managing geospatial information. 'Geospatial maturity' is a term used to describe the level of sophistication that a country has in its ability to collect, manage, and exploit geospatial information for the benefit of the nation. A geospatial maturity assessment is a tool that can help organisations objectively understand how mature their geospatial capabilities are.

16. https://www.fig.net/resources/publications/figpub/pub58/figpub58.pdf



Explaining land terms

There are many terms that people use to talk about land, its ownership, its use, and how it is managed. The broadest of these terms is land administration, which describes the governance aspect of land management, of which tenure is one part. While there are some important differences, there is much overlap between these terms, and they may be used equivalently in some instances. Below is a list of these terms and their definitions, for the purpose of disambiguation.

Land administration is the process of determining, recording and disseminating information about ownership, value and use of land and its associated resources[17].

Tenure is the relationship among people as individuals or groups with respect to land. Rules of tenure define how property rights in land are to be allocated within societies. Land tenure systems determine who can use what resources for how long and under what conditions[18].

Land registration describes systems by which ownership, possession or other rights in land can be recorded. In common law countries, title registrations are broadly classified into two basic types: the Torrens title system and the English system, a modified version of the Torrens system[19].

Land title is defined as evidence of a person's rights to or ownership of land[20].

Land titling is a process through which private and public property can be formally registered[21].

Land rights define the theoretical and legal ownership of resources and how they can be used. These resources can be both tangible or intangible and can be owned by individuals, businesses, and governments[22].

Land use corresponds to the socio-economic description (functional dimension) of areas: areas used for residential, industrial or commercial purposes, for farming or forestry, for recreational or conservation purposes, etc[23].

Tenure is the relationship among people as individuals or groups with respect to land

17. http://www.fao.org/in-action/herramienta-administracion-tierras/introduction/concept-land-administration/en/
18. https://www.oecd.org/dac/gender-development/47566053.pdf
19. https://www.theweek.co.uk/52-ideas-that-changed-the-world/106633/52-ideas-that-changed-the-world-44-land-registration
20. https://www.igi-global.com/dictionary/international-land-deals-and-agricultural-investment-in-ethiopia/44949
21. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=940959
22. https://www.investopedia.com/terms/p/property_rights.asp
23. https://www.eea.europa.eu/help/glossary/eea-glossary/land-use

Land tenure in Africa

It is estimated that 60% of national land area across Africa is held under traditional forms of land ownership, known as customary tenure, which provides communal rights to indigenous communities. However, Africa has the largest portion of unrecognised indigenous and local community lands. A study carried out in 2020 found that in 8 out of 14 African countries studied, 60% of native territories are not afforded legal recognition.

A consequence of colonialism is that customary tenure systems were arbitrarily overridden. Post-independence governments have tended to maintain the essence of the colonial land administrative framework[24]. In addition, urbanisation and industrialisation has led to the loss of agricultural lands. As global demand for food, fuels, minerals, fibres and other natural resources grows, land acquisitions are on the rise around the world. Indigenous and community lands held under informal customary tenure arrangements can be left vulnerable to outside commercial interests, increasing the likelihood of farmers being dispossessed of their farmlands[25]. This is especially true for women: although 60-80% of food production is managed by women, female land tenure is under-represented and remains the most at risk[26].

Many African countries are struggling to cope with the demand for registering land transactions which is exacerbated by the rapid changing patterns of land use associated with accelerated growth. In Ghana, for example, mining and biofuel cultivation have contributed to land conflicts in the country. The disputes are between local communities on one side and corporations, including the government, on the other. These conflicts arise due to environmental damage, relocation of inhabitants and breaches of concession agreements. A mining company can be granted rights to privately-held or stool land, restricting the owners' land use and could potentially lead to the owner being displaced. Land rights issues have also been raised due to investment into biofuels[27].

Competition over land ownership is in turn causing huge challenges and pressures on land

24. https://dai-global-developments.com/articles/customary-land-tenure
25. https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0246502
26. http://www.fao.org/3/cb0706en/CB0706EN.pdf
27. https://land-links.org/wp-content/uploads/2016/09/USAID_Land_Tenure_Ghana_Profile_0.pdf

management governance and land rights. This has resulted in a number of other problems for countries, such as inability to increase their revenue base, distortion of urban land market and delays in the implementation of urban development. In Chad it has been shown around 80% of pending cases in court relate to land dispute, demonstrating insecure tenure and overlapping land management systems are not 'fit-for-purpose' leading to inefficiencies, tensions and ultimately conflict[28]. Lack of secure land rights can also lead to household food insecurity and a lack of agricultural productivity[29]. This insecurity is a major underlying cause of deforestation and land degradation, which are usually linked to unsustainable land use practices.

