Smith School of Enterprise and the Environment

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Land Sector Working Paper

Appendix B

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Executive Summary

"Achieving optimal use of Rwanda's most limited land resource through integrated approach to national planning, sustainable land use management and improved information management"

This paper is one of nine sector working papers written as part of the process of developing a National Strategy on Climate Change and Low Carbon Development for Rwanda. It follows on from the Baseline Report produced in February 2011 which provides the local context for each sector, including current programmes and development plans. This paper focuses on Land Use Management and Planning while the other working papers cover Energy, Water, Agriculture, Forestry, Transport, Built Environment, Mining and Finance. The paper should be read in conjunction with the 'thinkpiece' which proposes the Strategic Framework including a vision for 2050, objectives, guiding principles and enabling pillars. The aim of each paper is to identify the vulnerabilities and opportunities facing the sector, to review global best practice and relevant case studies, and to propose an action plan for addressing climate change and low carbon development in the short, medium and long term. This action plan is put forward to stakeholders in Rwanda for review and comment. As the title suggests, the working papers are aimed at prompting discussion with stakeholders, rather than being the final word. The sector working papers, thinkpiece and stakeholder input will be used to compose the final Strategy in July 2011.

Realising adaptation to climate change and achieving a low carbon growth path is rooted in achieving land tenure (ownership) security and instigating a robust integrated framework for development planning and sustainable land management – improved land information management is essential. With land tenure comes responsibility to manage the land in accordance to planning codes and the economic incentive to improve the asset.

Increased competition for land resource will continue to grow with increased pressures from intensive agriculture and livestock. Encroachment on sensitive areas persists until land reforms are completed. Poor or limited access to land and productive arable lands contributes to urbanisation. Industrialisation further competes for the limited land resource. As the labour force shifts from subsistence agriculture to processing and manufacturing roles, the land demand for housing changes. Higher density urban development will become increasingly necessary.

If the changing demands and use of land is not managed by a rigorous planning and zoning regulatory framework, impacts in real terms are escalated uncontrolled development, increased energy demand and emissions, inefficient transport systems, over-burdened water and sanitation systems leading to reduced livelihoods, environmental degradation, continued loss of biodiversity, food insecurity, poor air quality, and health impacts. A Vision of Land Use Planning and Management in 2050 is proposed in box 1.

Box 1: Land Management and Planning Vision 2050

- Rwanda is renowned globally for its Green Economic development success whilst preserving its natural and cultural heritage.
- Land and Planning Framework that achieves optimal land use and promotes land improvement and protection of biodiversity.
- Environmental Management Plans under EIA process are monitored and enforced.
- Strategic Environmental Assessment plans applied to key development zones, such as industrial parks, agricultural zones, tourism zones, national parks, and major projects.
- An Active Land Market supports economic growth, investment, and wealth creation.
- Modern land tenure system supports land valuation and property revenue systems at the district level. Revenue supports GIS based integrated planning, hazard mapping, community based NRM and planning.
- Formalised Land Tenure allows the greater population access to credit mechanisms, supporting land improvement
- A vibrant financial services sector through secure land tenure and active land market promotes investment.
- National Spatial Data Infrastructure provides detailed mapping and monitoring of land use and land use change, supporting integrated planning, part of national ICT.
- National Spatial Data Infrastructure supports national and district hazard mapping, early warning system of active sensors, and future modelling and disaster mitigation.
- Communities are informed of local hazards and maintain event readiness through practised community and household disaster management plans tailored to individual communities.
- Spatial information supports health care planning, CENSUS, decision making of government and is accessible by private sector and individuals.
- Information sharing and access policy promotes efficient Government, that makes decisions on the best and most complete information available whilst preserving individual rights to privacy.
- Farmers and districts understand their responsibilities for sustainable land management practices with improved land husbandry.
- Soil erosion and land degradation overcome through improved land husbandry and maintenance of hillside region interventions such as radical terracing, trenching, progressive terracing and aforestation.
- Early investment in infrastructure and planning in transport, energy and sanitation, enables the City of Kigali and regional settlements to grow and prosper maintaining cultural and natural heritage.
- Rwanda's urban environs are healthy and productive centres for commerce and trade.
- Over 25 million Rwandan's enjoy an improved livelihood and have greater access to employment, heath care, education, and wealth creation.

The vision targets are provided as a guide to planners and administrators to consider how Rwanda will get from where it is at now to where it aims to be in 2050 when it surpasses middle income country (MIC) status supporting a knowledge-based economy, market-based agriculture, and progressive green industry. The 2050 vision statements are principle ideals that will assist framing the climate change and low carbon development policies and guide the short, medium and long term action agenda.

The recent promulgation by Cabinet of the National Land Use and Development Master Plan and associated land use legislation is an important step in establishing a robust framework for integrated land use planning. Land regularisation

through titling is expected to be completed in one to two years. Priority now is the preparation of detailed District Development Plans, preparation of the Urban Development Plan and Area Action Plans, together with continued regulatory reforms and development of capacity to support the planning and zoning framework. Without formal land arrangements, limited access to credit contributes to a poverty "lock". Unequal distribution of land will lead to increased potential for conflict in the future. Uncontrolled land use change will lead to further loss of Rwanda's unique natural and cultural heritage. Ultimately, optimal land use is not achieved, impacting Rwanda's development and growth potential. Rwanda is now making positive headway in addressing sound management of its most limited resource.

Contents

Acronyms and Abbreviations

BTC	Belgian Technical Cooperation
CGIAR	Consultative Group on International Agricultural Research
CGIS-NUR	Centre for GIS and Remote Sensing of the National University of Rwanda
DFID	UK Department for International Development
DRC	Democratic Republic of Congo
EIA	Environmental Impact Assessment
EWSA	Energy, Water and Sanitation Authority
FAO	Food and Agriculture Organisation
GEF	Global Environment Facility
GIS	Geographic Information System
GIZ	German International Cooperation
GoR	Government of Rwanda
GPS	Global Positioning System
ICT	Information and Communication Technology
IFAD	International Fund for Agricultural Development
IFC	International Finance Corporation
ISAR	Institut des Sciences Agronomiques du Rwanda
ISNAR	International Service for National Agriculture Research
IISD	International Institute for Sustainable Development
IWRM	Integrated Water Resource Management
Kagera-TAMP	Transboundary Agro-ecosystem Management Programme for the Kagera River Basin
KIST	Kigali Institute for Science and Technology
KWAMP	Kirehe Community-Based Watershed Management
LAS	Land Administration System
LIS	Land Information System
LTR	Land Tenure Regularisation
LVBC	Lake Victoria Basin Commission
LWH	Land Husbandry, Water Harvesting and Hillside Irrigation Water Project of the World Bank
MINAGRI	Ministry of Agriculture
MINECOFIN	Ministry of Finance and Economic Planning
MINICOM	Ministry of Commerce
MINIRENA	Ministry of Natural Resources
NBI	Nile Basin Initiative
NELSAP	Nile and Equatorial Lakes Subsidiary Action Plan
NISR	National Institute of Statistics of Rwanda
NLC	National Land Centre (now the Department of Lands and Mapping under RNRA)
NUR	National University of Rwanda
PSTA II	Strategic Plan for the Transformation of Agriculture in Rwanda - Phase II
RADA	Rwanda Agricultural Development Agency
RBS	Rwanda Bureau of Standards
RDB	Rwanda Development Board
REMA	Rwanda Environment Management Authority
RHODA	Rwanda Horticulture Development Authority
RITA	Rwanda Information Technology Authority

RNRA	Rwanda Natural Resources Authority
SDI	Spatial Data Infrastructure
SIDA	Swedish International Development Agency
UK	United Kingdom
UNECA	United Nations Economic Commission for Africa
UN-ECE	United Nations Economic Commission for Europe
UNEP	United Nations Environment Programme
US	United States
USAID	United States Agency for International Development
WB	World Bank

Introduction

This paper is one of nine sector working papers written as part of the process of developing a National Strategy on Climate Change and Low Carbon Development for Rwanda. It follows on from the Baseline Report produced in February 2011 which provides the local context for each sector, including current programmes and development plans. This paper focuses on Land Use Management and Planning while the other working papers cover Energy, Water, Agriculture, Forestry, Transport, Built Environment, Mining and Finance. The paper should be read in conjunction with the 'thinkpiece' which proposes the Strategic Framework including a vision for 2050, objectives, guiding principles and enabling pillars. The aim of each paper is to identify the vulnerabilities and opportunities facing the sector, to review global best practice and relevant case studies, and to propose an action plan for addressing climate change and low carbon development in the short, medium and long term. This action plan is put forward to stakeholders in Rwanda for review and comment. As the title suggests, the working papers are aimed at prompting discussion with stakeholders, rather than being the final word. The sector working papers, thinkpiece and stakeholder input will be used to compose the final Strategy in July 2011.

Rwanda has a very limited land resource. Attributed to the high population density, land is scarce with high competition for land use experienced throughout the country. The land area of Rwanda is just 24,688km^2 with 45.6% arable lands, 10.3% permanent crops, and 44.2% other use. Competition for land is likely to intensify in the decades to come, in consideration of an 18% urban population increasing at a rate of 4.2%. It is expected that over 50% of the population will be urban dwelling by 2020.

Competition lies in renewed priorities for intensive agriculture, commercial and industrial development, rapid urbanisation, agroforestry and biomass demand, expansion of mining activity, and greater recognition of the need to protect Rwanda's regionally and internationally significant ecosystems including wetlands, the volcanoes national park, and remnant montane forests.

High density leads to high fragmentation of land holdings. The majority of the land has been under small holdings with the national average land parcel size of 0.35ha. It had been earlier estimated that over 8 million land parcels are available in the country for just 10 million people. The number has since been revised throughout the continued Land Tenure Regularisation efforts, with figures up to 12 million possible, partially attributed to landholders move to endow land to children and family members prior to demarcation and improved data on fragmentation in the districts. Given the fragmentation, assembling land for intensive agriculture, industry and business development is likely to be relatively difficult and costly.

The lack of clear and stable land use planning and zoning regulation in Rwanda has restricted the ability of district authorities to plan for a sustainable future that protects environmental, social and economic needs and ambitions of the community. National spatial planning is now being addressed by the introduction of the National Land Use and

Development Master Plan. The master plan now requires implementation by land related authorities and subsequent preparation of detailed district plans that will dovetail the master plan. Draft Law of 2010 supporting National Land Use and Development Planning System must now be promulgated.

The explanatory notes of the National Land Use and Development Master Plan by SwedeSurvey in 2009 call for increased development of the detailed planning process within local authorities, capacity development of planning officers, and greater use and exploitation of GIS in the planning process. Currently, within the District Development Plans (DDP), existing conditions are listed in table format, where as a spatial representation would be far more meaningful. Issues such as urbanisation are not addressed in the 30 DDPs and the opportunity to encourage rural urban centres/regional cities is being lost.

