CASE STUDY IN BRAZIL: THE MAIN CHALLENGES FACED BY LAND ADMINISTRATION

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NATIONAL CONTEXT

Location, Area & Political-Administrative Arrangements

- Location: it occupies the central and western portion of South America
- Area: 8,514,046.79 km²
- Political – Administrative Arrangements: Union, Federal District, 26 States and 5,560 Municipalities
- Population: 182 million people

The History of Land Settlement

The country originates in the XVI century, as a Portuguese colony. Land settlement starts with the foundation of cities along the vast Atlantic Ocean coastline. Each city has a number of dependent urban settlements that, gradually, penetrated inland and colonized the vast territory that the country occupies.

- Settlement was lured inland influenced by the building of road corridors.
- The building of Brasilia, in 1960, was very significant for the settlement of the Central-West Region.
- Most of the population still resides in highly concentrated areas on a strip of land situated along the coastline, of approximately 450 km wide.

The History of Land Settlement: URBANIZATION

- The current demographic distribution pattern features the great impact of two main corridors:
  - North – Central West: cities developed along two Road Corridors: Belém-Brasília and Cuiabá-Porto Velho.
    - River corridors determined the demographic distribution pattern in the Western Amazonas.
    - Northern and Eastern Amazonas: the settlement programs implemented since the 1970’s changed the traditional demographic distribution pattern. This pattern also changed under the influence of road corridors.
  - State of São Paulo: the largest in the country. Since the early 20th century, the construction of Railroads contributed to the expansion of coffee culture inland and north of the State of Paraná.
  - Northeast: stable demographic patterns. The coastline concentrates the most dynamic economic activities, most of the population and the largest cities. Cities loose density as you penetrate deeper inland, into the country.
  - South: area where the European immigration in the 20th century settled.

Demographic Density and Road Network
NATIONAL CONTEXT
The History of Land Settlement

Brazil: 20th Century

Almost 80% of the population live in urban areas.

10 large metropolis spread across the country.

The largest metropolis:

São Paulo: almost 18 million people;

Rio de Janeiro: close to 11 million people.

Cities over 250,000 people

Municipalities with over 250,000 people

Número de Municípios com população acima de 250 000 habitantes
Estrato de tamanho populacional | Número de municípios
--- | ---
De 250.000 a 500.000 | 55 | 49 | 25 | 14 | 5 | 3
De 500.000 a 1.000.000 | 18 | 13 | 8 | 6 | 4 | 1
De 1.000.000 a 2.000.000 | 2 | 2 | 1 | 0 | 0 | 0
De 2.000.000 a 5.000.000 | 2 | 2 | 1 | 0 | 0 | 0
Acima de 5.000.000 | 2 | 2 | 1 | 0 | 0 | 0

The distribution pattern of rural population is similar to that of urban population in densely populated areas: metropolitan regions in the States of São Paulo, Paraná and Rio Grande do Sul, and along the coastline in the Northeast.

More traditional farming areas with high rural density: Northeast (wild and semi-arid).

Self-consumption agriculture: West of State of Santa Catarina.

Other high density rural areas: recent settlements in Rondônia; some areas along the Transamazonic Road in the State of Pará; and along the river corridors in the North Region.
NATIONAL CONTEXT

History

- LAND POLICIES
  - Up until the 1930’s: The Brazilian Government works in a centralized fashion.
  - After the 1930’s: The nationwide economic and social planning era. The Government adopts land administration policies to foster the industrial development of the country. Agencies related to land administration policies are established.
  - 1934: The National Institute of Statistics is created
  - 1936: The National Council of Geography is created
  - 1937: The National Institute of Statistics and the National Council of Geography are merged
  - 1938: Creation of the Instituto Brasileiro de Geografia e Estatística - IBGE (Brazilian Institute of Geography and Statistics)

IBGE’s Institutional Mission: provide the country with a system of statistical information and with a standardized cartographic system.

Information for Land Administration purposes

Late 1990’s.

- Publishing of information on natural resources (geology, geomorphology, vegetation and soils) of the Amazonia, in digital format.
- The digitalization of data, use of cartographic bases, in digital format, are an integral part of the standard procedure for the IBGE’s production of data.
- Supporting tool for producing land audits used by land administration policies.
- Articulation with other agencies (INPE - Instituto Nacional de Pesquisas Espaciais and INCRA - Instituto Nacional de Colonização e Reforma Agrária) to standardize spatial data and cartographic bases in digital format.
- The examples of FGDC (Federal Geographic Data Committee) and of NSDI (National Spatial Data Infrastructure) were taken into account to develop a standard model of spatial data bank in digital format.