Tenure security requires property rights that are clear in purpose and duration and accepted as legitimate and legal. Studies have shown that there is a direct correlation between poverty, land registration and informal non-transparent land markets. The positive effects of land tenure security are well documented, including higher-quality livelihood outcomes[30], economic productivity and better agricultural yields. With secure tenure owners are more likely to commit to long-term investments on the land. Secure tenure through land certification in Ethiopia has seen marked improvement of agricultural land through tree planting, terrace construction and soil improvement through composting[31].

There are a variety of land tenure systems currently in use across the African continent, with unique characteristics that bestow specific rights to the holder. Many of these rights are customary and not recognised by the registration law.

Current paper-based land information systems often suffer from lost or misplaced documents and inconsistent record keeping.

28. https://www.worldbank.org/en/results/2020/11/10/land-tenure-matters-for-agricultural-productivity-in-chad
29. https://www.tandfonline.com/doi/abs/10.1080/00220388.2020.1762862?journalCode=fjds20&
30. https://www.sciencedirect.com/science/article/pii/S0264837719320289
31. https://www.mdpi.com/2071-1050/11/20/5551/htm

In Ghana, the lack of a digital system means the process of registration, transfer of land, property titles and deeds takes an average of 120 days to finalise, which is four times longer than state targets[32].

With first-time registration costing up to US$1,000 per title in some cases[33], it is easy to argue that costs undermine the economic rationale for titling. However, advances in technology such as drone, aerial and satellite imaging, have drastically reduced the costs of surveying. This has been proven in Rwanda where 11.5 million parcels were demarcated and registered at US$5 to US$6 per parcel[34].

Geospatial data is a vital component for modernising land tenure. By converting records to digital formats and producing authoritative cadastral maps that form the basis of modern cadastral registration systems, your nation can address and overcome land rights challenges. This report outlines how nations can establishing secure land rights, thereby boosting economic productivity, reducing poverty and building a fairer society.

32. https://www.graphic.com.gh/news/general-news/land-registration-duration-reduced-to-120-days.html
33. https://www.researchgate.net/publication/46511473_Is_Land_Titling_in_Sub-Saharan_Africa_Cost-Effective_Evidence_from_Madagascar
34. https://www.gov.uk/research-for-development-outputs/sustaining-the-success-of-the-systematic-land-tenure-registration-in-rwanda

PART ONE: LAND TENURE FOR GROWTH

2

Economic growth

The total value of all the real estate in the world has been estimated at $217 trillion, which is almost three times the world's GDP[35]. However, by some estimates, as much as $9 trillion of this value could be considered "dead capital", much of it in the global south[36].

One proposed method of unlocking this capital, and thereby empowering the world's poor, is by issuing formalised tenure to residents of informal settlements and customary lands. Digital records can drastically reduce the time and cost associated with carrying out this type of land administration. In economies that have digitised land registry, the time required to transfer property fell by 38%, according to the World Bank[37]. Geospatial data, in its ability to authoritatively record precise property boundaries, is a vital tool in modernising land administration.

Alleviating poverty

In rural communities, land can provide a primary source of income, food security, cultural identity and shelter. It also serves as a fundamental asset for the economic empowerment of the poor and provides a safety net in times of hardship. Secure rights to land and greater equity in land access are important for poverty reduction and are central to the attainment of the Sustainable Development Goals (SDGs), namely SDG 1 which relates to ending poverty, according to The Food and Agriculture Organisation of the United Nations (FAO)[38]. Land and housing are the most important assets of the poor, according to the World Bank, and improving tenure security for both women and men can have an important impact on household income, food security, and equity[39].

35. https://www.cityam.com/the-total-value-of-all-the-property-in-the-world-is-217-trillion-27-times-the-worlds-gdp/
36. https://www.imf.org/external/pubs/ft/fandd/2001/03/desoto.htm
37. https://elibrary.worldbank.org/doi/10.1596/978-1-4648-0667-4_Registering_property
38. https://www.un.org/esa/sustdev/csd/csd16/documents/fao_factsheet/landtenure.pdf
39. https://www.worldbank.org/en/topic/land#2

Boosting productivity

When people don't have secure land rights, they're at risk of losing the property they live in or work on. This can lead to an underinvestment in property and a disincentive to make best use of the land. Farmers, for example, may focus on agriculture that is easier to relocate, rather than more lucrative crops that may take longer to grow, although there are many different factors influencing farming practices.