The demographic data for the districts is inadequate. Instruments such as the Rwandan Household Living Conditions Survey (EICV) and other census data should be integrated and refined to the socio-economic conditions within each district. Agriculture data for the districts is also inadequate. Agriculture is a primary economic driver in Rwanda and has an important influence for the rural areas of the districts. However, the analysis of agricultural capabilities of each district is not well developed. Specific data on the existing agriculture production and agro-ecological/economic potential should be included in the analysis of land use planning and expenditures.

Until recently, the majority of land in Rwanda was un-demarcated, un-registered and thus not ready for formal transaction. The majority of lands held were informal or under customary individual ownership and remained largely undocumented according to government statistics. The lack of established and reliable titles had greatly increased the risk of private transactions. The land tenure regularisation programme that commenced in 2005 is now making strong headway in addressing the need to formalise ownership. For the land that has records, it is for the most part recorded in the existing paper-based system that in its present format is unable to provide a complete view of all ownerships and their geographic location, thus making it difficult for planners or investors to identify available lands for development. Planners and administrators of land are effectively blind, restricting their ability to quickly make decisions based on multiple interests on land, to consider environmental scenarios, or to readily identify current use or the responsible authority in control. Until the land information is made electronic and in a usable format, competing interests in land will go unchecked and land use demarcation will remain problematic. Optimal land use will not be achieved and encroachment on sensitive areas will continue.

In order to help overcome problems in identifying available land in the meantime (prior to the completion of titling and land system modernisation), the GoR has moved to allocate areas for development such as the Special Economic Zones for commercial and industrial development and agricultural lands earmarked for land consolidation and intensive cropping.

Baseline

From primary data, field research and interviews, a Baseline Report was completed in January 2011. Findings from the study are summarised below.

2.1 National and District Planning

Given such a limited land resource, perhaps the most important national priority is to ensure a sound, integrated and participatory approach to planning, zoning and land development approvals. In response, the Rwanda Natural Resources Authority (RNRA), Department of Lands and Mapping have prepared the National Land Use and Development Master Plan with the assistance of Swedish consultancy firm SwedeSurvey. The national master plan, approved by Cabinet on the 19th January 2011, sets the national scale plan of current and future planned land use activities and priorities across the country. The master plan sets the framework for local authorities to prepare more detailed district plans to establish zoning for building and construction, agricultural development, urban centres and conservation areas. The plan features management strategies for ecosystems, population distribution and development of networks for rural and urban settlements, social services and infrastructure, and conservation of protected areas such as wetlands. Figure 1 illustrates the overview of Directives for Sustainable Land Use Planning map as part of the overall National Land Use and Development Master Plan.

In addition to the master plan, draft laws relating to land usage and development were also approved in January 2011. The next tasks in line with the Department of Lands and Mappings' efforts to establish a comprehensive national planning framework include the preparation of the Urban Development Plan and the Area Action Plan. Until now, there has been little opportunity for national and district authorities to adequately plan for, and monitor, a new course, or vision, of development and growth within their respective communities. Thus, it has remained difficult for environmental and natural resource management priorities to be assessed against the growing activities of agriculture, industry, mining and urbanisation. Changes in land use or development approvals remained a largely ad-hoc process.

The City of Kigali (KCC) has prepared a robust Conceptual Master Plan with assistance of United States based firm OZ Architecture in 2006-07 (approved by Parliament in 2008). In addition, KCC commissioned OZ to complete four Sub Area Plans (2 in Gasabo District and 2 in Kicukiro District) with guidance for detailed sub district planning. KCC together with Nyarugenge District (location of the CBD area) engaged Singaporean firm Surbana in 2008-09 to develop a 2030 Vision for the CBD. Considerations of climate change and low carbon growth will have an impact on the proposed plan and will need to be assessed in terms of transport options, energy use, planned infrastructure and environmental impacts at the National and District levels.

To the extent District plans exist today, many, particularly in the rural districts now require updating in relation to National Land Use and Development Master Plan. Without generally applicable land use plans all industrial development has in the past been addressed on an ad-hoc basis and there is an

understandable reluctance to approve industrial uses in the absence of sound land use planning. For example, the existing Gikondo industrial zone, now under a relocation program, was established entirely in a sensitive wetland area. It is perhaps an object lesson in what can happen in the absence of an integrated approach to land use planning (the intended National Planning system is illustrated in figure 2).

2.2 Integrated Approach to Sustainable Land Management

The National Environmental Policy and the Organic Land Law address the need for principles of sustainable land management. Any land policies and procedures designed must aim to support both efficient and sustainable use of land. Business interests must be promoted within the overall land policy frame, taking into account other important social and environmental objectives. Sustainable land management is a priority of IWRM (Integrated Water Resource Management) related programs for the transboundary basins including the Kagera and Congo basins with targets for prevention of land degradation and soil erosion and nutrient replacement. For these activities to succeed, establishing the current land use and responsible authority is necessary. There are three main categories of land type which are important to understand in approaching sustainable land management and land use change:

- Public Land – land held and occupied by the national and sub-national governments and

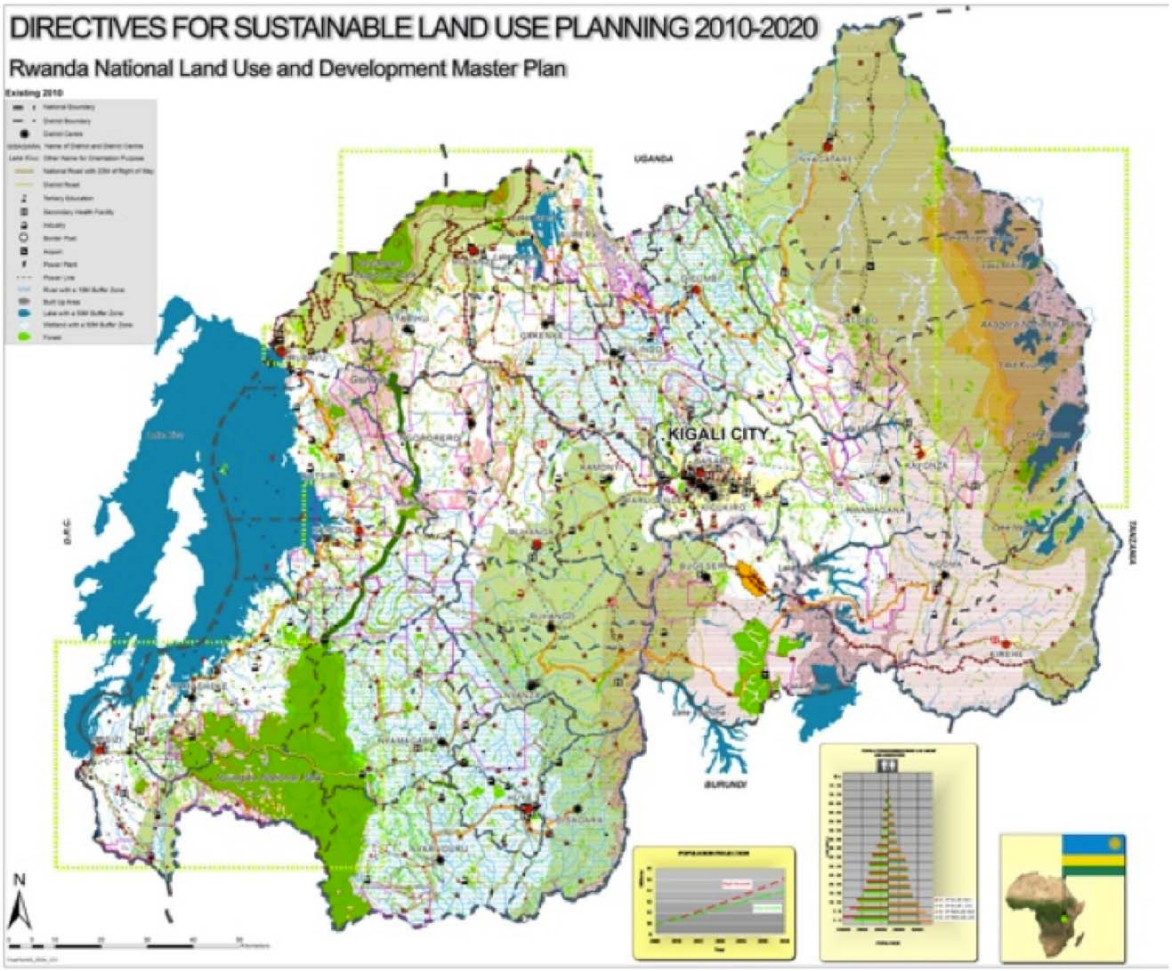


Figure 1: National Land Use and Development Master Plan[1]

their respective instrumentalities and used for public purposes only, e.g. roadways and government buildings.

- Private Land – land held by national and sub-national governments and their respective instrumentalities but are made available for private use.
- Individual Land – land held and occupied by citizens and legal entities under some form of private tenure, including ownership and long term lease. Individual land includes both statutory and customary forms of tenure.

Ideally, land use and ownership maps (detailing the above land classifications) would be available to enable planners and policy makers to readily identify land managers, owners, and users. However, until land regularisation is completed this information remains mostly paper based, and difficult to integrate with for example; socio-economic data, or soils, agricultural or environmental datasets.

2.3 Land Tenure System and Regularisation

The approach to land tenure varies from country to country. In Rwanda, it includes forms of freehold tenure, state leasehold and community-based tenure (legally recognised indigenous tenure and community-based). Improper land use and management systems lead to erosion and deteriorating land quality, while rural productivity remains at low subsistence levels. Any agricultural transformation efforts to overcome land fragmentation have to deal with land reforms, with both redistributive reforms and land tenure reforms to make sure that the population (both men and women) enjoy the same rights on land, to improve the value of the land, to promote investment and to contribute to sustainable land use and management.

