A proposition to solve the land cadaster system in Brazil: the role of CNIR and a new institutionalization

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Introduction

Brazil has, on the one hand, strong institutions in various areas, improved social situation and, on the other, the rural land situation is still very precarious, with basic unresolved questions, such as for example, knowledge of what is public and private land, due to the absence of cadaster. The legislation moved forward in an attempt to link the cadasters of INCRA, the Internal Revenue Service, with information from the Registry of Real Estate with the enactment of Law No. 10,267 / 2001, creating the National Register of Rural Properties – CNIR. Besides that the land Management System – SIGEF, created in 2013, is contributing to the formation of a cadaster of rural land, comprising public and private areas, showing significant quantitative results of rural, public and private property, already georeferenced. However, the main step is the integration of all cadasters and the proposition of a way forward.

The fragility of property rights in Brazil was been highlighted by several studies: Reydon (2011) World Bank (2013), World Bank (2015) among others. One dimension of this weakness is the lack of a single, integrated cadaster of private land holdings in the country.

The various agencies and institutions involved in land administration, (see Reydon, 2011) have some sort of landowners cadaster, but without interfaces with one another, and thus unable to capture the property as a whole. Legally the Brazilian rural cadaster has to be centralized and managed by the Federal Government, at the National Institute of Colonization and Agrarian Reform – (INCRA) that manages the National Rural Registration System (SNCR), based on the Article 3 of Decree No. 72 106, 18/4 / 1973.

Besides the rural cadaster, there are many others land cadasters: the tax records, environmental records, indigenous lands records, public land from the states and the public lands of the Union, each with its own base of descriptive and graphical information.

The enactment of Law 10,267/2001 was an attempt by the federal government and the notaries, to integrate INCRA, the RFB and the Real Estate Registry, to gather literal information, graphical information and Registry of Real Estate of rural properties, through the creation of CNIR (which stands for Cadastro Nacional de Imóveis Rurais - National Cadaster of Rural Property, in a loose English translation). With this new law, CNIR will be a common information base, managed jointly by INCRA and the Federal Revenue of Brazil - RFB, produced and shared by the various federal and state public institutions, producers and users of information about the Brazilian countryside, which will seek to address more efficiently and effectively increasing government demands and the diverse universe of users.

Reydon *et al* (2013) showed that there is progress in the cadaster of private properties, mainly deriving from Law 10.267/2001 and the obligation to geo reference the properties that go through any changes along the Registry of Real Estate. This has been done through the implementation of the CNIR, counting, among its tools, with an important innovation: the Land Management System - SIGEF (Sistema de Gestão Fundiária). The SIGEF is an electronic tool developed by the National Institute of Colonization and Agrarian Reform (INCRA) and the Ministry of Agrarian Development (MDA) to subsidize land governance in the country.

The program has been running since November 23, 2013, when all the data in the geo-referencing procedure was transferred into SIGEF. The deadlines for owners to arrange the procedure for geo-referencing rural properties are differentiated by the properties size. Thus, only by the deadline for registration of all cadasters will it be possible to know the extent of the overlapping property titles. It is important to note that the deadline is scheduled for completion only after 2023, when the properties under 25 hectares will be indexed. However, INCRA is already issuing certifications for rural properties, which, in theory, showed no overlap, the same is liable to be registered in the Registry of Property, upon examination of the officer. This is a dimension of the fragility of property rights, little known in Brazil, that stems from the lack of integration between the notary notes, the system of land registration and the various agencies that make up the system of land administration.

The largest gap to be faced by this cadaster system under construction is still the state land (terra devoluta), from federal level to state level, for which there is no cadaster and there is dispute if it has to be registered. The Federal level has many different institutions involved: from INCRA/Terra Legal, SPU (Navy Land), FUNAI (Indigene's People Land), MMA (Conservation Units) and others. At state level there are mainly the State governors and the Institutos de Terras that should have cadasters of land granted and of land still available, but in most cases do not have this information.

The main objective of this paper is to analyze the advances and limitations that the present Brazilian cadaster system presents and propose advances on the integration of the different existing cadasters.

The paper is organized in four sections:

1. Literature review on Brazilian and international land cadasters;

2. Weak Brazilian land governance and the state of the art on the different landowner cadasters obtained from LGAF experience and meetings with experts;

3. National Rural Property Cadaster (CNIR) and the Land Management System (SIGEF): Advances Made with Land Cadasters and proposition to solve the land cadaster system in Brazil: the role of CNIR and a new institutionalization (SINTER)

4. Polycentric governance proposition

1. Literature review: Brazilian and international land cadasters

According to FIG apud Williamson (2010:6) for an adequate land governance and/or land administration, a system of land information, defined as a cadaster is:

> *"The operational component of the land management paradigm is the range of land administration functions that ensure proper management of rights, restrictions, responsibilities and risks in relation to property, land and natural resources. These functions include the processes related to land tenure (securing and transferring rights in land and natural resources); land value (valuation and taxation of land and properties); land use (planning and control of the use of land and natural resources); and, increasingly important, land development (implementing utilities, infrastructure and construction planning). The functions interact to deliver overall policy objectives, and they are facilitated by appropriate land information infrastructures that include cadastral and topographic datasets. "*

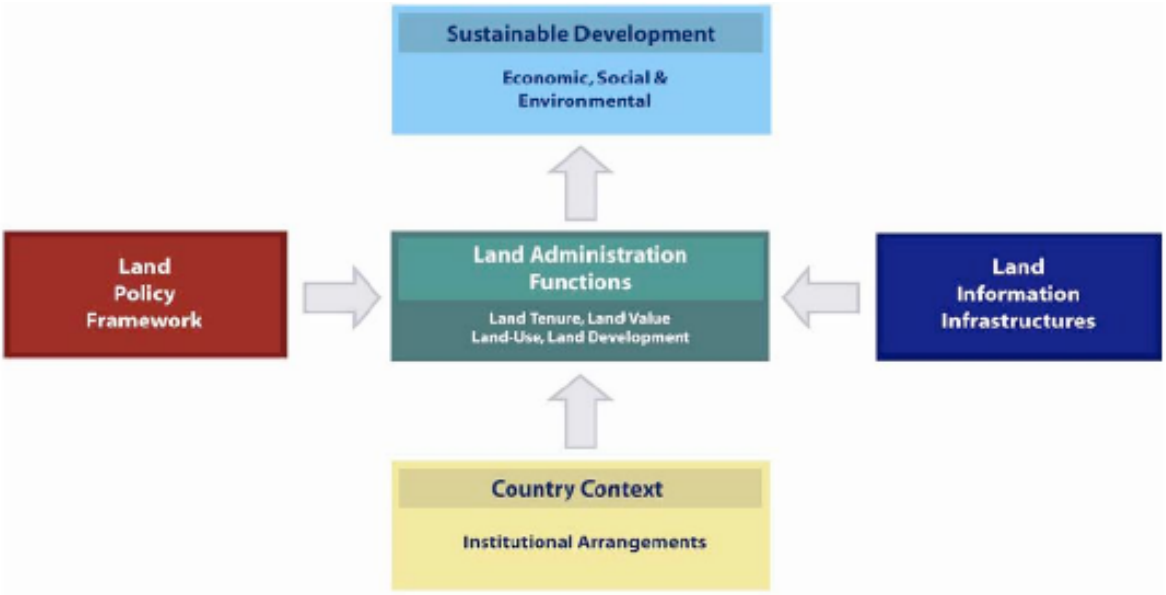
UN (1996:11) specifies that land administration requires a land cadaster with some characteristics:

> *"A cadaster is similar to a land register in that it contains a set of records about land. Cadasters are based either on the proprietary land parcel, which is the area defined by ownership; or on the taxable area of land which may be different from the extent of what is owned; or on areas defined by land use rather than by land ownership, Cadasters may support either records of property rights, or the taxation of land, or the recording of land use. Cadasters may also be used in a multi-purpose role to provide a wide range of land-related information. In such cases, it is best if they are constructed around the proprietary land parcel, as this is the legal basis for all dealings in land. Where ownership has not yet been proved, as may be the case where the land is being restored to former owners, such multi-purpose records can be built around the land parcel as defined by rights of use.*
>
> *The cadaster is an information system consisting of two parts: a series of maps or plans showing the size and location of all land parcels together with text records that describe the attributes of the land. It is distinguished from a land registration system in that the latter is exclusively concerned with ownership."*

According to Williamsom (2010), sustainable development is only obtained using definitions of land use, property, value and policies for its development. All these aspects of land governance

are a result of an adequate infrastructure concerning information about land, that is, a good land cadaster.