Similarly, when property rights aren't secure or clear, people working the land can spend a lot of time and resources defending their ownership. This can include physical protection, such as employing guards to look after crops, or legal protection through the court system, but the result is the same: higher costs for the landowner and an inefficient allocation or resources.

By working to achieve secure land rights, governments have the potential to significantly improve the use of land across their nation, increasing crop yields, reducing costs and boosting productivity.

Taxation

Land registration provides governments with information regarding landholders and property boundaries, which provide the basis for a system of property taxes[40]. Effective taxation systems support the delivery of infrastructure and services, which create favourable conditions for increased economic activity, such as transport of goods is made more reliable, and education delivers expanded opportunities to the population. The formalisation of land administration is considered a way to strengthen an effective fiscal state – when countries increase the share of land held under individual property rights, the share of income tax as a share

40. http://www.hubrural.org/IMG/pdf/iied_lt_cotula.pdf

of GDP also increases. A study found that registration of land in African countries can increase tax intake from direct taxes on individuals between 0.6 to 1.4%, showing investment in legal infrastructure in the form of public-order and information-based property administration leads to a more efficient tax state[41].

In Buenos Aires, a large-scale land titling programme in the late 2000s helped unlock significant property investment and tax revenues. However, these gains are now being reversed because 78% of property transfers since the registration programme have taken place informally, thus undermining property investment and security provision in mortgages[42].

Credit

Land registration is essential for establishing a formal system of credit, which enables farmers and other entrepreneurs to secure loans to start a new business or expand an existing one; property is the most common form of collateral[43]. Credit is critical to farming because it sparks agricultural transformation, the process of investment and technological change leading to higher productivity[44]. There is evidence that formalised property rights reduce informal credit, while also making it cheaper; land titling is an effective way of transferring informal credit into a formalised system of credit[45].

41. https://www.wider.unu.edu/sites/default/files/Publications/Working-paper/PDF/wp2021-175-no-taxation-without-property-rights.pdf
42. https://www.nber.org/papers/w22482
43. https://corporatefinanceinstitute.com/resources/knowledge/finance/collateral/
44. https://blogs.worldbank.org/allaboutfinance/much-ado-about-land-rights-how-digital-technology-can-disrupt-agricultural-credit
45. https://www.siecon.org/sites/siecon.org/files/oldfiles/uploads/2016/09/MIGHELI.pdf

Microfinance

Microfinance, in much the same way as other types of credit, is enabled by access to collateral, of which property is the most common. Formally titling assets of rural land increases access to credit by microfinancing, and allows small rural businesses to interact with the global system of finance capital. A study published in 2019 in conjunction with ACLEDA Bank, Cambodia's largest provider of microfinance loans, explored how a rural land market and microfinance sector can grow in tandem[46]. It is important to note that while land titling can help to expand access to credit in some circumstances and can be an important part of a poverty reduction strategy, it is just one of many criteria that comprise an enabling environment for establishment of an effective formal credit system[47].

Internal investment

An effective land administration system that incorporates formalised land registration is essential not just for establishing internal credit markets, but also for securing international investment. Foreign direct investment (FDI) is an integral part of an open and effective international economic system and a major catalyst to development, according to the Organisation for Economic Co-operation and Development (OECD)[48]. An ineffective land administration system can be a major impediment to securing international investment, as is shown by the 2015 example of an Indian mining company suing Indonesia for $581 million[49]. India Metals & Ferro Alloys Ltd. (IMFA) filed the claim against the Indonesian government at the Permanent Court of Arbitration in The Hague after finding it could not legally operate as its mining permit overlapped with other permits issued in the region. While the court eventually sided with the state[50], a more effective land registration system would have provided a better outcome for both the state and the investor. Ghana's supreme court has issued legal judgements that make it clear that uncertainty about whether property deals are valid deter foreign investors[51].

46. https://www.researchgate.net/publication/332673259_From_rice_fields_to_financial_assets_Valuing_land_for_microfinance_in_Cambodia
47. https://land-links.org/wp-content/uploads/2016/09/Land-Titling-and-Credit-Access-Understanding-the-Reality.pdf
48. https://www.oecd.org/investment/investmentfordevelopment/1959815.pdf
49. https://www.thejakartapost.com/news/2015/11/18/indian-mining-co-sues-indonesia-581-million.html
50. https://www.italaw.com/cases/8034
51. https://africanlii.org/article/20200326/chaotic-land-ownership-records-shock-ghanas-supreme-court

CASE STUDY

Land registration in Vietnam

The Vietnamese land registration and property allocation system underwent a significant change during the early 1990s. Prior to this, the Vietnamese government periodically allocated land to households for cultivation and no land transactions were allowed.