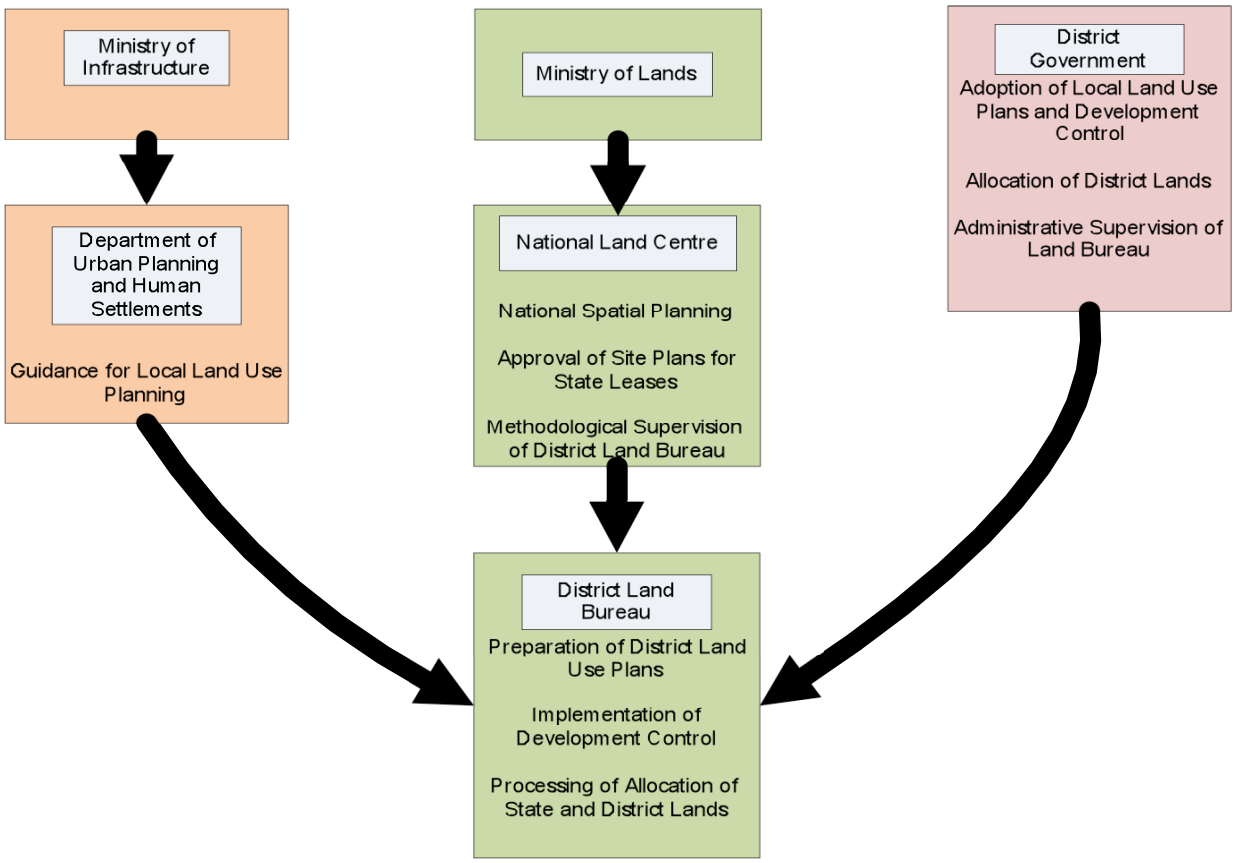


Figure 2: National Spatial Planning and District Land Use Planning in Rwanda[2]

Land reform is an engine of development and plays an important role in enhancing peace, stability and equality if undertaken in a participatory and orderly manner, and plays an important role in the process of poverty reduction. Land formalisation allows access to credit (against the land), encourages land improvement, enables efficient collection of property revenue via district taxes and transfer fees, and in turn, enables government authorities to fund and action sound land management practices and undertake detailed planning.

Land tenure regularisation has expanded to all 30 districts. At end of November 2010, about 3.2 million parcels had been demarcated and adjudicated with title – 41% of the projected 7.9 million parcels in the whole country. More than 91% of parcels have been completed for Kigali City. All three central districts of Kigali are expected to be completed and cover at least 50% of the remaining 27 districts by June 2011. The remaining parcels should be completed by June 2012. Kirehe district is now almost complete (in terms of demarcation and adjudication) having received additional assistance to accelerate titling through the community watershed management KWAMP program. Title issuance is expected to be completed by June 2011. Until recently, several western districts were progressing slowly due to a lack of aerial photography. Updated detailed imagery is essential for efficient land identification and demarcation. More than 95% of Rwanda has been captured by high resolution aerial photography, an important resource/tool for determining land use, and land use change, and for the monitoring of ecosystems.

2.4 Agricultural Land Use Consolidation

Agricultural intensification efforts under CIP have enabled farmers to take more profits at market and increase their yield. Land use consolidation, focusing production of particular crops in designated areas, has enabled farmers to consolidate efforts and work together, with cooperatives, to produce higher amounts and be more connected to markets. The results have been substantial and are the main catalyst behind the current levels of high growth. Such productivity increases have enabled Rwanda to move away from being a country considered to be food insecure.

2.5 Geographic Information System (GIS) Support

At present, land information in Rwanda is segmented, scattered across different ministries and agencies. Sharing information is difficult whilst data remains mostly paper based. There is an emerging understanding in Rwanda of the potential benefits of an integrated, multi-purposed Land Information System (LIS) supported by available ICT and GIS technology. A number of key initiatives are underway by the GoR, including the National Land Tenure Reform Programme and Land Tenure Regularisation (LTR) Programme, the Land Administration Information System, and preparation of the National Land Use and Development Master Plan.

These are important building blocks of a viable LIS to aid land use management. The potential is for GIS-enabled monitoring of environment: climate, water, soils, agriculture, and integrated planning utilising the national framework GIS datasets as a backdrop as part of a national Rwanda Spatial Data Infrastructure (RSDI). This will enable consistency and harmonisation of sectoral data for accurate and detailed modelling of cross-sector trends and impacts. Regional data can also be introduced to obtain a view of entire catchments, to plan for potential hazards, or assist in weather forecasting. Incorporating health and demographic data, placing social trends in a spatial context, can greatly enhance the optimal placement of services. Real time sensor data can also be incorporated for early warning and decision support systems.

2.6 National Spatial Data Infrastructure (SDI)

In 2007, a pilot project was sponsored by the Global Spatial Data Infrastructure Association (GSDI) at the Centre for Geographic Information Systems and Remote Sensing Centre of the

National University of Rwanda (CGIS-NUR). The aim of this project is to accomplish a geodata inventory representing the spatial data holdings of CGIS-NUR, establish a sample web mapping service and upload the gathered information to a Geo-portal (refer Figure 3 below).

Although the initial focus was narrowed down to CGIS-NUR, the overall goal is to facilitate the development of NSDI in Rwanda. The project helped to raise awareness within the National University of Rwanda (NUR) and contributed to the establishment of an NSDI plans a part of National Information and Communication Infrastructure (NICI) Plan in Rwanda. However, full realisation of Rwanda SDI is yet to be achieved. A renewed effort and development of a National SDI strategy is now required.

The Government of Rwanda is implementing four 5 year National Information and Communications Infrastructure (NICI) Plans, (1st, 2nd, 3rd and 4th NICI) over the 20 year time span of the Vision 2020 socio-economic development programme. The individual time span and goals of each of the successive NICI plans are:

1. The 1st NICI Plan (2001 to 2005)

- Goal: To support the development of an economic base and environment for accelerated growth and development towards transforming Rwanda into an information-rich knowledge-based society and economy.

2. The 2nd NICI Plan (2006 to 2010)

- Goal: To support the strengthening of the economic base and improving the economic environment to accelerate development and growth towards achieving an information-rich knowledge-based society and economy.

3. The 3rd NICI Plan (2011 to 2015)

- Goal: To facilitate the process of sustaining economic development and growth towards improving national prosperity and global competitiveness

4. The 4th NICI Plan (2016 to 2020)

- Goal: To consolidate the process towards achieving a middle-income status and an information-rich knowledge-based society and economy.

As far as SDI development in concerned, the NICI plans are largely still restricted to the promotion and exploitation of GIS within sectors rather than building a national shared land information platform. Now that the Land Tenure Regularisation programme is nearing completion, it is timely that efforts are focussed towards improvement of land information across government, establishment of a information sharing and access policy, and notably development of Rwanda SDI. Responsibility for SDI development is with Government to assert appropriate management of the key national datasets, however there is much opportunity for the private sector and academia to assist development and create tools and platforms to exploit the datasets, in addition to training and capacity building especially at the District levels.

Land regularisation efforts have been re-invigorated in 2010 through multi-donor assistance. Current targets set completion of the City of Kigali's three districts early in 2011 (already over 91% complete) and full regularisation is set to be achieved by mid-2012. Figure 4 illustrates progress of the Land Tenure Regularisation (LTR) programme up to the end of February 2011.

The agricultural land use consolidation is supported by Cabinet decree (March 2010) to address land fragmentation and to allow farmers to work in cooperative arrangements to optimise land use and market potential through increased production. Furthermore, the area of marshlands to be reclaimed is to increase by 2012 to 30,000 ha for agricultural use which increases the production potential of farmer's across the nation. About 81% of arable land is now sustainably managed against soil erosion which substantially exceeds the EDPRS/CPAF target for 2009/2010.

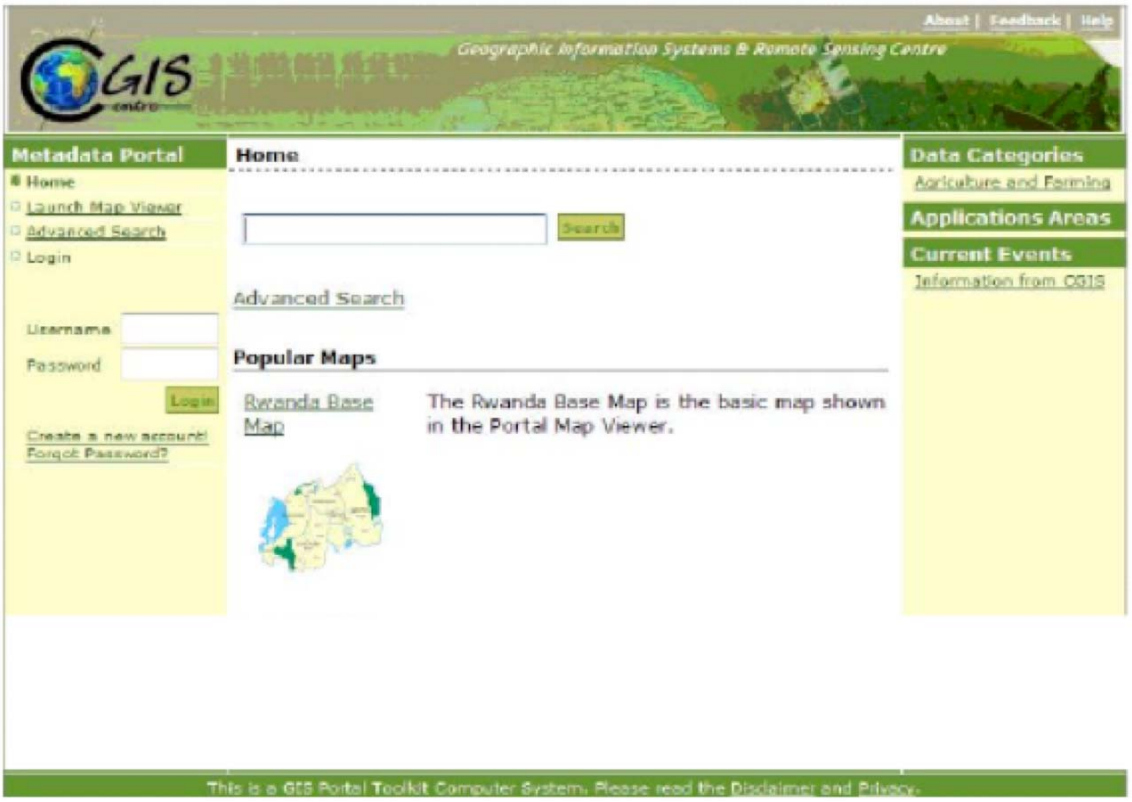


Figure 3: Prototype Geoportal at CGIS-NUR: Metadata of Key National Datasets Available[3]

2.7 Land and Property Transactions

In an effort to ease doing business, the government of Rwanda with the Rwanda Development Board (RDB), with support of the One United Nations programme, and UNCTAD, have developed the e-Regulations Web portal, the portal details the Rwandan system of land and the processes of land acquisition and transfer and required instruments – available at http://rwanda.eregulations.org/. The e-Regulations portal also expects to publish procedures for acquisition of Private State land and Private City of Kigali.