Figure 1 – Land Governance according to Williamson (2010)



Source: Williamson, 2010.

The main Brazilian scholars that study cadaster properties comprehend that the internationally accepted concept of FIG is the best definition of cadaster: a public inventory of organized data concerning its territorial parcels inside a specific administrative region, based on its limits.

Another cadaster definition is the one used by the Officers of Property Register offices: "Territorial cadaster is a set of information about the territory done by the State to make it viable its political and administrative operation, concerning the State public policies and directed to national development (Augusto 2013)"

These researchers have been looking for the construction of Multipurpose Territorial Cadaster, according to LOCH and ERBA (2007:40):

> *"A good cadaster is the one that contributes to equal distribution of tax burdens, promotes the property security and creates the bases for the urban and regional planning. This latter idea opens a path for a new sight: The Multipurpose Territorial Cadaster - CTM that envisage beyond the traditional economical, physical and juridical aspects, also concerning the property environmental and social (people who lives in) data. CTM is structured based on the integration of institutions whose activities are linked directly or not to*

the territorial control. This way, it is important the interconnection between de cadaster with the property register, the state organizations and concessionaries of public services. It is quite common that CTM of a jurisdiction is considered a map showing its land structure, containing information that belongs to theme maps, at least in a cartographic manner. CTM concerns not only measures; it also integrates the variables that characterize the land use and occupation. The CTM structuration process seeks generating and making available a larger amount of data than the ones generated by traditional property cadasters, this way more users can be benefitted."

Concerning the matter, Paixão et al (2012:271) affirms the existence of major problems elaborating a multipurpose cadaster:

"A georeferencing law presents a great opportunity to endow the country with a strong and capable territorial georeference. However, given its complex aspect involving a new professional approach, combining integration and cooperation among the institutions, the matter concerning its deployment was difficult. Ten year after the law enacting, many obstacles are still present, such the urgent need for adjustments. In spite of that matter, is already possible to observe the law benefits in the country development."

Carneiro (2012: 271)

"For a multipurpose territorial cadaster in three-dimension to succeed, there's an urgent need to establish certain standards in structuring and data sharing. A lot of data is lost caused by the lack of precise information in Brazil, that contributes to the country´s lack of development."

Jacomino (2005) understand the issue in a different manner, although working in the same result, and points out that the main question is that cadaster and register, are like Siamese brothers, one needing the other for a proper system work.

"Nowadays, there is a stronger institutional concern about the perfect integration in a multipurpose cadaster – a cadaster that could comply with the social, public and private demands. It would serve as a register standard in Brazil. Therefore, a scientific partnership was sought with a university, in this

way, contributing with present expertise and knowledge." (in: http://www.quinto.com.br/artigos_31.htm)

To explain better this issue, the differences between register and cadaster can be found in the chart 1 below.

Chart 1 – Differences between Register and Cadaster

Differences	Register	Cadaster
Definition	To protect the constitutional right of private property among other rights connected to the property;	To inventory data of land tenure for different uses;
Objective	Constitute a legal right to an individual;	Improve management of land use and land tenure;
Methodology	Register the qualified properties considering its owners;	Cadaster property and other information connected, disregarding existing rights;
Rights	Constitute real right to the owner;	Does not recognize property right;
Execution	Judicial power attribution using land register notaries;	Executive power attribution using land governance organizations;
Legality	Provides publicity and legality to the property;	Provide consolidated information of the properties at the cadaster;

Source: Based on Augusto (2013)

Paixão et al (2012) explains about the problem of detachment between register and cadaster. This division makes clear the problem of land governance to notaries that nowadays are not aware of this issue. In Paixão's words (2012:15)

"In Brazil, the separation in territorial and juridical cadasters shows that different territorial systems exist. In the case of rural cadaster, this difference explained above represents conceptual differences in the definition of territorial unit, as well, presented in Paixão (2010) and Carneiro et al (2011), among INCRA and existing registering services, since these concepts depend in the use of each cadaster. There are some issues in Brazil, as showed by Paixão (2010):

*• **Lack of spatial data** - incomplete, inconsistent and urban-focused spatial coverage, in urban areas case there is formal documentation of its occupation and*

territorial development. This requires a better cartographical update, as irregular and non-planned land occupations are not usually mapped, thus becoming impossible their being controlled and planned, like the case of slums and low-income communities. The land limits described in registers are different from the ones found in locus. This way, many deeds contain inconsistent or incomplete data of property limits. Additionally, concepts and cartographical information, like Datum, is usually omitted.

*• **Lack of real estate right** - The document comproving the real estate is often inexistent, causing an incomplete denomination of the valid chain of ownership. Many properties that are not registered use to be transferred with no ownership proof. In some cases, land transactions are non-formal with or without documents, creating then, a precedent for frauds. As presented by Molina (2007), many cases of land transactions are no registered in Latin America due to an enormous amount of bureaucracy required to prove who the authentic owner is, finding no proofs leads to corrupt practices in the land description and registration.*

*• **Law enforcement**– the measures described in the law, like the creation of the national cadaster of rural properties (CNIR) and its integration with the legal cadaster, according to law 10.267/2001, aren't enforced."*

The differences showed above explain that in Brazil register and cadaster are activities of different organizations; the information is obtained and kept by itself.

There is no doubt that the multipurpose cadaster is the solution to many land problems in Brazil. As evidenced by Carneiro et al (2012:271), there is still a long distance to obtain this type of cadaster, mainly because of institutional and legal orders reasons that need to be solved:

"The current situation of the rural and urban cadasters in Brazil is a proof that many challenges are yet to be overcome. The existing cadasters are still based in two-dimension data that are dispersly available in different situations and standards. Although these problems are faced, new opportunities are sought to revert the situation. The georeferencing law that created the CNIR, the directives of CTM formation and the Decree 6.666/2008 has established the deployment of the National Infrastructure of Spatial Data INDE, they are pioneer norms that indicates the real

possibility of deployment of multipurpose territorial cadaster in Brazil, built over institutional partnerships."

The researchers understand that register and cadaster have no systematic interconnection that shows the exact number of registered and cadaster properties, this makes difficult the land governance good practices, weakening the individual rights and so the country´s developing.

This interconnection between the institutions was established by the Law 10.267/01, that created the National Cadaster of Rural Properties (CNIR), a multipurpouse cadaster, reliable and integrated to the property register office. It is still not fully functioning because: the lack of contact among the organizations, the different concepts used, the non-standardization of data and slow law enforcement.

Based on Law 10.267/2001, there's no doubt that the land governance in Brazil is following a new path, the requirement for more precise data that will qualify the cadaster information, such as graphical description and geographical location.

Nevertheless, this concepts and standards differences, along with lack of contact among some of the organizations and the possession are obstacles yet to surpass. Next item will explained this idea, examining the existing cadasters on its aims, focus and lack of articulation.