During the transformation land-use certificates were introduced and land was allowed to be transferred, exchanged, leased, mortgaged, and inherited. Numerous economic studies have found that this change led to a significant increase in economic growth across the country.

This impact was observed both on a national level, with GDP and average incomes being significantly higher in the following years, but also on a more localised level, with night-time light intensity (a proxy for economic development) increasing in rural villages after the reforms[52].

52. https://www.jstor.org/stable/10.1086/533549

Infrastructure delivery is 2.7 times more expensive without tenure security

Civic life and services

Land registration is one of the most important prerequisites for provision of utilities, public services, and participation in civic life, including exercising the right to vote in democratic elections. Accurate records related to property, underpinned by geospatial data, can facilitate the provision of utilities, including water and electricity, that support the empowerment of residents, and create an enabling environment for industry[53].

Civic life and identity

Understanding land ownership is a core component of civic life in all nations. Awareness of population demographics, distribution and change over time, guides effective policy development, allowing governments to better plan services and infrastructure that cater to citizens' needs. It also supports the implementation of effective taxation systems to raise revenue to address market failures, pay for essential goods and services, and ensure the best outcomes for their citizens.

As citizens without tenure are often not documented, and because areas without surety of ownership also often lack effective addressing systems, they can become effectively invisible to the government.

It is important to have a land tenure system that supports a national addressing system as addressing provides additional economic growth potential when used alongside land tenure, and access to social welfare entitlements, utility supply, education and healthcare[54].

Service provision

One of the defining characteristics of informal settlements is unknown or disputed tenure. Residents in informal settlements usually do not own the land their property is built on. The housing in informal settlements is built without centralised urban planning, and may not comply with planning and building laws and regulations[55]. Incomplete or nonexistent records of addresses in neighbourhoods that lack tenure can cause gaps in service provision. This can result in the poorest people spending significantly more on basic resources than the rest of the population. For example, connection to utilities requires a record of property ownership and address – without these, inhabitants may have to rely on bottled water, which can be up to 20 times more expensive than water from the mains[56].

53. https://openknowledge.worldbank.org/bitstream/handle/10986/13837/780850PUB0EPI00LIC00pubdate05024013.pdf?sequenc
54. https://www.addressingtheunaddressed.org/about
55. https://stats.oecd.org/glossary/detail.asp?ID=1351
56. https://www.womenforwater.org/uploads/7/7/5/1/77516286/water_at_what_cost_wateraid_2016.pdf

Infrastructure

Because citizens without tenure are often not documented, they can become effectively invisible to urban planners, and may therefore lack access to infrastructure like roads. This can in turn make it harder for them to receive goods and services that are delivered by vehicles that require access to the property. Infrastructure delivery is considerably cheaper in tenure-secure neighbourhoods – in Colombia, it has been estimated to be 2.7 times more expensive to deliver infrastructure in informal settlements[57].

Justice

In many countries, a large proportion of court time is taken up by property disputes. Establishing clear ownership through a digital tenure system can greatly reduce the burden on the courts, meaning fewer delays in the justice system.

For example in Ghana, over 80% of land titles lack the documentation to prove ownership, and it is estimated that about 57% of the total cases in courts are land cases. This can cause delays in the justice system that can last decades[58].

57. https://cdn.odi.org/media/documents/3199.pdf
58. https://www.oecd.org/corruption/integrity-forum/academic-papers/Georg%20Eder-%20Blockchain%20-%20Ghana_verified.pdf

CASE STUDY

A land rights experiment

During the 1980s in Buenos Aires, Argentina, a group of families squatted an area of derelict land. The Argentine parliament passed a law transferring land rights to some of the squatters, compensating the original landowners, but not all of the squatters achieved tenure.

This provided a unique opportunity to study the difference that land rights make on social and economic outcomes, by comparing two groups of people, one with land rights and the other without them.

Those families who gained land titles had a significantly higher probability of having good-quality housing, and a statistically significant improvement across a range of socio-economic indicators. Families with property rights produced fewer children, and the children they had completed secondary education in much higher numbers.

This case study exemplifies the benefits of an effective land tenure system. Geospatial technologies including base maps and addressing support the implementation of land tenure systems[59].