The Rwanda land system is defined by the Organic Land Law of 2005. No difference is made between nationals and foreign investors. All land belongs to public entities: the State, the Cities and the Districts. "Public land" is reserved for public use or for environmental protection.

"Private land" can be allocated by its public owners (State, Cities and District) to natural or legal persons. It then becomes "individual land". It is leased, for up to 99 years, through a lease contract and against payment of an annual lease fee. The lessee can obtain an ownership certificate by paying at once 10 years of lease fee and by constructing a building on the land (or by improving/exploiting it conforming to its intended use). Land rights can be transmitted (through sale, donation or inheritance). Individual land customarily owned before the 2005 law can be registered under the new law. A summary of the main transactions of land tenure in Rwanda is provided in table 2.

There is much potential to enrich the e-Regulations portal through geographic display of land availability, land use and restrictions. Interactive GIS would enable current and prospective land holders to understand their rights and obligations in land management.

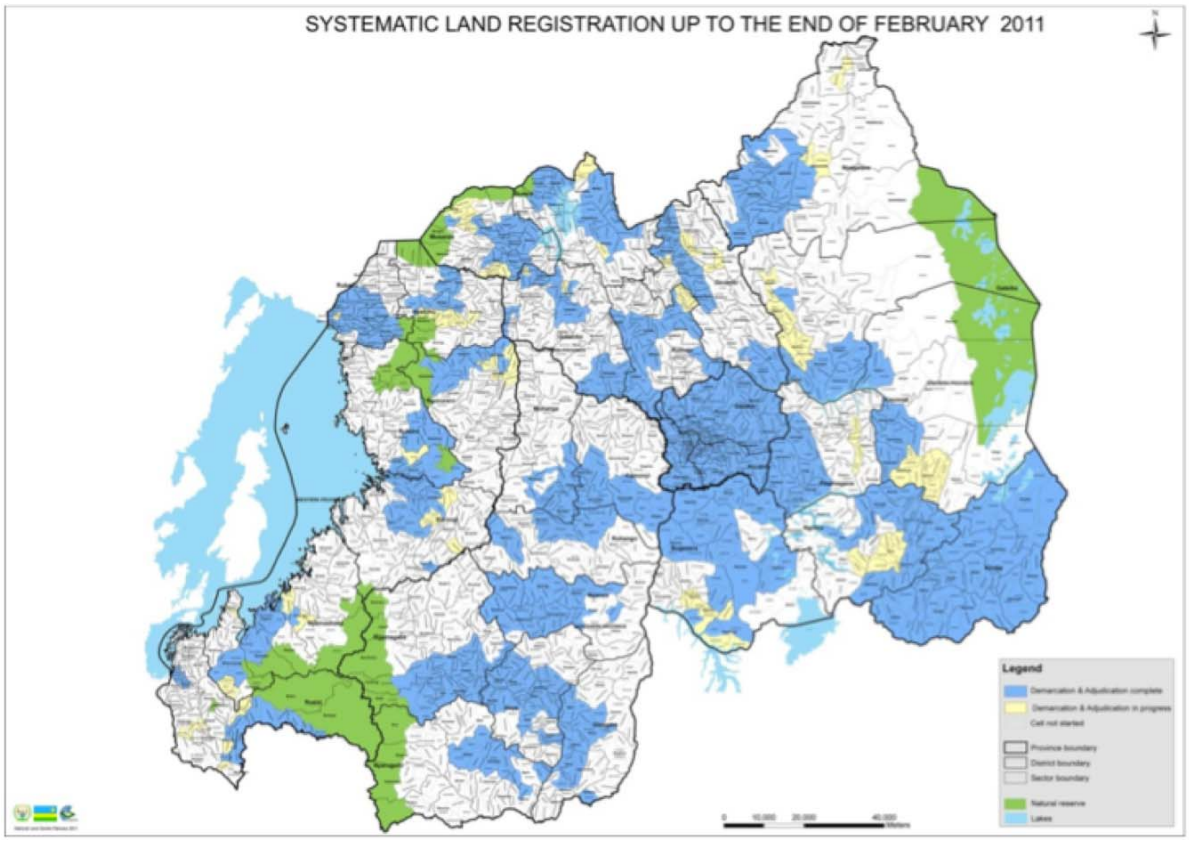


Figure 4: Land Tenure Regularisation progress to end February 2011[4]

2.8 Human Resources and Capacity

The institutional and human resource capacity remains a challenge to the success of implementing the planned land reforms. Rebuilding the training and education sector to supply the much needed professionals is crucial to Rwanda's success. Rwanda's public sector benefits from a young and dynamic workforce, but there is a shortage of these skilled professionals with much competition for their services from private sector. In the government agencies and district level offices observed, new graduates tended to hold positions for 1-2 years before rotation or being lured by attractive salaries within the private sector. Senior administrators have few years of experience and, if very good, are frequently rotated throughout the public service to assist priority areas of government. Retention of organisational knowledge and skills-base is constantly being eroded by this dynamic workforce that impacts continuity of long term reforms such as land.

2.9 Capacity Issues at District Level

The human resource constraints seem to be the most serious at the district level where land bureaus will continue to be one of the key components of the land administration system and are essentially the front line agency for most land-related functions. Their activities include the majority of administrative approvals in land dealings and transactions such as approval of applications for Deed Plan, Lease Contract, and Lease Title Certificates. District land officers are responsible for district planning, and zoning, approval of Construction Permits and Occupation Permits, through to approval of applications for full Land Title. These duties and the assigned time to approve are detailed in the internal GoR Client Charter.

District land offices are limited in their staffing of 10-15 in central urban districts and down to 3-5 staff in rural districts. District staff is usually first or second year graduates of planning and engineering

Table 2: Summary of Property Transaction Processes in Rwanda[5]

Transaction	Description
Register individual land in Kigali	"Individual land" refers to land held and occupied by citizens and legal entities under some form of private tenure: customary occupation, long-term lease or ownership. Customary occupation is made official by a "certificate of provisional land ownership", which must be transformed into one of the two registration options recognised by the 2005 Land Law: ownership certificate or leasehold certificate. A full ownership certificate is granted to leaseholders who pay 10 years of lease at once and who have made tangible improvements to the land (fences, buildings, etc.).
Transfer of individual land in Kigali	Rights to land may be transferred between individuals or they may be guaranteed through succession; they may be donated, leased or sold; rights may also be mortgaged according to requirements and procedures provided for by ordinary civil law without prejudice to specific provisions of the organic law. Final transfer of rights on land like sale, donation or exchange by a representative of the family requires the prior consent of all other members of the family who are joint owners of such rights.
Acquisition of private district land (w/o expropriation)	Land can be acquired, and tenure rights obtained (lease contract or ownership certificate), for: - Customarily held individual land - "Private land" owned by the State, the City of Kigali or the Districts not reserved for public use or nature preservation and available for "individual" tenure (contrary to "Public land").

education. District staff retention is poor with rotation of 1-2 years with staff entering private industry or identified for senior roles within the GoR. The breadth of duties and responsibilities of land officers is overwhelming, leading to imbalance in the demands for efficient processing of approvals and due diligence. While remuneration within central agencies is relatively high, in Districts, particularly the rural areas, remuneration is not commensurate with the workload, responsibility and duties carried out by District Land Officers. Beyond the District resourcing, the LTR program is attempting to address building the capacity of Sector and Cell based land representatives on the land committees. The Districts also provide support to the sub-regions. GoR might consider reviewing District level staffing and remuneration levels particularly within the land offices and reduce reliance on external contractors to fill the gap.

2.10 IT Capacity

Information technological capacity at the national level observed was high with staff IT savvy, well equipped with new computers in all offices visited, and full software and antivirus installed with Internet connectivity. GIS was observed in urban and rural land offices. GIS skills were high at the Department of Lands and Mapping and KCC, moderate to low at central districts Nyarengenge, Gasabo, Kicukiro, low to absent at rural districts. Districts with special regions been GIS enabled with NUR-CGIS or external assistance to piloting level only with GIS not part of normal business activities. In all settings, further training and enhancement of the skills base is required to fully utilise the equipment and software available.

2.11 Land Professionals: Surveying and Valuation

There is a lack of training programs for land administration related roles in land management, GIS, surveying, and valuation. The Department of Lands and Mapping recognises education and training in different aspects of land administration and management are required at different levels (professional, technical, clerical and administrative) and through different formats to create central and decentralised capacity to administer and manage land in accordance with the requirements of the OLL. This will become more important as professionals are needed to implement and guide the National Land Use Development Plan. At the

moment, training in land related disciplines is largely conducted on-the-job placing pressure on the few senior staff and external assistance providers.

Survey services are predominantly outsourced by the District Land Offices. There is an absence of a recognised professional body of surveyors with the industry unregulated by government or by industry. There is no accreditation or professional training available for surveyors, planners or valuers within Rwanda. Recognised professional surveyors are known by districts and land valuers listed by the BNR (Central Bank). Only surveys undertaken by recognised 'known' surveyors are accepted to support loan applications. Land officers also undertake some of the survey task in preparation of final Deed Plans using the surveyors' field data and undertaking civil works surveys. The risk of having non-professionally trained surveyors (or para-surveyors) preparing land surveys is potential reduction in the integrity of land records, particularly in urban settings where achieving spatial accuracy reduces potential for land disputes.

The Department of Lands and Mapping have flagged plans to develop curricular in the fields of land surveying, valuation and land administration. However, greater effort and support is now required to progress a structured degree-based program in conjunction with lead education providers such as the NUR and Kigali Institute of Science and Technology (KIST) where engineering based programs could be extended to land based curricula. In the interim, the Department of Lands and Mapping with education partners should develop short courses on land administration and land management, and GIS, and further develop its workshop programs. To address these needs in the short-term, the NUR-CGIS have implemented a short course and diploma program in the field of land management and GIS. A selection of short (2-3 week) courses are available on a commercial (fee for service) basis to professionals seeking training and a points based system for postgraduate certificate or diploma accreditation over two to three years.

Vulnerabilities

From primary data, field research and interviews, a Baseline study was completed in January 2011. Findings from the study contributed to identifying the key vulnerabilities to land use planning and sustainable land use management in Rwanda. A summary of the key findings are listed in Table 1 below.