2. State of the art on the different landowner cadasters obtained from LGAF experience and meetings with experts

Studies based on Land Governance Assessment Framework (LGAF) made clear that the main Land Governance problem in the country is a complex institutional setting composed of legal, overlapping and attribution problems, as observed in World Bank (2014:35):

> *(...) there is a huge body of constitutional law, land law, civil property law, environmental law, and planning law, operating at the national, state and local levels, which governs land relations in Brazil. Moreover, a large number of agencies are involved in the establishment and regularization of land rights, their recording and documentation, processes for establishing permissible uses, managing special use areas, planning overall land use, and resolving disputes. This body of law and these institutions, while well intentioned,*

sometimes create uncertainty or unrealistic burdens, which eventually manifest as gaps between legislative intent and reality on the ground.

This legal and institutional situation, according to LGAF's report in World Bank (2014:5) causes:

> ***The assessment identified six areas of relative weakness in Brazilian land governance.*** *They include: the existence of extensive areas of unregistered and undelimited land (terras devolutas); notaries' limitations; absence of an authoritative, integrated register of public and private land; low levels of property taxation; a disconnect between urban land supply, land use planning and regularization on the one hand and demand on the other; and lax governance of large scale land acquisition and forests.*

This same report World Bank (2014: 5) points some mains problems in land governance in the cadaster issues:

> "a) ***Extensive areas of unregistered and undelimited land (terras devolutas)***
>
> ***There is a clear perception that a central land governance problem in Brazil is the lack of governance over public lands, especially the category of those public lands, which neither are delimited nor registered (terras devolutas).*** *Since a large area of public land falls into this category, such land is prone to being privately appropriated through possession. The perpetuation of this process is seen as the loophole that sustains the government's lack of control over its lands and land policies, undermining the efforts of improving land governance in the country. Consequently, estimates of the completeness of identification and mapping of public land varied across the assessments ranging from less than 30 percent in Piauí to 40 percent in São Paulo to above 50 percent by federal panelists. The main public agencies, Agrarian Development Ministry (MDA), the National Institute of Colonization and Agrarian Reform (INCRA), the Secretariat of the Brazilian Union Patrimony (SPU) and State Institutes of Land, are not provided with a clear policy for the procedures, in terms of undelimited and unregistered land (terras devolutas).*
>
> ***b) Recorded Information Limitations***
>
> ***The record of private land rights is unreliable due to the limitations of the property registration system.*** *The notaries are private entities offering a public function on concession by the Federal Constitution. Consequently, they*

have difficulties integrating with the public land-related bodies. Moreover, the incentive structures do not encourage the generation of an authoritative record of property rights as at the level of an individual notary, fees are based on the number of registrations, not on the accuracy of the information being registered. Perhaps as a consequence of this, the assessments found that despite their perceived profitability, notary offices, except in São Paulo, are generally not making adequate capital investments even for their short term needs.

The coverage of the real property register is very incomplete and out of date. *There is no legal provision requiring purchasers to register their purchasing titles. Many do not for reasons extrinsic to the system. In Pará, fewer than 50 percent of individual urban properties are reportedly formally registered while in Piauí and São Paulo, it is thought to be less than 70 percent. For rural properties, the situation in Pará and Piauí was ranked the same as for urban properties. Additionally, almost unanimously, registered records on public and private land were regarded as out of date in at least 50 percent of cases. Relatively high transfer and registration taxes may partly account for these limitations, as they may be discouraging owners from registering transfers and other transactions and inadvertently encouraging under-declaration of transaction values in the notaries.*

Another problem with the real property register includes the frequent lack of georeferencing and the consequence this has for duplication of claims and propagation of false claims. *All three state assessments reported that fewer than 50 percent of records for privately held land registered in the registry are readily identifiable on maps in the registry or cadaster. Even when properties are registered in the notaries, present in each district, notaries are not required to investigate the information or documents used to register private properties. In addition, the information in their registries is not consolidated, which raises additional questions of trustworthiness and makes it nearly impossible to access information on the number and area of registered properties and land possessions in a given locality. Locations of assets that appear in the real property cadaster are usually only descriptive, not including maps or other spatial information.*

The problem is compounded by the fact that when the notary registers the transaction record (escritura) or other document, it gives a degree of legitimacy to the claim in any location of the country even without investigating the authenticity of the supporting documents. *Regulation is also a challenge in practice as the assessments across all three states showed that except for private land in São Paulo there are no meaningful service standards for public access to land information. To regulate and inspect the notaries, each state has an Internal Affairs Department (Corregedoria) and each state IAD is supposed to be supervised by the National Council of Justice (CNJ). Nevertheless, there are significant gaps in supervision in the northern and northeastern Brazilian states.*

c) Absence of an authoritative, integrated register of public and private land

Directly related to the above-discussed limitations, a further area of major compromise in Brazilian land governance is the absence of an integrated register of public and private land. The main public bodies responsible for public land do not have an integrated register and use different legal definitions. The absence of an integrated record of private and public land means that the state agencies charged with public land management are largely operating without a proper asset inventory, a key element for good stewardship. Related to this, the assessments of all three states concluded that systematic information on the public land inventory in public bodies is generally inaccessible. This is a significant constraint on public policy execution, such as proper land use planning or infrastructure decision-making processes as well as on the ability of civil society to hold government's accountable."

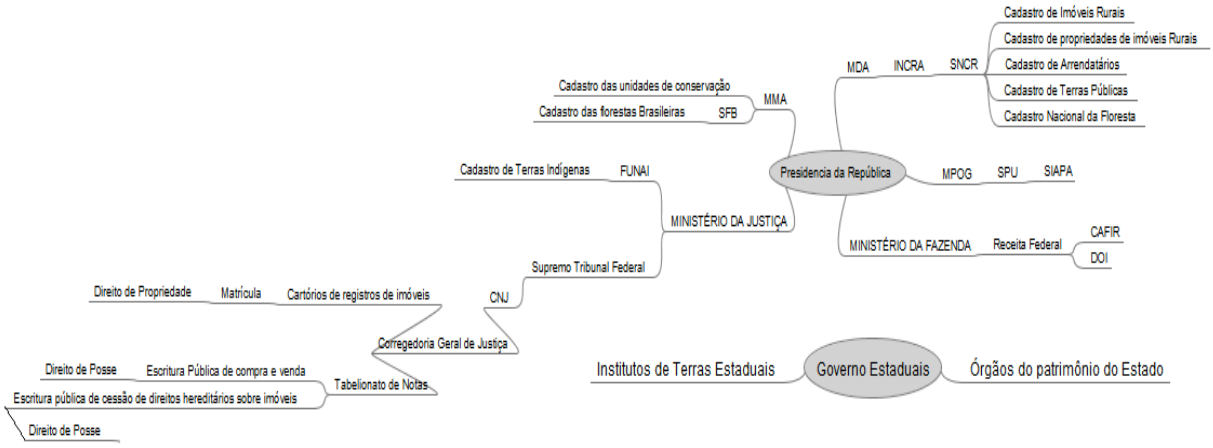
These legal and institutional unclear roles are the main cause of the problems of the cadasters. Figure 1 characterizes the different cadaster and their institutional links, connecting to the ministries. The next five ministries have land cadasters for different purposes:

a. Ministry of Agrarian Development - Ministério do Desenvolvimento Agrário – INCRA;
b. Ministry of Planning, Budget and Management - Ministério do Planejamento, Orçamento e Gestão – SPU;
c. Ministry of Finances - Ministério da Fazenda – Receita Federal;

d. Ministry of the Environment - Ministério do Meio Ambiente – SFB e ICMBio e
e. Ministry of Justice - Ministério da Justiça – FUNAI, Oficial de Registro de Imóveis e Tabelionatos de Notas.