59. https://www.isid.ac.in/~tridip/Teaching/DevelopmentMicroeconomics/Readings/Galiani&Schargrodsky-JPubEco2010.pdf

CASE STUDY

Estonia's e-land register

The e-Land Register is a one-of-a-kind web application that contains information on all ownership relations and limited real rights for properties and land parcels. Paired with a geographical information system (GIS), the electronic Land Register delivers real-time geographical data through Estonia's innovative data exchange system, enabling advanced map-based visualisations that power many of the location-based services in Estonia.

A critical tool for the real-estate market, it provides total transparency; listing the registered owner of each property holding, showing the property boundaries and providing other information that potential buyers need to know.

Records information contains cadastral data (including address, area, purpose of land), ownership relations, encumbrances, restrictions, rights of use, other notations and mortgage information. The system has transformed the way property transactions are carried out in Estonia, eliminating the need to visit public offices and spend hours waiting for a civil servant to search records.

This paper-free system has reduced the processing time for land transactions from up to 3 months to 8 days. Businesses benefit from the security of having instant access to land titles and the ability to confirm ownership with a few clicks[60].

60. https://e-estonia.com/solutions/interoperability-services/e-land-register/

PART TWO: LAND TENURE FOR CLIMATE JUSTICE AND EQUALITY

3

Climate change

Deforestation rates are up to three times higher in forest lands without secure indigenous tenure

Land tenure is a core aspect of responsible land governance, a fundamental component of sustainable land management and an essential element in addressing desertification/land degradation and drought, according to the UN Convention to Combat Desertification (UNCCD)[61]. Environmental sustainability, social conflicts, and food security are intimately related to land tenure, according to the FAO[62]. Two of the main driving forces behind wood-land deforestation are poverty and the lack of well-defined property rights[63].

By managing the world's land more sustainably, such as by protecting forests and investing in reforestation, up to 37 percent of emissions reductions necessary to limit the global rise in temperature to 2 degrees Celsius by 2030 could be achieved, according to the World Resources Institute[64].

Geospatial data underpins the effective and responsible land administration that is needed to reduce emissions and adapt to climate change. Authoritative digital records, including accurate and up-to-date cadastral records and property boundaries, are underpinned by geospatial data, and managed using geospatial tools.

Community / indigenous land rights

Protecting indigenous peoples' rights to their lands and forests has an important role to play in reducing emissions; a report from the Rights and Resources Initiative shows that indigenous peoples and local communities worldwide manage at least 293 billion metric tons of carbon in the trees and soil of their forests[65]. Keeping this carbon stored in soil and forests, and keeping it out of the

61. https://www.unccd.int/actions/land-tenure
62. http://pdf.wri.org/ref/fao_02_land_tenure.pdf
63. https://d3pcsg2wjq9izr.cloudfront.net/files/6063/articles/4943/X04337I08P3HG08Q.pdf
64. https://www.wri.org/insights/safeguarding-carbon-stored-indigenous-and-community-lands-essential-meeting-climate-goals
65. https://rightsandresources.org/wp-content/uploads/2018/09/A-Global-Baseline_RRI_Sept-2018.pdf

atmosphere, depends upon strengthening indigenous land rights.

It has been demonstrated in the Amazon that community tenure has a lower impact on carbon release[66]. However, there is uncertainty in the spatial extent of indigenous land. This uncertainty is exploited causing deforestation which in turn releases carbon.

Providing indigenous communities with better tools to delineate their tenure and to enforce their rights against others can help protect your nation's forests and their valuable role in carbon capture and storage. Land security for indigenous communities not only helps to fight climate change, but also promotes sustainable development.

A spatially enabled land registration system can support the enforcement of land rights as and when legal frameworks are reformed to support policy reforms, such as global initiatives like COP.

Climate change adaptation

A report from the International Union for Conservation of Nature (IUCN) found that sensitivity to land tenure conflict and associated land tenure rights are essential for successful climate change adaptation initiatives[67]. This is because tenants are more likely to take actions that would mitigate the effects of climate change if they have some security in their property. For example, planting trees can help protect land from flooding, can lower temperatures locally, and remove carbon from the atmosphere but it can take many years for trees to reach maturity. Tenants are more likely to make an investment in a long-term intervention such as tree planting if they have the confidence that they will be able to realise the benefits for the land in the future.

Climate change and gender

One of the recommendations from the IUCN report on climate and tenure is that governments must explicitly acknowledge and recognise that women and men have equal rights to land[67].