Table 1: Vulnerabilities for Land Use Planning and Sustainable Land Use Management in Rwanda

Economic/ Finance	Land degradation, soil and fertility loss, land unavailable for productive use and development, un-planned settlements and urbanisation.
Social/Capacity	Low access to land for production, low access to credit and opportunity for wealth creation, sporadic development, settlement in high risk or sensitive areas.
Technology/ R&D	Poor land use management decision making not based on adequate geo- information, unplanned communities at risk of natural and man-made disaster.
Political	Land not available for development, for individuals, imbalance of national priorities for land, low confidence in governance.
Legal/ Institutional	Low formalisation security of land ownership, inadequate land use planning and development approval legislation.
Environment/ Climate	Land not allocated for environmental protection, encroachment on protected areas, biodiversity loss.
Communication/ Information	Silo based land use management (i.e. industry, agriculture, forestry, water), District planning capacity, lack of spatially (GIS) based decision making, lack of community sensitisation of land use practices.

Opportunities

A summary of the key opportunities, based on the baseline investigation, are provided in table 3 below.

Table 3: Opportunities for Land Use Management and Planning in Rwanda

Economic/ Finance	Optimal land use achieved. Land available for growth, industry and agriculture. Sustainable development. Vibrant land market and public revenue.
Social/Capacity	Formalisation of tenure, security of land ownership, wealth creation and capital, confidence in government, individual land improvement.
Technology/ R&D	Demarcation of land tenure and use. Comprehensive geo-information used and shared across sectors. GIS support national and district planning and decision making.
Political	Land available for growth, investment, tenure security promoting growth and stability, revenue generation to fund public service delivery.
Legal/ Institutional	Integrated approach to land use development and planning, Organic law, environment law, national and district planning and development codes and enforcement.
Environment/ Climate	Sustainable land use and environmentally sensitive development, protection of environment and biodiversity.
Communication/ Information	National to District partnerships for delivery of services in planning, land use approvals. District peer to peer experience sharing. Extension to Districts, farmers, and communities.

Sectoral Overlaps

The key sector and sub-sector areas of overlap in authority, powers and responsibility are identified in table 4 below.

Table 4: Sectoral Overlaps

Economic/ Finance	Economy, infrastructure, industry, energy, agriculture, built environment, transport.
Social/Capacity	Land reform, regularisation, governance, education, economy, education, infrastructure, industry, agriculture, built environment.
Technology/ R&D	Planning, ICT, education and skills, disaster management, environment and climate.
Political	Governance, Planning, ICT, economy, finance, industry, agriculture, built environment.
Legal/ Institutional	Law, decrees, regulations, planning codes, enforcement.
Environment/ Climate	Development, urban and rural growth, agriculture, planning, Environmental monitoring and enforcement, energy, built environment, transport.
Communication/ Information	Communication across all land users: agriculture, industry, water, infrastructure, transport, forestry, environment tourism, housing.

5.1 Key stakeholders

Guided by the National Land Policy and Organic Land Law, responsibility for land use planning and land administration is today divided among several agencies and levels of government as listed below and illustrated in figure 5:

- Ministry of Natural Resources (MINIRENA) is the direct supervisor of the Rwanda Natural Resources Authority and has several important mandates in land matters under the Organic Law. The Ministry is responsible for environmental compliance and establishes the rules and procedures for environmental impact review of land development projects.
- Rwanda Natural Resources Authority (RNRA) (Law 53/2010 of 25/01/2011) - Establishing Rwanda Natural Resources Authority (RNRA) and determining its mission, organisation, and functioning was recently promulgated to bring together the functions of the previous National Land Centre (NLC), the Office of Geology and Mineral Resources (OGMR), the National Forestry Authority (NAFA), and notably functions of Water Resource Management as new responsible Departments of RNRA
- Department of Lands and Mapping (formerly the National Land Centre), headed by a Deputy Director General, is a responsible agency of RNRA. It is the main

counterpart for the ongoing work of systematic land titling, development of the national land information system, and development of the national spatial plan. The Department of Lands and Mapping has ongoing responsibility for management and maintenance of the land registry, which it carries out through five provincial land registrars and the district land bureaus, and for oversight of leasing of state and district private land.

- Ministry of Agriculture (MINAGRI) is taking an active role in development of agriculture and agribusiness, addressing land degradation, and addressing agricultural land issues.
- Ministry of Infrastructure (MININFRA) has responsibility, through its Department of Planning and Human Settlements, to develop land use planning, the lack of which is seriously impeding development of Rwanda land markets and stagnating sound urban and rural development.
- National Land Commission is a high level land policy forum for the senior stakeholders in government to consider proposed developments.
- District Government, the Mayors and District Councils (30) are responsible for day to day implementation of land allocation and development control policies.
- District Land Bureaux, are the line agencies responsible for implementing planning and development controls. They also serve as the district land registrar, providing cadastral (survey and deed plans) and registration functions.

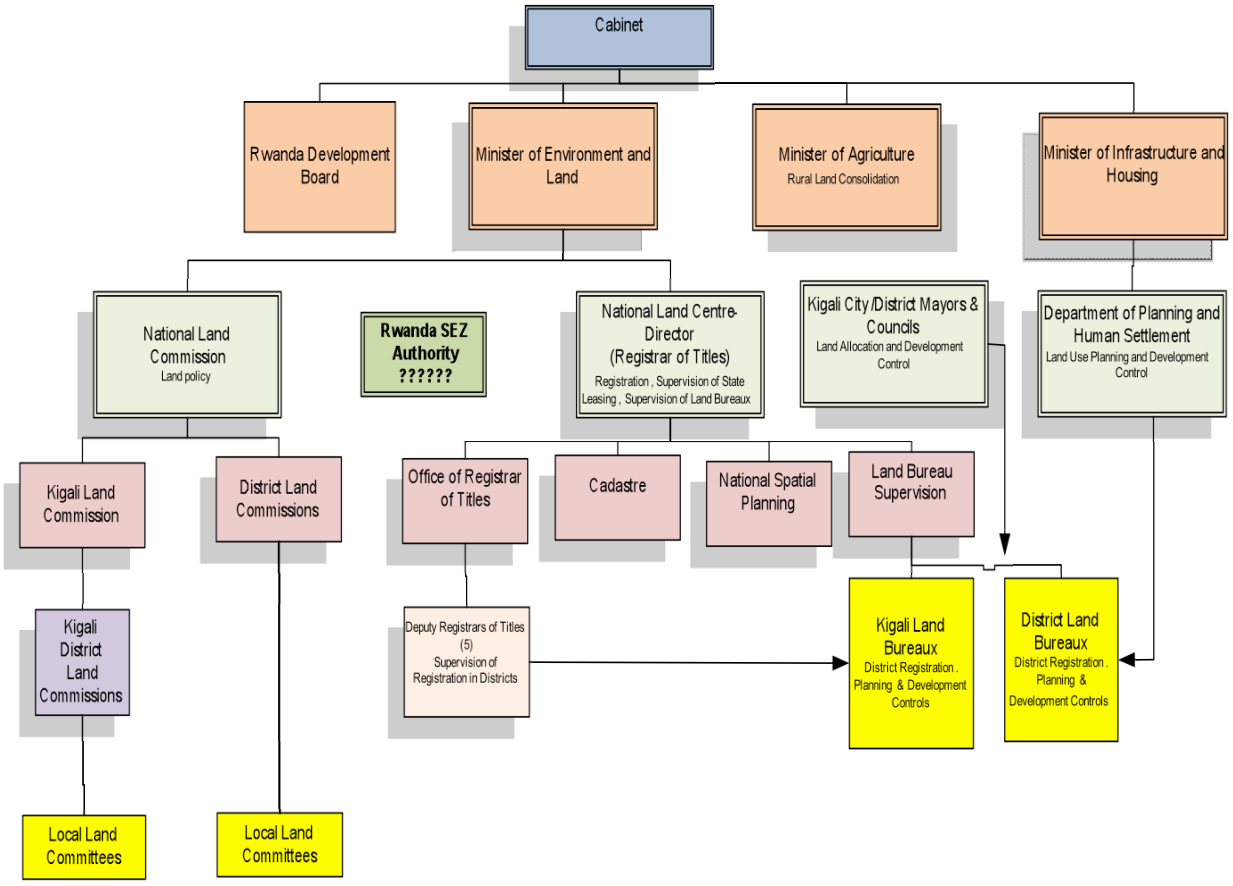


Figure 5: Organisation of Government Land Activity in Rwanda[2]

Focus areas

Building upon the baseline investigation and extensive in-country consultation, the following focus areas were established as being the foremost priorities for the Government of Rwanda to address in working towards a climate resilient and low carbon future. Options to address the focus areas are listed below in table 5 and are addressed in the following review of selected best practices.

Table 5: Focus Areas: Options to address Climate Change and Low Carbon Growth

Focus area	Option 1	Option 2	Option 3
Institutional / Legal Framework	Promulgate planning laws for NLUDMP, SLM, WRM	Update district plans	Capacity and institutional development
Information Management / ICT Infrastructure	National Spatial Data Infrastructure Strategy (Rwanda SDI)	National policy for information access and sharing	Spatially enabled Government plan under National ICT Policy (NICI)
Technology diffusion	Spatial Information Council and Technical Working (User) Group	National & District Technology Partnerships, Foster technical community	District accreditation in NLUDMP, SLM, WRM technology and practice
Capacity	Formal courses at Universities (professionals and para-professionals)	Training programs, short courses and formal accreditation	Professional accreditation, continuing professional development

**National Land Use and Development Master Plan (NLUDMP), Sustainable Land Management (SLM), Water Resource Management (WRM), National Information and Communication Infrastructure (NICI).*

Review of Best Practice

7.1 Case Study: Indonesia

Indonesia has a population over 230 Million, of whom around 39 million are poor. Covering an area of about 9.8 Million sq km of both sea and land areas, with approximately 17,500 large and small islands, Indonesia has a combined land mass of about 1.86 Million sq km with 70% classified as forest land. The centrally administered Indonesian Government presides over a capital district (Jakarta), 27 provinces, 2 special regions (Yogyakarta and Aceh), and 370 regencies and municipalities.

In Indonesia, the Land Management and Policy Development Project (LMPDP), a USD88 Million USD World Bank funded project is advancing land administration reform. A five-year project, LMPDP aims to improve land tenure security distributing more than 2.5 million land title certificates, improve the efficiency and transparency of land administration service delivery, and enhance local government land management. Lead by the National Land Agency (Badan Pertanahan Nasional - BPN) with Bank support, BPN has set forth a comprehensive Strategic Plan 2007-2009 for land reform centered on ICTs to provide equality and security in land ownership with computerised LIS central to the strategic goals of building national SDI and e-Government service delivery [6].

A nationally consistent inventory of land ownership records and land rights allows countries to have land information readily accessible and on-hand to plan for, mitigate, and respond to short and long term disaster events, both man-made and natural. The December 2004 earthquake and Tsunami in Indonesia's Aceh Province provided important lessons for land administration. In addition to the immense human toll, nearly all evidence of land and many land records were damaged. Computerised LIS of ownership records and detailed cadastral mapping means towns and communities can be quickly rebuilt. Surviving partners, children and family members will be assured rights to their land. In Aceh, the biggest encumbrance to reconstruction was the delay in the settlement of land disputes. The World Bank through the USD 28.5 million, Reconstruction of the Aceh and Land Administration System (RALAS) project supported community based adjudication to support reconstruction[7]. World Bank support is helping the Indonesian Government rebuild modern land offices to assist the ongoing efforts in Aceh Province and developing national LIS and National SDI to help safe guard communities.