In practical terms, each organization has its own land cadaster and they are not integrated. MDA/Incra has SNCR and its five cadasters, moreover INCRA also manages two properties certification systems: SNCI and SIGEF, according to law 10.267/2011 for CNIR deployment, that is being built with RFB.

Figure 1. Different Land cadasters and its links



The main land cadaster is the CNIR, being built since Law 10.267/2001 and is based on information from INCRA's SNCR and RFB's CAFIR and managed by both institutions. The other cadaster would be thematic, then, and serve as producers, feeders and users of the CNIR database, as of §3º, art. 7º, Decree 4449/2002.

Besides these studies, the Brazilian accountancies court (TCU) on August/ 2015 published an audit (Acordão 1942/2015) on the debility of land governance in the country. Besides corroborating the results achieved by LGAF at World Bank (2014) it has the next main propositions:

a) recommend to the president efforts to be taken to articulate with the National Congress the review and strengthening of territorial organization and land access law, establishing guidelines, directives, limits and resources for the executive power to act in this matter;
b) define in an organized and legal manner the obligations, limits and integrations of the agencies acting in territorial organizing and planning, at a federal scale.

c) define in an organized and legal manner the obligations, limits and integrations of the agencies acting in water and land organizing and planning, at federal scale.

d) articulation with several player involved in land and water management, at federal, state and municipal scale, developing and publishing then a long term planning that foresees strategic objectives concerning the alignment and integration, at national level, considering inputs, activities, products, effects and impacts that occurs based on the problems in territorial organization and soil and water sustainability;

e) to characterize federal policies intervention; identifying the effects caused by its deployment; identifying the main mechanisms required to the public policies fulfilment; to limit precisely the main target associated with products and expected effects; explicating the initial reference stage of the policy to feed the evaluation of the policies' results; planning specific related activities; precise definition of responsibilities by products and actions;

f) identify precedence orders to do activities; forecast continence alternatives; forecast the means of control, monitoring and evaluating; participation of interested parts; testing the strategy of policies deployment; to define, according to the efficiency principle described in article 37 of the federal constitution, to set deadlines and mechanisms of interministerial supervision, for the forum of government initiatives deployment, concerning the regulation of soil and water being to use tools to define themselves; coherent objectives, commonly agreed and aligned among all involved institutions; current governance structure , just like its functions and responsibilities, including the leading cooperative effort;

g) coordination mechanisms and horizontal relationship between public and private actors and coordination mechanisms, communication and collaboration for aligning strategy and operations of the organizations involved in cross and decentralized policies to achieve a common result; establish mechanisms for coordination of the various institutions responsible for data collection and storage, as well as the generation of geo-referenced information on the land situation in the country, mainly public land for constituting conference routine and beat of this information and make it available in open bases allowing work operationally building analytical foundation for informed and effective participation of the various stakeholders in public policy governance of land and

sustainable use of soil, water and biodiversity; establish mechanisms for coordination and integration of the various governmental institutions responsible for the implementation of the resolutions arising from instructions; to recommend to the President and the Minister of Planning, Budget and Management, the standardization for mapping and integration of geospatial information systems, concerning the public institutions, both federal and per state, about the rural Brazilian areas;

h) recommend to the Ministry of Agriculture, Livestock and Supply which includes the review of its strategic plan, specific goal that addresses the sustainability of land use and water, comprising government activities for the conservation and recovery of natural resources, it is recommended to the Ministry Agriculture, Livestock and Supply, the Ministry of Agrarian Development, the Ministry of Environment, the Ministry of Justice, the Ministry of Science, Technology and Innovation, the Ministry of Planning, Budget and Management and the Ministry of National Integration and units linked, in conformity with Article 1 of Law 5,868 / 1972 (as amended by Law 10.267 / 2001) and regulated by Article 7 of Decree 4,449 / 2002, report to CNIR the governing bodies needs to integrate their records to CNIR or if not possible, to report to the Court the reasons for missing the integration;

i) determine the National Institute of Colonization and Agrarian Reform and the Internal Revenue Service, in compliance with Article 1, Law 5.868 / 1972 (as amended by Law 10.267 / 2001) and regulated by Article 7 of Decree 4,449 / 2002, to undertake the survey and the integration of rural cadastral systems used in federal and state government; recommend to the National Institute of Colonization and Agrarian Reform and the Federal Revenue Secretariat that will regulate the conditions for the mapping and integration of information systems of various federal government institutions and producing state and information of users on the Brazilian countryside, in obedience to Article 1, Law 5.868 / 1972 (as amended by Law 10.267 / 2001) and regulated by Article 7 of Decree 4,449 / 2002 (paragraphs 116-125).

The TCU recommendations requires a change in the land management paradigm in Brazil, using a mechanism that involves the law; to unify or become similar to concession, demarcating, income, allocation and regularization procedures; to make

possible to have synergy among the land administration organizations; to integrate the information thus constituting a single mosaic of the Brazilian territory.

The TCU recommendations corroborate very strongly all what has been showed in the different studies and by the Land Governance Working Group since 2013 with INCRA. But despite all of this large advances has been made by the cadaster institutions involved as can be seen in the next item. To fulfill the institutional needs required by Brazilian land governance, the working group proposed the use of polycentric governance, that will be showed shortly in the forth item.

3. National Rural Property Cadaster (CNIR) and the Land Management System (SIGEF): Advances Made with Land Cadasters and a new proposition to solve the land cadaster system in Brazil: the SINTER

3.1. National Rural Property Cadaster (CNIR) and the Land Management System (SIGEF) and advances

The Law 10,267/2001 which created the National Rural Property Cadaster (CNIR) brought about many changes to previous land laws: Law nº 5,868/72 (BRASIL, 1972) – creates the National Rural Cadaster System or SNCR; Law nº 6,015/73 (BRASIL, 1973) – Regulates the public registries; Law nº 6,739/79 (BRASIL, 1979b) – Regulates the registries and the Land Registry Offices; Law nº 9,393/96 (BRASIL, 1996) – regulates the Rural Land Tax (ITR).

This item will deal, in particular, with the changes towards the Law of Public Registries (Law 6,015/1973). These changes determined that all the public land registries when dealing with land sales, dismemberment, parceling or consolidation require the corresponding area to be georeferenced according to the Brazilian Geodesic System and with precision defined by INCRA.

The CNIR was created thus to attend the need of a georeferenced national cadaster, serving as a common base for the institutions that produce or use information about the Brazilian rural areas. The manager institution, in this case, is both INCRA and the Federal Revenues Office (RFB).

In a first step, the databases that used to create this new georeferenced cadaster will be the SNCR (INCRA) and CAFIR (RFB).

In 2015, INCRA made changes to the SNCR creating the electronic declaration and allowing the system to search for graphic information on land properties through one of its subsystems, the SIGEF (Georeferenced Information System). The SNCR is still a cadaster that deals with literal information (owners or holders, land use, etc.) and graphic information (for properties only) which is updated annually.