According to the World Health Organisation women and children are 14 times more likely to die when a natural disaster happens than men[68]. Because women and children are more vulnerable to climate change and have less secure land rights generally, one of the best ways to mitigate the damage caused by disasters caused by climate change is to secure land tenure and promote equal participation in land governance decision-making, especially for indigenous women[69]. Owning land is key to helping women cope with the impacts of climate change, such as drought, and enables them to feed their families[70].

A study on land rights in Ghana recommended that women's land right should be formalised, as this gives them collateral which allows them to access credit that can be used to implement climate adaptation practices[71].

66. https://www.sciencedirect.com/science/article/abs/pii/S0921800917309746
67. https://www.iucn.org/downloads/tecs_csa_4_secure_tenure_nuesiri.pdf
68. https://www.unisdr.org/files/48152_disasterandgenderstatistics.pdf
69. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/980912/Guidance3-WEE-Climate-Change-Primer.pdf
70. https://www.climatechangenews.com/2020/12/18/kenyas-changing-climate-women-claiming-land-rights-feed-families/
71. https://eprints.whiterose.ac.uk/92652/2/StringerImpactsoflandtenure.pdf

CASE STUDY

Land rights and climate change

Achieving land security for indigenous communities not only helps to fight climate change, but also promotes sustainable development. This is especially important in Latin America, where converting forests to farmland and other uses accounts for almost half of total emissions[72].

Studies have shown that tenure-secure community land yields positive environmental outcomes: the average annual deforestation rates in tenure-secure indigenous forestlands in Bolivia, Brazil and Colombia are as little as a third of that in similar land not managed by indigenous people[73].

In Peru, titling of indigenous lands reduced forest clearing by more than three-quarters and forest disturbance by roughly two-thirds in two years. Long-term leases can also encourage sustainable land use, as shown by a study in Guatemala[74]. Another study that looked at deforestation in Africa has shown that land tenure security reduces deforestation, and consequently mitigates the cost of land degradation[75].

72. http://siteresources.worldbank.org/INTLAC/Resources/17619_LowCarbonHighGrowth_English_PDF.pdf
73. https://www.sciencedirect.com/science/article/pii/S0921800917309746
74. https://www.wri.org/publication/economic-costs-and-benefits-securing-community-forest-tenure
75. https://d3pcsg2wjq9izr.cloudfront.net/files/6063/articles/4943/X04337108P3HG08Q.pdf

Gender equality

If women had the same access to land as men, crop yields would increase by up to 30%

The issue of gender inequality is illustrated most starkly in the worldwide differences in access to and ownership of land. Women in half of the countries in the world are unable to assert equal land and property rights despite legal protections[76].

Women's economic empowerment is essential in promoting equality between women and men, and women's unequal access to land and property is a key obstacle to women's economic empowerment, according to the Swedish International Development Cooperation Agency (SIDA)[77].

Improving gender equality is central to the UN's Sustainable Development Goals (SDGs). Gender equality is recognised in SDG5[78], and land tenure is recognised as an SDG indicator, which are used to measure progress against the SDGs[79].

Land tenure can be uniquely beneficial in the hands of women, especially in a development context, where gender and land rights undermine much of the UN's 2030 Agenda. Geospatial data and digital records are crucial to establishing a legal framework for land registration that recognises the legitimacy of land rights, irrespective of gender, race, social background, amongst others and empowers the disenfranchised.

Investing in your nation's digital geospatial infrastructure can be powerful tool for equality, while also boosting productivity by giving women financial autonomy.

76. https://www.worldbank.org/en/news/press-release/2019/03/25/women-in-half-the-world-still-denied-land-property-rights-despite-laws
77. https://www.oecd.org/dac/gender-development/47566053.pdf
78. https://sdgs.un.org/goals/goal5
79. https://landportal.org/node/52264

Land and gender

Cheryl Doss, a feminist economist at Yale University, has published research on the scale of the problem[80]: Globally, more men than women own land; 12% of women report owning land individually, while 31% of men do so. In addition, more of the privately owned land is reported as being owned by men than by women. For example, in Niger, only 9% of the land is reported as owned by women, and 62% by men. In Tanzania, only 16% of the land is reported as owned by women, and 48% by men. In Ethiopia, 15% of the documented land ownership is reported as owned by women, 45% by men[81]. In more than 30 countries women and girls do not have the same rights to own or inherit land as men and boys[82].