NATIONAL CONTEXT

History

- The improved knowledge of the national territory and the identification of its characteristics and imbalances resulted in two land administration projects designed to achieve national integration and regional development. As an example, we may mention:
  - the Plano de Metas (Goals Plan) (1990’s): That Plan included the building of roads and of the country’s new capital city, Brasília.
    - Objective: to draw settlement inland to integrate the national territory;
    - Instruments: creation of regional development agencies (the Superintendência de Desenvolvimento do Nordeste – SUDENE, in 1953, and the Superintendência de Desenvolvimento da Amazônia - SUDAM);
  - The Plano Nacional de Desenvolvimento Econômico e Social (PND) and the Programa de Integração Nacional (PNI), in the 1970’s.
  - Most recent projects: Multi-Anual Plan (Plano Plurianual, PPA) and the Ecological-Economic Zoning (Zoneamento Ecológico-Econômico, ZEE).

STATE DEPARTMENT’S RESPONSIBILITIES

1. Department of Agriculture, Cattle Raising and Supplies (MAPA)
   - Empresa Brasileira de Pesquisa Agropecuária, EMBRAPA: carries out research projects for the sustainable development of agribusiness in Brazil. This is achieved by the production, adaptation or transfer of technologies .
   - Project Brasil visto do Espaço: Countrywide observation. Production of new grids from images taken by Landsat 5 and 7 satellites, by Embrapa Satellite Monitoring.
   - Monitoramento Orbital das Queimadas. Land burnings affect several ecologic systems and types of agriculture, with local and regional environmental impacts. It combines remote sensing, digital mapping and electronic communication. Since 1991, EMBRAPA monitors land burnings across Brazil.

2. Department of Cities
   - Programa de reabilitação de Áreas Urbanas Centrais: This institute is responsible for the agro-meteorological monitoring system. This system provides its users on-line access to weather and agro meteorology information from several Brazilian municipalities and states.
   - Programa Nacional de Apoio à Regularização Fundiária Sustentável
   - Programa de reabilitação de áreas urbanas centrais
3. Department of Science and Technology

- Programa para Proteção das Florestas Tropicais do Brasil (Program to Conserve the Brazilian Rain Forest): It was designed to ensure the environmental benefits of Brazilian rain forests. This program is a model of partnership between the Brazilian government, the civil society and the international community. Subprogram and projects:

  - **Apêncio Espacial Brasileiro (AEB):**
    - Programa Nacional de Atividades Espaciais (National Program of Space Activities) designed to develop action plans in remote sensing, meteorology, oceanography, communications and navigation, development of spatial systems (especially, satellites and launching vehicles) and allied technologies and space sciences. This program is formed by:

  - Instituto Nacional de Pesquisas Espaciais (INPE): Space Research) It supports the Brazilian Space Program. It operated by means of geodetic and topographic surveys carried out following the Brazilian Geodetic System. Its purpose is to determine the outside boundary of the Brazilian continental shelf, following the United Nations Convention on the Law of the Sea, signed by Brazil in Montego Bay - Jamaica, December 1982, and ratified in December 1988.

  - Programa CBERS (China-Brazil Earth Resources Satellite). Manufacturing of satellites for remote sensing purposes;
  - Centro de Previsão do Tempo e Estudos Climáticos (CPTEC). Coordinating research activities on climate issues. It allows simulating the performing of the atmosphere across the planet;
  - Programa de Gerenciamento da Estrutura Fundiária (MGF): (Human Resources Capacities, Environmental Impacts of Cleaning and Development Sustainability). Database on the impacts derived from converting the Amazon forest into farming land and from giving other uses to the land. It even focuses on impacts related to the global warming.

- **Experimento de Grande Escala da Biosfera-Atmosfera na Amazônia (LBA):** (Large-scale Biosphere-Atmosphere Experiment in Amazonia) International research effort, coordinated by Brazil and designed to understand the climatological, ecological, biogeochemical and hydrological functioning of Amazonia, its interaction with the Earth system, and its response to land use change. The LBA aims at assessing the impact of land use change not only in the Amazon as a regional entity but also how land use change will affect the biological, chemical and physical functions of the global climate system.

- **Centro de Cartografia Automatizada do Exército (CCAuEx):** (Army Geography Surveying Divisions) to produce cartographic bases.

4. Department of Defense:

- **Diretoria de Desenvolvimento Territorial de Desenvolvimento Sustentável (DTE):** (State Secretary for Land Development) that provides support to the designing of the Planos Territoriais de Desenvolvimento Sustentável (Sustainable Development Land Plans)

- **INCA:** has jurisdiction on land administration. Programs:
  - Programa de Gerenciamento da Estrutura Fundiária (Land Plot Management) Land Use Georeferencing and Surveying of Land Use related to rural properties. Geographic location of rural properties and facilities, boundary demarcation and land use. It feeds the Sistema Nacional de Cadastro Rural (SNCR) (Rural Cadastre) with graphic data on geographic information of the properties.