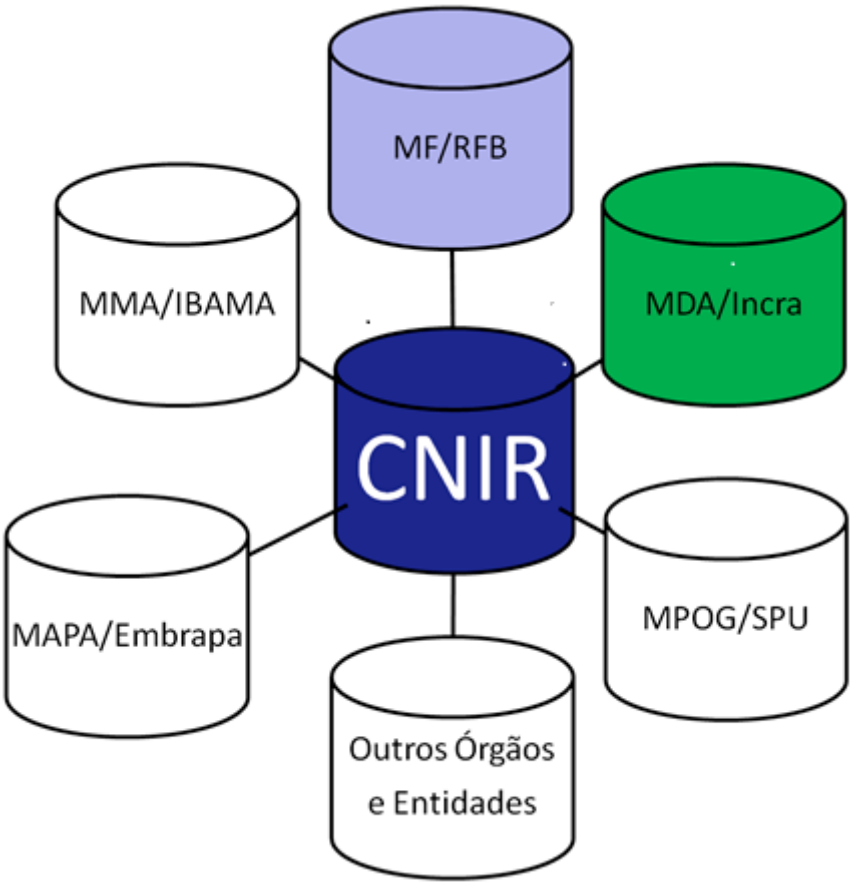
The CNIR will unite the information contained in land and thematic cadasters, since besides INCRA and the RFB, almost all federal public administration entities will produce, use and feed information to it (§3º, art. 7º, of Decree nº 4449/2002).

Although the law provides mandatories on production, feeding and using of information from CNIR for federal entities, state-level and municipal entities may integrate the CNIR database through specific agreements ((§4º, art. 7º do Decree nº 4449/2002). The CNIR manager institutions shall invite and encourage the participation of civil society entities working with their own cadastral data to interact and feed the national cadaster (§5º, do art. 7º do Decree nº 4449/2002).

The unique entry code from CNIR will be the code INCRA attributes to the property in the CCIR, made from one or more parcels, making its identification and the information sharing easier between the participant institutions. With a simple search on the CNIR it will be possible for the INCRA, RFB, land registry offices and other associated public institutions the status of any land extension in any place in the country. More than safety and benefits for the owners, this system should make it possible to enhance the struggle against rural land frauds.

The §4º of article 2º of the Law nº 10.267/2001 says that the information generated and managed by participant institutions, composed by specific data related to their interests, may be shared and thus will be part of the CNIR, as it is showed in figure 2.

Figure 2. Cadaster System proposed - CNIR



Source: Elaborated by INCRA and RFB.

The CNIR database is developed in a way that any change in structural data done to it will be replicated in the SNCR and CAFIR (RFB) databases.

The time schedule of CNIR for 2015 forecasted and accomplished the following goals:

- New SNCR – Electronic Declaration (integration of SNCR-SIGEF);
- Annual updates on the CCIR;
- Rural Cadaster Web Portal (INCRA-RFB);
- Linking the CAFIR-SNCR - DITR-CCIR 2015 (Development by Serpro in the city of Belo Horizonte).

Incra and RFB forecasts for linking the SNCR and CAFIR, separated by land size, are as follows:

Table 1: Schedule for linking the National Rural Cadaster

Area in hectares	Start	Final deadline
More than 1,000 ha	August 17, 2015	September 30, 2015
Between 500 ha to 1,000 ha	October 01, 2015	October 30, 2015
Between 250 ha to 500 ha	November 03, 2015	December 31, 2015
Between 100 ha to 250 ha	January 04, 2016	April 29, 2016
Between 50 ha to 100 ha	May 02, 2016	August 19, 2016

Source: INCRA and RFB, 2015.

After the link between the databases INCRA and RFB expect that, from 2016 onward, the collection of rural land taxes (ITR) will synchronized with the updates on the SNCR database – thus making it possible to update the CNIR database annually.

INCRA and RFB are also taking measures to integrate the CNIR database with other cadasters as, for instance, the Rural Environmental Cadaster (CAR). Several meetings with representatives from: INCRA, RFB, Secretaria de Política Econômica/MF (economic policy office), Serviço Florestal Brasileiro (Brazilian Forestry Service) and a joint workgroup was constituted aiming the strengthening the integration of land cadasters.

In July/2015 an Agreement was signed between RFB and INCRA to develop the CNIR and the implementation of the Rural Cadaster Webportal, which happened between June and July. Through the webportal the user can obtain information about the CNIR and its development.

The schedule forecasts for 2016:

- July – CNIR database
- August – integration of databases (INCRA-RFB)
- September – integrated declaration DITR-CCIR (rural land tax and rural property cadaster)

The cadaster is currently in implementation phase since 2010 and advanced in several directions. One of those is the evolution promoted by INCRA to the digital tool of the National Property Certification System (called SNCI) to the Land Management System (SIGEF).

In the late SNCI (2011-2013) the documental analysis was done manually and used the next 7 kinds of physical documents: 1) certification requirement, 2) property

registry, 3) descriptive memorial, 4) declaration of the bordering neighbors in respect to the limits of the property, 5) map of the property, 6) total area based on geocoordinates and 7) cartographic data sheet.

However, this resulted in poor performance and did not comply with the Law 10,267/2001 as the processing took months or even years to be done and creating the the possibility for secondary errors caused by human failures. This ended up in an overload of processes on INCRA's regional offices all around the country, not reaching the expected results.

On November 2013, aiming at speeding up the certification procedures for rural properties and implementing the CNIR, the Land Management System (SIGEF) was created. Its purpose is to automatize the certification process to obtain more agility, transparency and secure rights. In addition, it meant to integrate the certification data existing inside the INCRA and the Land Registry Offices.

The automated certification takes the following steps:

a. georeferencing the property by technical staff licensed by INCRA;
b. this information is uploaded to the SIGEF platform by the technical staff responsible for it (logged in with their credentials);
c. SIGEF automatically checks the uploaded data for overlaps and technical requirements;
d. technical requirements and no overlaps being checked, then follows the validation of the SNCR code and validation of the owner ID (in Brazil, it's called CPF);
e. the property is certified, then the system proceeds to emit the property plant and its description with the data informed.

In Brazil there are actually 3,588 Land Registry Offices authorized to use the SIGEF platform. The judiciary office that regulate the Land Registry Offices (Corregedoria Geral de Justiça) of two states - Rio de Janeiro and Rio Grande do Sul – already published, under INCRA's guidance, a set of standards for the Land Registry Offices to follow in utilizing the SIGEF platform. SIGEF has demonstrated its efficiency in rural property certification since its creation as can be seen in figure 2.

Figure 3.Evolution of Georeferenced properties

Source: INCRA, 2015.

More than 84.1 million hectares were certified through SIGEF. Summing up with older certifications, 5,913 public parcels (72.6 million hectares) and 184.402 private parcels (156.2 million hectares) are certified – for a total of 190,315 parcels and 228,9 million hectares of certified area, this amounts to 26.89% of the Brazilian territory. The figure below illustrates the dimension of the certified parcels (public and private) in Brazil:

Source: Acervo Fundiário INCRA, 2015.