In some cases, the law is changing to enfranchise women and girls; in 2020, supreme courts in India, Nigeria and Zimbabwe issued historic opinions recognising and strengthening women's rights to land and property[83]. However, in many cases, changes to the law alone are not enough, as knowledge and enforcement of new laws can be patchy[84].

Studies have shown a compelling link between secure land rights for women and household welfare, according to Landesa:

- Women with land rights contribute a greater proportion of income to the household, exercise greater control over agricultural income, and are more likely to receive credit.
- Women who own land are more likely to have the final say in household decisions.
- The odds that a child is severely underweight are reduced by half if the mother owns land.
- When women own a larger share of the household's farmland, families allocate a larger proportion of their household budget to food.
- When women in the household have land rights, children have higher levels of educational attainment[85].

Equality as a growth engine

Reducing barriers to women's control of rural resources, particularly land, is critical in the fight against poverty, according to the World Bank. Analysis of individual labor input data from Ethiopia, Malawi, Niger, Nigeria, Tanzania, and Uganda puts the female share of labor in crop production across these countries at 40%[86]. If rural women had the same access to land and capital as men, they could increase yields on their farms by up to 30%, raising total agricultural output in developing countries by up to 4%, reducing the number of hungry people in the world by up to 17%[87].

Land rights for women gives them potential access to credit, which can be more beneficial for economic development in the hands of women, as research shows they spend more on children's health and education, thereby investing in the futures of the next generation[88]. Land ownership confers direct economic benefits as a key input into agricultural production; as a source of income from rental or sale; and as collateral for credit that can be used for either consumption or investment purposes[89].

80. https://www.ifpri.org/publication/gender-inequalities-ownership-and-control-land-africa-myths-versus-reality
81. https://oxfamapps.org/fp2p/killer-factcheck-women-own-2-of-land-not-true-what-do-we-really-know-about-women-and-land/
82. https://www.landesa.org/resources/property-not-poverty/
83. https://blogs.worldbank.org/opendata/gender-equality-women-land-and-data
84. https://www.climatechangenews.com/2020/12/18/kenyas-changing-climate-women-claiming-land-rights-feed-families/
85. https://www.landesa.org/wp-content/uploads/Landesa-Women-and-Land-Issue-Brief.pdf
86. https://www.worldbank.org/en/programs/africa-myths-and-facts/publication/women-agriculture-and-work-in-africa
87. https://openknowledge.worldbank.org/bitstream/handle/10986/21033/927600NWP0Wome00Box385358B00PUBLIC0.pdf?sequence=1&isAllowed=y
88. https://voxdev.org/topic/finance/give-women-credit
89. https://openknowledge.worldbank.org/handle/10986/8355

CASE STUDY

Landesa, land rights and women's wellbeing

In Kerala, India, a study revealed stark differences in women's wellbeing and autonomy between those who had secure tenure and those that did not: 49% of women without property reported physical violence and 84% reported psychological violence. However, among women with land and a house, 7% reported physical violence and 16% reported psychological violence. In addition, 71% of propertied women who suffered violence left home compared to 19% of property-less women[90].

Whereas in Kenya, a Landesa team planned to implement a land administration project to empower women. Through interviews, the team discovered that the greater need was in dispute resolution. Working closely with local women, the Landesa team redesigned the project. Through the project, elders and chiefs, who acted as the local mediators, women, and youth, learned about women's rights, including land rights, under the new Kenyan constitution. The elders began to use those principles when mediating disputes. The community also elected their first group of women elders to join the panel of men who resolve disputes[91].

90. http://www.binaagarwal.com/downloads/apapers/Marial%20Violence,%20Human%20Development%20and%20Women%27s%20Property%20Status.pdf
91. https://www.landesa.org/wp-content/uploads/Landesa-Women-and-Land-Issue-Brief.pdf

Applying geospatial information to climate challenges

To support the UN goals at COP26, national mapping and geospatial agencies (NMGAs) can support their country by enabling:

Collaboration across borders - we can enable all countries regardless of economic or political differences, to tackle common issues.

Collect and curate authoritative data - we help plan and deliver measures that can be trusted and relied upon by policy-makers and the international community.

Make foundational data accessible and reusable - we encourage others to expand on our work to tackle specific problems in innovative ways.

Sponsor and embrace agreed standards - we ensure technical solutions can tackle common problems in a consistent way.

Learn how governments can address climate challenges by downloading the report.