- **Programa de Gerenciamento de Informações Geográficas (PGIG):** that will be geo-referenced to the Sistema Geodoérico Brasileiro (Brazilian Geodetic System).

5. Department of Agriculture Development

- **Secretaria de Desenvolvimento Territorial (State Secretary for Land Development):** that provides support to the designing of the Planos Territoriais de Desenvolvimento Sustentável (Sustainable Development Land Plans)
9. Department of Planning, Budgeting and Management
- Secretaria de Política de Desenvolvimento Regional: The Secretary of Regional Development Policies guides land administration actions.

7. Department of the Environment (MMA)
- Responsibilities:
  - National policy on the environment and water resources;
  - Policy for the preservation, conservation and sustainable use of eco-systems, biodiversity and rain forest;
  - Definition of strategies and economic and social instruments to improve the quality of the environment and to make a sustainable use of natural resources;
  - Policies focused on the integration of the environment and productive activities;
  - Environment policies for the Amazônia Legal;
  - The Economic Ecologic Zoning.

6. Department of National Integration
- The Planning and Budgeting (Provisional Order number 1.498-19, 9 July, 1996).

5. Department of Mining and Energy
- CONCAR President: Executive Secretary to the Department of Planning and Budgeting, to be replaced, if needed, by the President of the Fundação Instituto Brasileiro de Geografia e Estatística - IBGE.
- The IBGE is to provide technical and administrative support to CONCAR and to its Executive Secretariat.
- The Coordination is a three-person body, formed as provided by Decreto-law number 243, 28 February 1967, confirmed and amended by Decree of 21 June, 1994.
- This last Decree structures the Sistema Cartográfico Nacional, in articles 21 and 25 of the 1988 Constitution of the República Federativa do Brasil. The responsibility belongs to the Department of Planning and Budgeting (Provisional Order number 1.498-19, 9 July, 1996).

- CONCAR is a collectively operated agency that is part of this Department, as provided by Decree number 3,224 of October 28, 1999, Decree n/n from May 10, 2002 and Decree number 3,224 of July 16, 2003.
  - consultations services to the State Department in matters related to the monitoring of the National Mapping System;
  - coordinate the implementation of the National Mapping Policy.

3. National Mapping System
- Mapping activities are performed by the Sistema Cartográfico Nacional - SCN. The SCN is formed by national, public and private institutions that perform mapping tasks.
  - CONCAR: National Mapping Commission (CONCAR), a collectively operated agency that is part of this Department, as provided by Decree number 3,224 of October 28, 1999, Decree n/n from May 10, 2002 and Decree number 4,781 of July 16, 2003.
  - coordinate the implementation of the National Mapping Policy;

2. State Departments' Responsibilities

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The IBGE SHOULD DISSEMINATE MAPPING INFORMATION.
**LAND POLICY**

- 1970's: a decade of big federal plans and policies with a land zest (I and II National Plans for Development, Poliamazonia, Polibueno, etc.). The federal Government created the infrastructure and was active in regional development policies. The economic crisis from late 1970’s and early 1980’s put a halt to this entrepreneurial model.

- 1980’s: a decade when land policies were absent. The new 1988 Federal Constitution stated that it was the Union's responsibility the 'design and implementation of national and regional plans on land administration issues and on economic and social development matters'. The Constitution also provided some guidelines for urban development.
  - Following the 1998 Constitution, the Union, the States and the Municipalities are responsible for protecting the environment. The Municipalities are responsible for the land administration of the urban land.  
  - The 1988 Constitutions fosters land administration policies passed by the Union, the States and the Municipalities. Therefore, the articulation of these policies is a challenge that Brazil land planning should face.

**LAND INFORMATION AND GEODESY**

- The Brazilian Geodesic System is defined by the set of geodetic stations deployed on the portion of the surface of the Earth delimited by the country’s borders. These stations are positioned by strict operational procedures. The coordinates are determined following high-precision geodesic models that are compatible with the objectives they are intended to be used for.

- The last decade witnessed a true revolution driven by the use of GPS (Global Positioning System) technology in the fields of navigation and positioning.

**LAND MAPPING INFORMATION**

- In Brazil, systematic topographic mapping is under the responsibility of the IBGE and of the Brazilian Army. They share surveying and mapping production at scales standardized at national, regional and local level.