INCRA's Land Data Collection (Acervo Fundiário) is a visualization tool that allows the general public access to downloading and visualizing 242,5 million hectares of georeferenced parcels (public and private). Summed up with the information from other government agencies (FUNAI – indigenous land, ICMBio – federal and other protected areas, for instance) this area reaches up to 542 million hectares or 63,6 % of the Brazilian territory, excluding overlaps.

The table 1, below shows the data on the Land Data Collection (Acervo Fundiário/INCRA) related to the georeferenced parcels.

Table 1 Brazilian Land Tenure

INCRA RIGHTS ADMINISTRATION				
TYPE	NUMBER OF POLYGONS 2014	AREA 2014 (ha)	NUMBER OF POLYGONS 2015	AREA 2015 (ha)
Settlements Projects	7.789	78.895.036,6600	8.028	77.264.462,5745
Tradicional people´s land - Quilombola	169	1.811.779,4000	305	2.323.220,6000
Certified Public Properties Number/Area	3.139	60.743.496,7500	6.680	78.148.930,4617
Certified Private Properties Number/Area	141.930	144.082.446,3500	222.302	80.472.151,0617
Agreements of Land Regularization	107.853	4.335.993,96	107.853	4.335.993,96
Subtotal	260.880,00	289.868.753,12	345.168,00	242.544.758,66
BASE ACESS OF ENTITIES PARTNERS				
TYPE	NUMBER OF POLYGONS	AREA 2014 (ha)	NUMBER OF POLYGONS 2015	AREA 2015 (ha)
Indigenous people's land	553	120.989.725,60	553	120989725,6
Conservation Areas UC	1.431	153.140.480,1550	1431	153140480,2
Georeferenced Polygons of SRA	80.041	3.254.260,69	80.041	3.254.261
Georeferenced Polygons of Terra Legal Program	134.300	22.071.789,5221	134.300	22.071.790
Subtotal	216.325	299.456.255,97	216.325,00	299.456.255,97
GERAL TOTAL	477.205	589.325.009,09	561.493	542.001.014,63
TOTAL AREA OF BRAZIL		851.576.700,00		851.576.700,00

Source: Acervo Fundiário do INCRA, 2016

The advances demonstrated are significant to improve the Brazilian land governance; nevertheless, the main question unsolved is the consolidation of the CNIR and the practical integration of all the cadasters related to land – i.e. building a integrated consolidated cadaster.

The Interministerial Land Governance Group (Grupo Interministerial de Governança Fundiária), institutionalized by INCRA via Ordinance (Portaria) n. 165, April 3 of 2014, found out that the main problem affecting the future operation and aims of this cadaster is the lack of articulation between the institutions that relate do land administration and absence of legal information exchange that is supposed to feed the SNCR database. The law that created the SNCR and the law that created the CNIR later, both established as mandatory for every federal agency that has information related do land administration to exchange it with these cadasters, but this is not happening.

The parcel, internationally recognized minimum unit is finally adopted and it harmonized the different measure that existed in the different cadasters. According to the International Surveyors Federation (FIG), the parcel is the smallest registry portion, well defined by formal or informal limits that delimit a land area for the exclusive use of individuals (families or communal groups also). The parcel's limits may be defined by physical markers or by a mathematical description of it, usually based on a coordinate system.

Despite CNIR defined the parcel based on the FIG´s concept, the tools used to obtain the geospacial data, the SIGEF, as defines the parcels based on the *matrícula* (the way they register the property at the Land Registry Offices) and can have more than more than one parcel.

3.2. A new proposition to solve the land cadaster system in Brazil: the SINTER

Brazilian Federal Revenue Office (RFB) presented, in September 2013, a proposal for a new territorial information system: the National Territorial Information Management System (SINTER). This new system is in process of creation and aims at utilizing the already existing innovations in different agencies – as the Registry Offices' electronic registry and INCRA's georeferenced certification.

SINTER will have links with a spatial information database, juridic and cadastral data from the different Public Registries, rural and urban properties at the CNIR and other governmental agencies cadasters.

For the urban properties, SINTER serves as a platform of integration between the Federal Government and the Municipalities, where the cadastral data and georeferenced images will be located. For the rural properties, SINTER will use a direct link with the CNIR, which is already in construction through the agreement between INCRA and the RFB. Other government agencies will have access to this integrated database as needed (i.e.: federal police, federal revenue service, etc.) and have their own layers built in the system.

One of the central aims of SINTER is to be a multipurpose territorial management database. As such, it will be the official national cadaster built with appropriate GIS technology and integrated with the registries to improve the Land Registry Offices and land regularization efficiency to guarantee secure property rights and efficient land markets.

One of the first steps in that direction is the creation of the National Property Number (Código Nacional do Imóvel) in which every property will have one – and only one – indexing number. This unique number will be the connection between juridical, physical, geographic and economic information in the rural and urban parts of the cadaster.

Another step is the creation of the DIRE (Electronic Registry Interoperable Document), stored electronically, which represents a copy of the registry acts. The Registry Offices will continue to operate in their attributions and managing their paper and electronic data. However, the DIRE database will serve as a registry collection database to be accessed only by the Federal Executive, National Justice Council and States' Justice Internal Affair Courts.

This centralized properties cadaster database shall make it possible to stablish a direct connection between the many Federal agencies systems for data exchange and integrate the registries data with the urban and rural land cadaster.

Other uses of the SINTER cadaster is to serve as a secure backup copy of land property information in the eventual destruction of any specific Registry Office data.

It is therefore important to note that the SINTER is a landmark in building land governance in Brazil, since it is the first step towards the creation of a unique centralized land cadaster.

Figure SINTER proposed structure

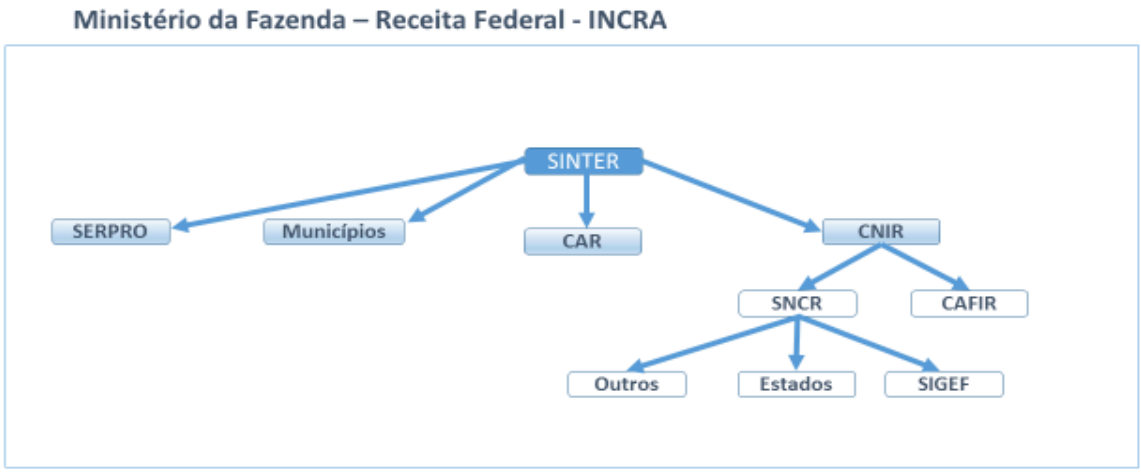
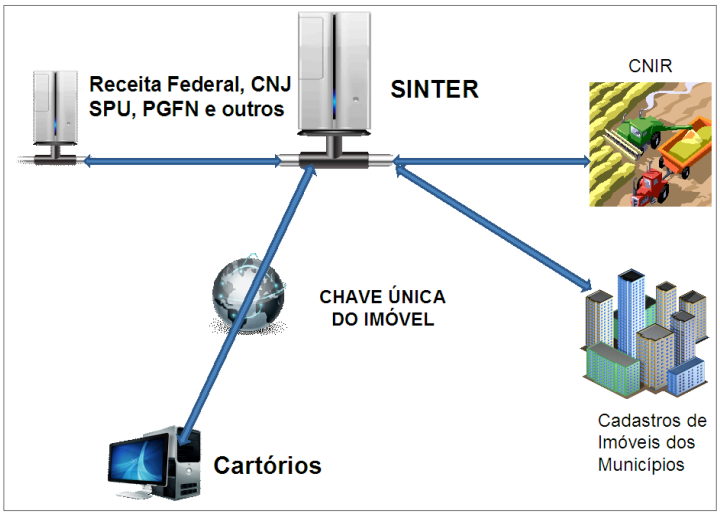