Recommendations for NMGAs

Geography puts NMGAs in a unique position to bring together people and data to address climate challenges, therefore we should:

1. Take an active leadership role as advocates for location data in our countries, understanding its value in supporting government priorities, and showcasing the real benefits it can bring to national adaptation and mitigation policies. We should act as drivers of change, empowering organisations and individuals to use location data in new ways and to actively respond to the current and future needs of citizens.

2. Recognise that a changing climate is a global issue that affects all nations differently. Adaptation and mitigation strategies need to be based on best-available national data and considered in a global context. In recognition of this we should work with others, not alone, creating new networks, and move to using internationally agreed standards to enable the use of trusted data for adaptation and mitigation solutions.

Recommendations for governments

To recognise the value of location data to support policies to fight climate change, governments should:

1. Mandate the use of available authoritative location data from NMGAs as a framework for bringing together multiple sources of information linking critical data from governments, industry, research, academia, NGOs and civil society.

2. Improve data infrastructure and assets by investing in the collection and maintenance of high-quality geospatial data to make the best use of their national response and provide a location context to their Nationally Determined Contributions.

CONCLUSION AND NEXT STEPS

4

Conclusion

Land accounts for a huge proportion of both value being generated as GDP and value being stored in assets. The value of land, and the rights of the people who live on it, are powerful tools for sustainable development, and land rights are pivotal to achieving almost all of the SDGs. Approximately 70% of land tenure rights are not properly mapped in developing countries[92]; providing the world's poor with titles for their land is a key component of the enabling environment that allows those living in poverty to access credit, potentially unlocking up to $9.3 trillion of so-called "dead capital".

Housing and property are important assets for the poor, and improving tenure security for both women and men can have an important impact on household income, food security, and equity. An effective land administration system that incorporates formalised land registration is essential not just for establishing internal credit markets, but also for securing international investment.

Registration of land is central to the function of civic life and the delivery of basic services, and underpins utility and infrastructure provision. Digital tenure systems also facilitate dispute resolution and greatly reduce the burden on the justice system.

Land rights can also be a force for good for the environment, slowing deforestation and reducing emissions. Tenure is also recognised as an indicator for the SDGs, and extending land rights to women is one of the most effective ways to reduce gender inequality. The UN has provided a framework for using geospatial data and tools to build effective systems of land administration through FELA[93, 94].

Geospatial technologies are essential for creating the base maps and digitisation of records needed for effective land registration[95]. While traditional surveying methods are both expensive and time-consuming, modern techniques that harness satellite imagery, unmanned aerial vehicles and machine learning can help you rapidly develop land registration systems at a fraction of the cost. By working with Ordnance Survey, you can leverage more than 200 years of experience with cartography, surveying and custodianship of official records, and benefit from cutting edge geospatial technology, to provide a bespoke solution to your land tenure challenges.

92. https://digital-strategy.ec.europa.eu/en/news/land-mapping-east-africa-european-geospatial-technology
93. https://ggim.un.org/documents/FELA_Consultation_Draft.pdf
94. https://ggim.un.org/IGIF/
95. https://cordis.europa.eu/project/id/687828

Geospatial technologies are essential for effective land registration

The benefits of geospatially enabled tenure security:

- Providing the world's poor with titles for their land could unlock $9.3 trillion in assets
- Infrastructure delivery is 2.7 times more expensive without tenure security
- Deforestation rates are up to three times higher in forest lands without secure tenure
- If women had the same access to land as men, crop yields would increase by up to 30%

Consider a geospatial maturity assessment provided by Ordnance Survey to identify how you can deliver land tenure cost effectively, helping you grow your economy, alleviate poverty, support gender equality and reduce emissions.

5 steps towards harnessing tenure to achieve your nation's objectives

01 Create an enabling environment for digital geospatial infrastructure

Establish Continuously Operating Reference Stations for delivery of GNSS data

02 Create consistent national standardised geospatial databases

Establish standards to make geospatial databases machine readable

03 Create land use, parcel maps and plot property boundaries

Collect and create geospatial data through remote sensing and surveying

04 Use geospatial data for analysis and prediction

Conduct sophisticated spatial planning, including flood analysis and precision agriculture

05 Monetise data for return on investment

Provide geospatial intelligence to industry and build sophisticated geospatial services that add value to infrastructure, utilities and telecoms organisations

We're actively looking for cities to partner with us to demonstrate how detailed geospatial information can make city planning and development sustainable. Register your interest:

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Ordnance Survey provides funding, consultancy and technology services to governments helping to break down silos and improve policy decisions across urbanisation, environment and sustainability, land tenure, resilience and statistics collection.

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