- The IBGE also produces the International Chart at the Million-User Scale, thematic maps and territorial units.

- These activities are performed with the cooperation of national and regional research institutes, universities and in association with other institutions.

- The main source of data for mapping activities are geodetic and mapping surveying performed by the IBGE.
LAND INFORMATION AND GEODESY

Brazilian Network of Continuous Monitoring

- The RBMC is formed by continuous tracking stations of GPS satellites deployed across the country.
- These stations are equipped with high-precision geodesic tracking systems with remote operation by the IBGE so as to obtain data to be processed by scientific applications.
- The RBMC produces data and information needed for the public use of GPS technology in Brazil. The RBMC is the connecting link with international reference systems.
- The Sistema de Referência Geocéntrico para as Américas, SIRGAS (Geocentric Reference System for the Americas) (SIRGAS, 2004) is an international initiative under the coordination of the IBGE to develop a new reference system in the continent.

LAND INFORMATION

- Brazil, as many other developing countries, does not have a full mapping coverage of its territory at the scales and with the precision that require the pace of development and the demand for spatial data. The country is very large; there is difficult access to many regions and the reduced investments of the 1980’s impacted negatively on the systematic mapping activities.
- These difficulties were contemporary with the emergence of new technologies that revolutionized mapping production procedures. The initial investments made on equipment, technical training and satellite imaging were offset by the future benefits and added value to data that were traditionally obtained by on-site observation and by flying over the targeted area.

LAND INFORMATION

- Purposes of the mapping, by scale:
  - Scale 1:1,000,000 – Provides information on general and strategic aspects, across the continent. It has national coverage and so far, has covered 100% of the country. It includes a set of 46 charts. The most recent edition was completed in 1999. In 2003, the corresponding digital product was published; data were vectorial and integrated for the whole of Brazil;
  - Scale 1:250,000 – It supports regional planning and projects that focus on the environment. It has national coverage and so far, has covered 72% of the country;
  - Scale 1:100,000 – It represents densely occupied areas, ranked by their need of government investment. It has national coverage and so far, has covered 72% of the country;
  - Scale 1:50,000 – It is a cartographic representation of densely populated areas. It is an appropriate tool for social and economic planning and for the formulation of engineering projects. It has national coverage and so far, has covered 14% of the country with a focus on the Southeast and South Regions;
  - Scale 1:25,000 – It is a cartographic representation of certain specific areas, with high levels of human occupation. It contributes some elements to social and economic planning. It also provides elements for engineering projects. This mapping survey, because of the characteristics that are proper to this scale, is basically used for areas located in the metropolitan regions. So far, only 1% of the country has been covered at this scale.

LAND INFORMATION

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LAND ADMINISTRATION FUNCTIONS

- Metropolis consolidation was a process that the Government finally acknowledged in the 1970's. Regulations provided for the creation of nine metropolitan regions: San Paulo, Rio de Janeiro, Belo Horizonte, Recife, Salvador, Porto Alegre, Fortaleza, Belem and Curitiba.

- However, it is worth outlining that Brazil, unlike most Latin American countries, does not feature the phenomenon called urban macrocephalia, that is, the development of only one huge metropolis, much larger than any other city of the urban network. In Brazil, urbanization was better spread. In 2000, there were 23 officially acknowledged metropolitan regions, including the Distrito Federal and its surrounding ring.

ASSESSMENT AND IDENTIFICATION OF PROBLEMS AND BARRIERS

- Land administration involves each and every planning area that relates with land organization, at federal, state or municipal levels. As already explained, Brazil does not have an integrated system of land administration that provides for coordinated actions at the different levels of government. This diversity of instruments, programs and actions focusing on land administration resulted in much harm to the country, especially in resource allocation for the social and economic development, mainly when such resources are always scarce.

- In order to properly develop land administration projects, it is necessary to have precise mapping information, updated data, at the proper scale that may feed systems associated to new technologies, such as GIS, a significant tool for planning and decision making.

- It is important that the State should establish cooperation agreements so as to keep a data bank with geographic information at national level that will ensure the consistency of land information until the country achieves the so expected economic development that is so much hoped by ample sectors in Brazil.

TEMAS OU DESAFIOS POTENCIAIS
TOPICS A GOVERNMENT OFFICER SHOULD CONSIDER

- Defining a modern plan on land administration that is integrated at federal, state and municipal levels, so as to achieve appropriate and sustainable use of land;

- Allocating resources to activities related to the production of geodetic and basic mapping infrastructure, in digital format, taking advantage of benefits from new technologies available, especially those associated with GNSS (Global Navigation Satellite Systems) and new remote sensing equipment.