Figure SINTER proposed structure



4. Polycentric governance proposition

4.1. Polycentric governance origins

Beginning in the 1950's, Michael Polanyi develop the policentrality concept in his book The Logic of Liberty. The concept's simplest definition is a social system with several different decision center, operating under general rules in autonomous and limited privileged manner.

After some years this concept diffused to the right area in the US, especially in the urban networks studies and other studies about governance. In 1960 a general discussion emerged about urban areas management based that they should behave as a large community, integrating social and economic relations. However, this functional unit has difficulties by the fact that no administrative unit exists, instead, several government institutions, municipalities and special districts existed, overlapping jurisdiction and responsibilities, thus causing conflicts. The first conclusion reached: efficient administration could be impossible due to its autarchy nature of the responsible institutions, thus not being capable of working properly. It was suggested then, that, without a coordination center, each institution operated in its own interesting, disregarding the public and urban interests.

Meanwhile, urban area scholars, already discussed the duplicity in roles and overlap jurisdiction, suggesting central planning as a superior alternative, Vincent and Elinor Ostrom defined that there are some relationships between government units,

public sector agencies and private sector, coexisting and working in a public economy that can be controlled by inter-organization arrangements.

The theoretically policentrality concept defined by Elinor Ostrom defines three mains points: 1) decision centers multiplicity is analyzed by the capability of deploying different methods, layers of autonomous decisions and a shared set of objectives in common; 2) the institutional and cultural arrangement determinate a broad rules system that defines the policentric system , then analysed in terms considering the splited or overlaped jurisdictions in decision centers, also concerning their presence in building broad rules (as a mechanism of collective choice, like via market or consensus); 3) the natural order created by the evolutionary competition among ideas of different decision centers and their general availability (Aligica e Tarko, 2012, p. 254).

This way, the necessary conditions for policentricity are defined as:

A) the continuous practice of giving different opinions and preferences (ideas or methods of conducting something as deployed by at least one decision center);

B) Stimulus compatibility or alignment among rules and stimuli (rules are considered useful by the ones subjected to them and the consequences of these rules are in some way transparent);

C) Autonomous layer of decision (different decision centers may take operational and autonomous decisions).

4.2. Polycentric governance in Brazil

The institutional architecture of land management in Brazil is quite complex, despite, however, being inefficient. Its structure is a result of a quite long historical process of creating and closing public institutions and government agencies related to land management. These facts caused an overlap of responsibilities and conflicts in several aspects and among institutions (federal, states, municipal). Additionally, as observed by the World Bank's LGAF methodology, the FAO's good governance practices and TCU's auditory, the government institutions are quite inefficient in deploying new public policies, that cannot reach their objectives, causing a lot of spending with no results by the Brazilian government.

The Land Governance Working Group presented four policies proposition based on the concept of polycentric governance.

4.3. Proposed policies for Brazil

4.3.1. Incentive to Cooperation environment creation

The first proposition (from a broad to a narrow view) is the creation of a cooperation, forum or platform environment, where would be possible to gather all kinds of decision centers (e.g. participating institutions in land management). This environment, be whether formal or informal, is the precondition for any working policentric system. This debate medium, in Brazil, should a place for several kinds of representatives involved in the land management cause: Landless Workers' Movement, Quilombolas (descendants of Afro-Brazilian fugitive slaves), jungle people, federal and states organizations, mayors associations, notaries, internal corrections (outsiders despite being part of the judicial branch), private sector representatives (like rural credit banks), etc.

Coming from this generalist, tough essential, proposition, continuing to propositions that are more specific related to the three central characteristics of a polycentric system.

4.3.2. Institutional alignment for land governance

Regarding the characteristic of the existence of multiple center of decision is possible to assert that the land management problems in Brazil exists due to the lack of interinstitutional alignment, concerning these acting decision centers. To that end, there is a need to get them to a common and single objective, more or less voluntarily accepted by all of them.

4.3.3. Creation of common rules

The main issue is the creation of an integrated rules system, one of the major problems is the lack of alignment among the law and rules that regulate the land management. The main cause is of this is the way law and rulings are written and passed in Brazil, affecting thus the objective they should regulate, in a contradictory manner. The solution for this problem requires an enormous effort of evaluating the law

and rules that try to regulate the land management, thus a proposition for standardizing them, hence eliminating redundant and contradictory law over land. The need for cooperation between the legislative branch and the platform of debate, among the decision centers, is therefore a necessary condition for deploying the proposition.

4.3.4. Creation of the institutional/cultural framework and the Cadaster

Concerning the spontaneous order or evolutive competition, the last out of the three main characteristics of a polycentric system, there is a considerable obstacle to confront: the problems related to the availability of shared information.

The two main problems related to information availability are:

1) lack of a consolidated cadaster linked to properties and possession in Brazil, both in public and private lands, thus making land management more difficult the land management, as the cadaster is the first base for the proper functioning of the land administration;
2) the toughness of information sharing among different organizations and institutions related to land management. Information is not shared or occurs in very problematic and/or slow manner. For example, the connection between notaries and other organizations, or even among government organizations, combined with lack of information to the society.

In addition, there is the problem that transparency cannot be complete: information access must be restricted, especially the ones related to national security and people's privacy. There's a double proposition, then: the creation of a consolidation cadaster containing all the properties and possessions, based on the cooperation of all institutions and organizations; and the debate to create common rules about how and which information should become available; thus avoiding inefficient and redundant works caused by the lack of communication linked to land governance.

Following the ideas proposed above, the way forward in the improvement of Brazilian land governance should aggregate all institutions to build the institutional and legal solutions in specific themes, to make them more effective. The proposition is to agglutinate all institutional interfaces in the next six principle vectors of discussions, institutional solutions and legal integration, showed at the figure 3: 1) Land

regularization; 2) Land valuation and taxation; 3) Soil use; 4) Cadaster; 5) register; and 6) Public land.