The Directorate of Building and Property Taxation, Ministry of Finance (PBB) has complete and accurate property information (in MapInfo application SISMIOP) of the Aceh province collected prior to the devastation. Figure 6 is an extract of the

Figure 6: Modern LIS Supporting Communities Affected by Disaster: Extract of PBB Property Tax Information of Aceh (pre December 2004 Tsunami), background ortho-imagery (post December 2004 Tsunami)[8]

PBB tax object based LIS known as 'SISMIOP' and demonstrates how PBB data can be utilised in the adjudication process when post-tsunami ortho imagery is suspended behind pre-tsunami occupation. Although the PBB property data only represents approximately 15-20% of affected lands (urban based, taxable objects)[7].

LMPDP is being implemented by three agencies, BPN as the executive agency, the National Development Planning Agency (Bappenas) for land policy development, and the Ministry of Home Affairs (MOHA) for local government capacity building, including GIS/LIS training and development (SLIM project) at the local level. Despite recognised coordination challenges in managing multi-agency approaches in ICT related projects, individual strengths and shared end-project ownership offset these risks.

BPN released its strategic plan 2007-2009, geared to achieve the Mid-Term Development Plan (MTDP) goals of LMPDP, the plan sets forth an action agenda for policy reform supported by building LIS. The LIS components include expansion of the National Land Information and Management System (SIMTANAS), the national land base. Cases of large-scale post disaster housing reconstruction in Aceh (caused by earthquake and tsunami, December 2004), devastation in Yogyakarta (caused by earthquake, May 2006), and events such as the arson attack on the central Jakarta BPN Office during the 1990s uprising, have made many people realise the importance of having legal documents to prove land ownership and has pressed the need for government to computerise land records and support Nation SDI development efforts.

BPN has set forth a comprehensive action agenda for land centered on ICTs to provide equality and security in land ownership. Visionary for its adoption of ICTs, the plan brings together the latest surveying and mapping technologies, computerised LIS, network infrastructure, and online information services. Under the plan, the SIMTANAS will be implemented in all central and regional land offices, connecting agencies and the public to property information and land services throughout the country as part of the broader e-government network. A snap shot of the national

Policy	Strategy	Activity
- To realise national land mapping to overcome inequality in land ownership and use, and improve prosperity - To secure legal certainty of land rights	- Implement fundamental framework of National Cadastre (KDKN), basic land map, land use and thematic maps, complete inventory of land records - To enable a complete, reliable, accurate, and up to date National Land Information and Management System (SIMTANAS) - Harmonise LIS across land offices as part of e-government network - Registration of all land rights across entire country - Information services for land for internal agencies and public	- Standards for data, survey and mapping - Accelerated systematic land titling - Implementing national land survey, thematic mapping and basic mapping - Aerial photo survey and acquire remote sensing imagery - Implement LIS hardware and software in central, regional and local land offices - Provisions for LIS infrastructure security and safety - Developing e-government and land related eServices, online and SMS services - Improve IT infrastructure, bandwidth, data storage, security - IT and LIS training and education

Figure 7: BPN Strategic Plan 2007-2009: e-Governance and ICT-enabled Land Administration
Source: BPN (2007)[6] (adapted)

land strategy and core ICT components are as shown in figure 7.

The BPN Strategy provides for a national framework for land information management in the context of a National SDI, a nationally consistent, complete and multipurpose LIS of land related thematic information. Problems in developing a National LIS are enhanced by the fact that there are two cadastre systems. The national tax PBB Directorate maintains a LIS, the Property Tax Information Management System (SISMIOP). Different coordinate and projection systems, different parcel identity number, and different accuracy and precision of surveying and mapping, and institutional barriers prevent the two systems from being aligned. A National Coordinating Agency for Surveying and Mapping (Bakosurtanal) is mandated with progressing NSDI under presidential order 85/2007.

Indonesia is leading innovation in eService delivery to rural and remote communities. The People's Land Titling Service (LARASITA) is a mobile BPN land office that travels on a modified van to remote villages to enable previously disconnected communities access to BPN property services (refer figure 8). The van is equipped with laptops that are connected to the main database in BPN Karanganyar office through wireless connectivity (WLAN), a 2.4 GHz wireless antennae installed on top of the van and on top of a 60 metre tower behind the BPN office. This infrastructure enables the LARASITA van to operate real-time within a 20 kilometre radius from the tower. To provide access to remote communities, LARASITA uses 'briefcase' software that allows data to be input into the laptop when offline. The data gathered is subsequently synchronised with the data in the main server when the team returns to the BPN Karanganyar office. Head of the BPN Karanganyar local office, Mr Rukhyat says, 'As long as we can bring BPN presence and services closer to the people, and provide the right information, then LARASITA has achieved its mission.' [9].

7.2 Case Study: Lao PDR

Lao PDR is the poorest and least developed country in the East Asia region, and one of the least developed in the world. Bordered by Thailand, Cambodia, Vietnam, China, and Myanmar, landlocked Lao PDR covers 236,800 square kilometres with a population of 5.3 million growing

Figure 8: LARASITA 'The Peoples Land Titling Service' bringing land and property services to remote communities in Indonesia [6]

at 2.5% per annum. More than three-quarters of the population lives on less than USD2 a day [9].

The National Land Management Agency (NLMA) is leading a comprehensive program of computerised land information systems (LIS) and digital cadastral mapping with the latest technologies including geographic information systems (GIS), global positioning systems (GPS), satellite imagery, aerial orthophotography, and staff training in IT and electronic surveying equipment. Bringing together land related functions under a single agency will foster improved information exchange and sharing amongst land management, planning, and natural resources agencies. NLMA and the land sector will benefit from the development of a national land information database as part of a National Lao SDI.

An ambitious LIS pilot is underway in Vientiane province introducing computerised land records and establishing cross-government coordinated LIS in the first of 14 provinces under World Bank support for land reform. The Vientiane Capital City (VCC) pilot involves digitizing existing paper cadastral maps and integrating available electronic records of land tenure, land use and land capability required for development planning. The VCC pilot will expand to neighboring provinces to form the basis of a national LIS by the end of 2008. The VCC is part of a comprehensive national LIS strategy under LTP2 to create the National Lao SDI [10].

Most of the Lao PDR land mass is mountainous. Arable land suitable for permanent cropping is perhaps less than 5%, and only 6% of the territory has slopes below 20%. Only 6% of the territory is used for agriculture divided equally between crops and livestock. An additional 30,000 hectares are under shifting cultivation[9]. Up to 45% is still under forest cover, but the shift to a market economy is increasing pressure on these forested lands, and agricultural lands are being assigned to international investors. A major priority for NLMA is protection of natural resources and the environment, especially from international interests. A national inventory of land use and land ownership data, and environmental themes including soil, biodiversity, geology and hydrology is vital for effective land management. By adding social themes such as census, population and livelihood indicators, sustainable land use and management policies can be determined. A national LIS will provide a better understanding of the impact of land allocation and land policies.

The Second Land Titling Project (LPT2) in Lao PDR is the next phase of the World Bank's long term support for land titling with land reform efforts tied directly to the Country's economic development and National Poverty Eradication Program (NPEP).

LPT2 is a USD14.83 million World Bank funded project with assistance from the German Aid Agency, Gesellschaft für Technische Zusammenarbeit (GTZ) and Australian Agency for International Development (AusAID). The newly created lead agency for land, the National Land Management Agency (NLMA) is heading a 10 year LIS computerization plan to convert cadastral records to the digital environment and establishing simple customer orientated e-Government services and transactions online.

Acknowledging Lao PDR has a long road ahead in harnessing the full benefits of computerised LIS the early signs show great potential. The key goals are digitizing existing land records and cadastral maps, implementing new electronic systems of cadastral mapping using the modern surveying equipment including GPS, and digital total stations for property boundary demarcation, electronic land records linked directly to the cadastral maps. Training of land office staff and field survey teams in ICT and advanced surveying techniques is critical in the success of the LIS initiative and has been the main thrust of both LTP I and LTP2 programs

Demonstrating the potential of ICT enabled LIS, the Khammouane MapServer developed with United Nations Food and Agriculture Organization (UNFAO) support is a web-based mapping system that successfully integrated various datasets at various scales. Users can view and interrogate agriculture, soils, forest change, demography, and poverty information online and generate customised A4 maps of their study region. Combined with available topographic maps, Landsat satellite imagery, elevation data, roads, rivers, villages and towns, the Khammouane Map Server becomes a powerful land management and decision making tool with tremendous potential for expansion [10].

A review of key datasets suitable for LSDI inclusion by Grant (2006)[10] identified a wealth of digital land information across Lao in various formats and accuracies. Several exhibited relatively high accuracy and are deemed suitable for LSDI inclusion as fundamental land information datasets – the geographic location of villages, village names and codes surveyed with GPS; the national and provincial road network; Spot satellite imagery at 1:50,000 and 1:100,000 scales; and 1:50,000 contour lines digitally scanned from 1963-67 US military topographic mapping; and the national soil dataset. A GIS Base Map of various geographic themes prepared in 1996 with Government of Japan aid agency JICA assistance covers 90% of the country. Combined with demographic data such as the National Census of 2005, integrated and made accessible in the LSDI, these spatial tools could readily be applied to decision support.

The National Geographic Department (NGD) and the Science, Technology and Environment Agency (STEA) are the two main organizations taking lead role in building national SDI for Lao. In 2004, STEA developed the 'ICT for Development Project' under the Office of Prime Minister and with support from the United Nations Development Program (UNDP). Two main objectives governed the project; developing the policy framework, and enabling standardization of Lao digital information exchange in order to implement the Government's ICT master plan and strategy for 2006-2010. Directly linked to the Millennium Development Goals, the ICT master plan is set to enhance socio-economic progress in Lao PDR.

The goals of LTP2 recognise the need for a complete inventory of land describing ownership, state land, concession areas and leases, protected areas, land use and spatial planning. The NGD has mandate for land, property, and natural resource information. NGD is also responsible approving all surveying, aerial photography and topographic mapping, although seldom adhered to in practice and much spatial information is collected in duplication and not provided to the NGD on completion. A framework for coordination and sharing of spatial information is needed.

Through the nurturing of LIS pilot programs and innovative ICT applications to land information, the goal of LTP2 is to create national inventories of land ownership and land use records to support a robust

land administration system for Lao PDR. Efforts towards building a multipurpose LIS of key national datasets of LSDI are focused on maturing the core building blocks of an appropriate institutional framework, technical standards, identifying fundamental national datasets, building the enabling technical ICT infrastructure, and enhancing the available skills base through training and education programs. Access to reliable and affordable 24hour electricity is a hurdle for any computerised LIS. World Bank Country Assistance Strategy for Lao PDR is addressing the nation's electricity needs with sustainable, self generation capacity through hydro power projects expected by 2012. In the interim, innovation in rural districts includes human-generated and solar powered alternatives.

Analysis of Options

Establishing the governance and coordination mechanisms is the first step for improving the management of land information resources. Progressive governments that recognise the importance of better managing their land information resources have implemented a strategic policy framework. The framework facilitates data standards adoption, access arrangements and enables government to keep abreast of new trends in ICT and spatial technologies.

8.1 Forging Partnerships between National Agencies and District Governments

A highly successful partnership based model for enabling innovation in District land use planning and management is highlighted in box 2.

8.2 Development of National Spatial Data Infrastructure (SDI)

An integrated National Spatial Data Infrastructure (National SDI) is the technical realization of a modern multipurpose cadastre. In recent years, many countries/governments have moved towards building comprehensive land information systems (LIS) aimed at linking the agencies that are in control of various land related data. This has been accepted as a means of overcoming the land information problems across government. A comprehensive LIS is used in a variety of ways to support economic, social and environmental priorities, including:

- Transferring land ownership
- Managing the environment
- Supporting hazard mapping
- Planning new towns
- Facilitating minerals exploration
- Administration of valuation and land taxes
- Planning and managing utility services

In Rwanda, National SDI development remains wanting. A plan is now urgently required to manage the Nation's land information resources and formally recognising the key fundamental datasets required to manage the land and water resource, support economic development and enable Rwanda to better plan and respond to the impacts of climate change.

The advent of next generation computing, optic-fiber networks and wireless technologies have enabled a new era in the way land information is shared, integrated, and made available. The potential is limitless – land registries can now be connected to the systems of birth, deaths and marriages and business registration systems; financiers can automatically query State mortgage systems; utilities can notify other referral authorities of new installations; and, developers and architects can readily inspect planning controls and zoning restrictions in any one location.

Box 2: Philippines Innovation Support Fund (ISF)

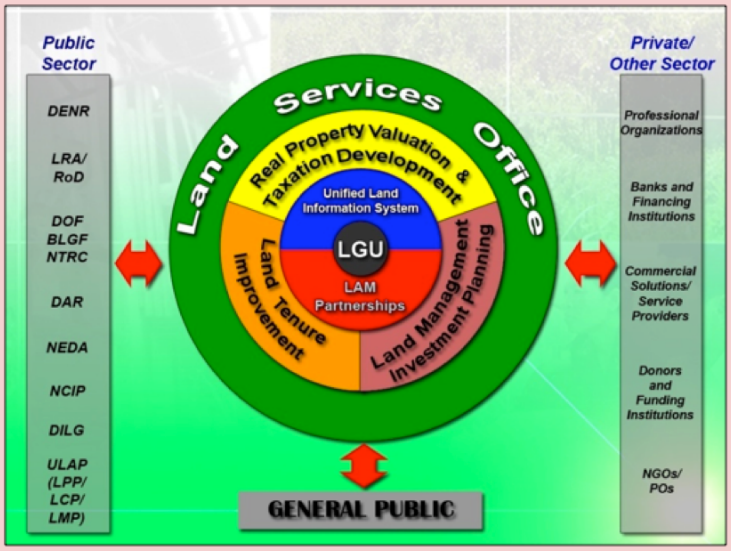
National-Local Partnerships for District Land Offices: A Funding Model for Multi-purpose LIS at District Offices to support Land Use Management[11]

ISF provided grants directly to local governments to partner with local and national agencies to develop and improve the delivery of land related services in support of local government social and economic development objectives. Local Governments principally use the grants to assist Local and National Land agencies acquire systems and technologies developed or sponsored by the LAMP2 program. The end product is a "Unified" digital cadastral database and land information system (LIS) that can be utilised for a wide range of purposes including: tax mapping and revenue collection and the related activities of real property valuation and taxation assessment; land survey and issuing land titles; social mapping and land use planning and management.

Currently some 16 Local Governments comprising 12 cities and municipalities have been supported by the program. Testament to the program's success is the on average 16% return on investment made within the first 12 months of the projects' started through improved real property taxation and revenue generation from land services. Several sites have returned up to 20% in the first month!

At a National ISF workshop for Local Governments across the country held in February 2010, Mayors proudly addressed the audience on the achievements of their Local Governments in introducing modern land management functions and their plans for expansion, demonstrating not only strong commitment to the reforms and new systems, but a sound comprehension of the technical details of the modernization efforts.

'And the word is getting around' with neighbouring Local Governments and even provincial governors taking note of the pioneering LIS efforts and revenue system efficacy.



The notable successes of this program and the early indications demonstrate high sustainability and extensibility potential!

Advanced computing and ICTs have enabled a new vision for the LIS of today – agencies and their databases, management information systems (MIS), document tracking applications, and payment systems can all be interconnected through web-based technologies. A schematic diagram is provided in Figure 9 that illustrates the LIS concept in detail showing the distributed network configuration joining local, provincial and central agencies to provide web-based services, a concept employed by the National Land Agency in Indonesia.

8.3 Example of Integrated Land Information System (LIS) Concept: Indonesia's National SDI

Some progressive governments such as Singapore's have focused their LIS efforts to support the property market with development of land and property services online via the Integrated Land Information Service (INLIS) and State Property

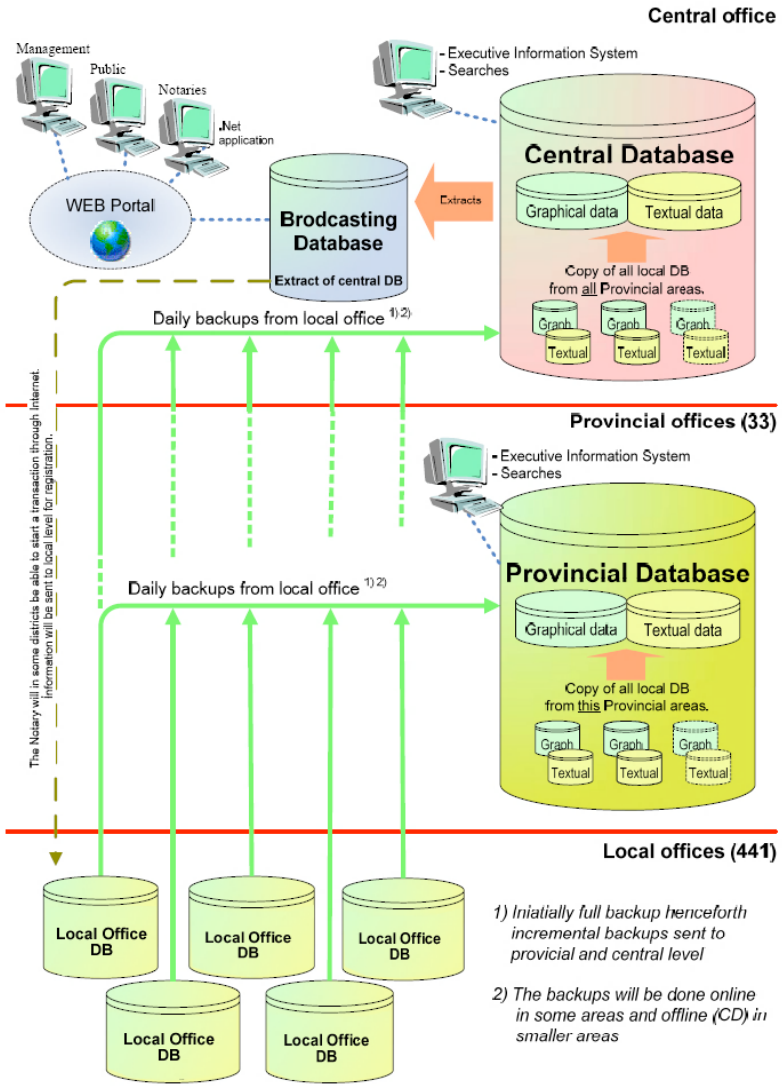


Figure 9: Example of Integrated Land Information System (LIS): Indonesia's National SDI
Source: BPN 2010

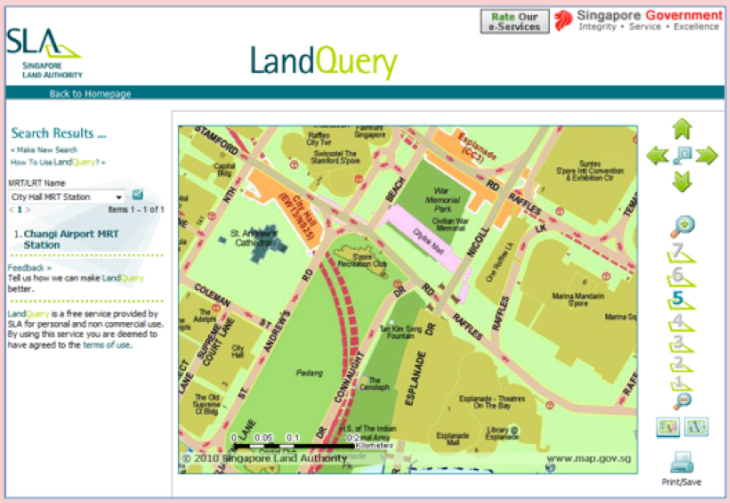
Information Online (SPIO) web-portals (refer Box 3). Producers and custodians of land information have come to realise that maintaining their land information relies on an inter-connected network of access to the data and systems of other agencies. Agencies are recognizing that users require a complete view of land and that they do not necessarily need to understand the institutional arrangements of government to perform their land dealings. Users, more and more, are demanding greater access to complete, authoritative land information and efficient online services 24/7.

Finally, a weak LIS makes it difficult, if not impossible, for governments to collect the appropriate charges and property taxes needed to support the public service provision. It further encourages informal land and property dealings, further exposing the system to abuse as there is no effective way to monitor and track transactions. Experiences are provided of LIS efforts via case studies in Indonesia, and Lao PDR.

Box 3: Singapore's LandNet: Providing Access to Land and Property Services via online portals INLIS www.inlis.gov.sg and SPIO www.spio.sla.gov.sg

Complete Property Information Services Online: Whether you are an investor, real estate professional, architect, developer, lawyer, surveyor or general public, the Singaporean Government's Integrated Land Information Service (INLIS) allows you to obtain property information conveniently via internet and in the comfort of your home or office with secure online payment systems.

Singapore's State Land Market is accessible via the State Property Information Online (SPIO), a one-stop portal on State property rental and sale information – providing timely information on over 5,000 State buildings, 14,000 Ha of State land, and 4 Million m^2 of floor area for residential, commercial, and industrial uses.



8.4 Standards for Data, Survey and Mapping

Enabling the sharing of data through a LIS by a wide range of agencies and the private sector requires that data transfer standards be developed and implemented, institutional arrangements within and between agencies be established, and that the data is complete, consistent and accurate. In many cases the emphasis is less on data sharing, and more on establishing information exchange – a system of "notification" and "access" where the key stakeholders in land are notified of any change or amendment to the status of land such as an approval, transfer or new title, or can access the most up-to-date record. This is the essence of land information management, the aims of which are to:

- Ensure the land record is complete and up to date
- Reduce duplication of data and increase efficiency of data processing
- Make the data more readily available and accessible
- Ensure potential revenues from land information services are realised

However, this level of information accessibility and integration demands a national approach in dealing with the land information management issues. The key policy, procedural rules, and coordination arrangements under which the integrated LIS will operate must be established. Furthermore, there may be many restrictions on the dissemination of land information including privacy, licensing, royalties, copyright, distribution arrangements, legal constraints, and maintenance costs that need to be addressed in the management framework.

Data exchange is dependent on the adoption of data standards. Technical specifications for the common collection, storage, transfer and use of the various themes of spatial information need to be developed and adopted by all agencies. Spatial data standards should be consistent with international best practice and International Standards Organization (ISO) specifications for geographic information. Reference should also be made to the specifications of industry standards based organizations including the Open GIS Consortium (OGC). Data structures should be consistent with the Standard Parcel Identifier

constructs enabling systems to cross reference and exchange land information – "the key to connectivity". Adapting new conceptual models of tenure should also be considered such as the Social Tenure Domain Model development efforts by UNHABITAT/Global Land Tool Network.

8.5 Privacy, Security and Access to Information

The fine line between personal data and non-personal data must be defined and maintained. Agencies should only collect information that they are legally authorised to access "lawful right". Challenges arise when personal data becomes electronic and aggregated, coming into the domain of electronic information storage and transfer which demands a further level of governing policies and laws for its management to protect citizens. As agencies, particularly local governments, start to utilise their cadastral index maps for social mapping purposes beyond land administration and taxation, new issues of privacy and personal data management arise, especially when linked to the household. For such social mapping purposes such as national and local census, the use of the parcel unit is not appropriate. An aggregation of household data to the "mesh block"[12] (aggregate of an area block of households) or some other unit of aggregation (greater than household and smaller than Cell or Sector) is strongly recommended.

System security is a paramount concern to prevent illegal access both physically and electronically. Rules of access must be defined and established. Protocols for access to data and systems must be developed for the variety of technical and administrative staff that interact with the systems and for public access. IT systems must be secure and have appropriate defence mechanisms from malicious software and hacking intrusions. IT and database administrators must be tough on enforcement. Pirated software, weak antivirus, misuse of portable storage devices can quickly disable an entire LIS, corrupt data, or result in a complete loss of records. Equally, laws must be enacted to penalise offenders illegally accessing personal information and for anyone mishandling records or systems.

Action Plan

The proposed Policies for Climate Change and Low Carbon Development drawn from the discussion and focus areas are listed below:

9.1 Proposed Actions

1. Improved understanding through monitoring and observation of land use changes, forests, biodiversity.
2. Improved planning to achieve sustainable land use management – "optimal" land use is achieved.
3. Impacts of development and industry controlled through a robust and integrated development approval and planning process.
4. Impacts controlled through monitoring and enforcement of land use, emissions, pollutants, and waste water and physical wastes (key agents REMA, RBS, Industry self regulation).
5. Biodiversity and wetlands protected through controlled land use and development, precisely defined discrete boundaries are monitored.
6. Forested areas and agroforestry lands delineated and quantified. Lands earmarked for future land use change are defined.
7. Building code control of energy efficient design through improved planning process (i.e. transport, roads, dwellings, office space, industrial plant, water supply and treatment facilities).

9.2 Options for Low Carbon Development and Climate Resilience

1. Improved understanding through monitoring and observation of land use changes, forests, biodiversity.
2. Improved planning to achieve sustainable land use management – "optimal" land use is achieved.
3. Impacts of development and industry controlled through a robust and integrated development approval and planning process.
4. Impacts controlled through monitoring and enforcement of land use, emissions, pollutants, and waste water and physical wastes (key agents REMA, RBS, Industry self regulation).
5. Biodiversity and wetlands protected through controlled land use and development, precisely defined discrete boundaries are monitored.
6. Forested areas and agroforestry lands delineated and quantified. Lands earmarked for future land use change are defined.
7. Building code control of energy efficient design through improved planning process (i.e. transport, roads, dwellings, office space, industrial plant, water supply and treatment facilities).

Box 4: Priority policies for achieving Climate Change Resilience and Low Carbon Development

1. Integrated Approach to Planning and Sustainable Land Use Management
2. Rwanda Spatial Data Infrastructure: National Land Information Management and Information Sharing and Access Policy
3. Improve GIS adoption, use and uptake throughout Ministries, Districts and implementing agencies
4. GIS Capacity and Professional Development

9.3 Action Plan

To guide decision-makers, the policies are brought together into the action plan in Table 6. The table outlines the focus areas, indicating policies and actions, responsible stakeholders, suggested timing, preliminary indicators and finance source.

Table 6: Action Plan

Focus area WHY	Policies and Actions WHAT	Stakeholders WHO	Timescale WHEN	Measurables HOW	Sources of Finance
Planning	Integrated Approach to Planning and Sustainable Land Use Management - Promulgate land use planning law - District detail plans (DDPs) under NLUDMP - Integrated land use planning decision support - Strategic Environment Assessments (SEAs) for key Development Zones	RNRA, Department of Lands and Mapping, Land Commissions, RNRA, MINIRENA, MINILOC, Districts, District Land Bureaux, MININFRA, MINAGRI, MINICOM, RDB, REMA, NUR, KIST	Short Term	- Pass law - District plans updated - Districts 'accredited' for Integrated Land Use Planning - National land use planning incorporates climate resilience principles - SEAs adhered to in key development zones	Central
Spatial Information	Rwanda Spatial Data Infrastructure: National Land Information Management and Information Sharing and Access Policy - Information sharing and access policy - Nation SDI Strategy - National detailed feature mapping - Monitor land use and environmental change	RNRA, Department of Lands and Mapping, MINIRENA, MININFRA, MINAGRI, All Ministries - Custodians of Key National Datasets, CGIS-NUR	Short – Medium Term	- Strategy adopted - Policies adopted - Fundametal National Datasets Identified - Data accessible - Data used - National SDI for climate observation and management	Central
GIS Adoption	Improve GIS adoption, use and uptake throughout Ministries, Districts and implementing agencies - Foster GIS User community - Dept of Lands lead District Planning Capacity program - National > District Government Partnerships	RNRA, Department of Lands and MINIRENA	Short – Medium Term	- GIS Units in Ministries and Districts - No of software licenses in each National Agency and District - GIS SWAp - Spatial Data Council - GIS Technical Workgroup	Central
Professional & Technical Capacity	GIS Capacity and Professional Development - CGIS-NUR, KIST etc to provide additional training courses - Extend formal courses in GIS and twinning - Professional accreditation - Foster Industry and Professional Bodies	RNRA, Department of Lands and MINIRENA	Medium Term	- No. Licensed or Accredited Professionals - No. Courses - No. Students enrolled/ graduated	Central

The policies offered are geared to overcome the most pressing challenges in achieving sustainable land use management and optimal use of Rwanda's limited land resource. Priorities are listed in order of priority and have a natural timing involved. All can be commence immediately. However, a roadmap of set actions and tasks will also be provided with short term geared to the EDPRS III revision for 2013-2017, medium term from 2017 onwards and select long term outcomes to be achieved by 2050. The timescales are mapped out in table 7.

Table 7: Timeline for Policies and Actions

Focus Area	Policies and Actions	2011 Q3	2011 Q4	2012 H1	2012 H2	2013	2014	2015	2016	2017
Integrated SLM	Review Planning System									
	Complete Tenure									
	Review EIA/EMPs									
	Water & Energy Footprint in EIA									
Rwanda SDI	National SDI Strategy									
	Information Access Policy									
	Custodial Arrangements									
	National Data Centre									
	Land Info Portal									
	Integrate Finance and Property Tax									
	National Feature Mapping									
GIS Diffusion	National GIS Diffusion Strategy per NICI									
	Inventory Software & Assets									
	Annual Workshop									
	District GIS Capacity Programme									
	Identify Key Climate Datasets									
	Spatial Information Council									
Capacity Building / Professional Development	Higher Education									
	Short courses									
	Professional Accreditation Competency Framework									
	Professional Societies/Bodies									
	Climate Education									

Climate Finance

Although sustainable land management is not among Rwanda's top six urgent and immediate actions to adapt to climate change, it does feature prominently in the National Adaptation Plan of Action (NAPA). Preparation and implementation of a national land development plan is among the top eleven listed priority adaptation options. As such, there should be opportunities to receive grants from multilateral climate funds. Below is a list of the funds that offer support for NAPA implementation:

- Adaptation Fund
- Least Developed Country Fund
- Global Environmental Facility
- Global Climate Change Alliance

Other multilateral funds that support sustainable land management include the following:

- Special Climate Change Fund
- International Development Association
- UNDP/Spain MDG Achievement Fund
- ClimDev-Africa Special Fund
- Global Climate Change Alliance
- International Climate Initiative

Each fund has its own mandate, institutional requirements, and application and monitoring procedures which are outlined on the website www.climatefinanceoptions.org. Public funds could also come from Rwanda's future environmental fund, FONERWA, which will in turn be capitalised by bilateral development partners and environmental fiscal sources. A further source of revenues could be a tax on property valuation as part of national tenure and planning system. This revenue stream would be installed at district level to support district resources for local level planning, hazard mapping, agricultural and industrial development, and environmental management.

Summary

Realising adaptation to climate change and achieving a low carbon growth path is ostensively rooted in achieving land tenure (ownership) security and instigating a robust integrated framework for development planning and sustainable land management – improved land information management is essential. Land reform is an engine of development and plays an important role in enhancing peace, stability and equality if undertaken in a participatory and orderly manner, and plays an important role in the process of poverty reduction. Land formalisation allows access to credit (against the land), encourages land improvement, enables efficient collection of property revenue via district taxes and transfer fees, in turn, enabling government authorities to fund and action sustainable land management practices and undertake detailed planning.

Increased competition for land resource will continue to grow with increased pressures from intensive agriculture and livestock. Encroachment on sensitive areas persists until land reforms are completed. Poor or limited access to land and productive arable lands contributes to urbanisation. Industrialisation further competes for the limited land resource. As the labour force shifts from subsistence agriculture to processing and manufacturing roles, the land demand for housing changes. Higher density urban development will become increasingly necessary.

The land tenure regularisation programme that commenced in 2005 is now making strong headway in addressing the need to formalise ownership. For the land that has records, it is for the most part recorded in the existing paper-based system that in its present format is unable to provide a complete view of all ownerships and their geographic location, thus making it difficult for planners or investors to identify available lands for development. Planners and administrators of land are effectively blind, restricting their ability to quickly make decisions based on multiple interests on land, to consider environmental scenarios, or to readily identify current use or the responsible authority in control. Until the land information is made electronic and in a usable format, competing interests in land will go unchecked and land use demarcation will remain problematic. Optimal land use will not be achieved and encroachment on sensitive areas will continue.

In Rwanda, National SDI development remains wanting. A plan is now urgently required to manage the Nation's land information resources and formally recognising the key fundamental datasets required to manage the land and water resources, monitor land use and environmental change, support economic development, and enable Rwanda to better plan and respond to the impacts of climate change.

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