Figure 3. Vectors of engagement for polycentric land governance in Brazil

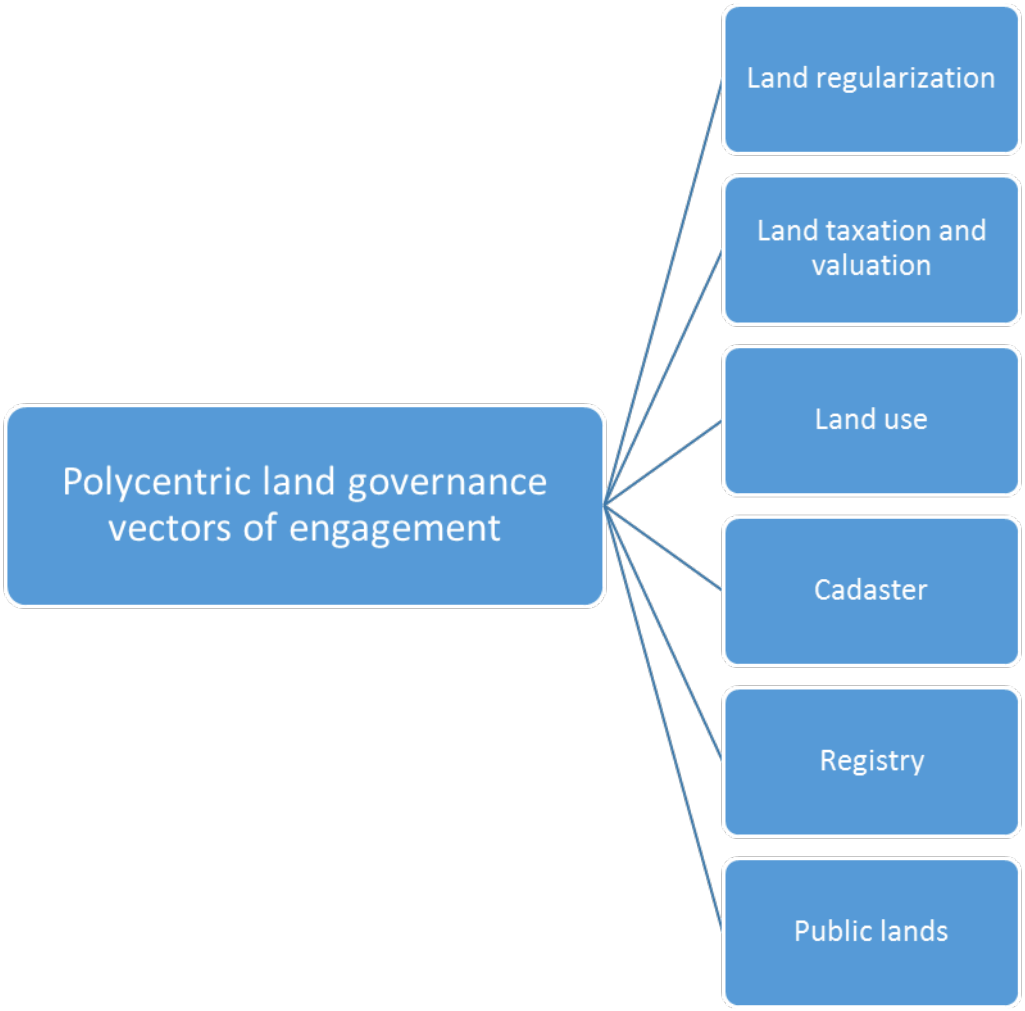
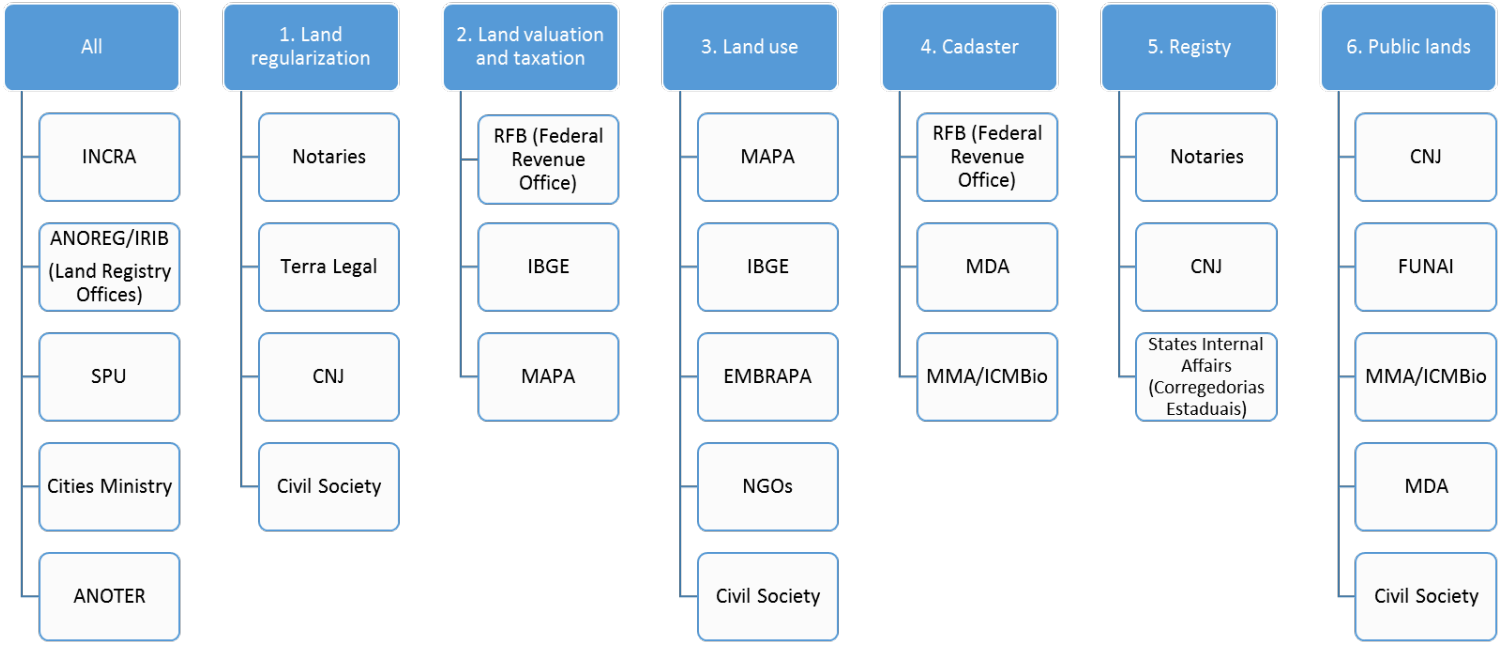


Figure 4: Land governance entities proposed organization



Source: elaborated by the authors.

The presented propositions will promote the synergy among the institutions that work with land, organizing roles, making the integration and planning possible, thus allowing the public policies preparation and deployment with the efficiency needed in Brazil for its territorial organization and collaborating in a sustainable economic development.

Conclusion

This paper highlighted the importance of a strong and reliable cadaster for land governance focused on the Brazilian case – where this task is yet is still undone. The urge for it is greater still if one brings the continental size of Brazil with all its biodiversity while, at the same time, fast growing urbanization, large scale mechanized agriculture, indigenous population justly demanding land, land grabs and a confusing institutional framework.

The international literature on land cadasters sets the benchmark for what would it take for a cadaster to be reliable, efficient and what are the functions it would be expected to perform. The first section of this article brought about this discussion and related it to the Brazilian literature on cadasters trying to put the reader into context.

The second section, explored the results of LGAF to point out some of the strengths and, especially, the most pressing weaknesses of Brazilian land governance. The main issues are: a) the overlapping of laws and institutional settings and responsibilities on land issues; b) the lack of private and public mapped land cadasters and c) the uncomplete and unreliable registration system.

The third section focused on showing the recent efforts in building a cadaster that shall be suitable to the Brazilian specificities and to international standards. The SIGEF, the cadaster being build has already reached about 57 % of the surface of the country in about 3 years. This section showed also the other large project on Cadaster called National Territorial Information Management System (SINTER) and it is the first of this kind and size. This section also, showed the main difficulties arising from the Brazilian context: the split between urban and rural cadaster, the difficulties of information exchange between government agencies and the Land Registry Offices, and

the difficulties of information exchange between government agencies on land governance issues.

For the fourth section, proposed a polycentric governance setting for the Brazilian case. In it, we used the polycentric governance approach for land governance in Brazil, highlighting with it the centrality of creating an institutional environment that shares some common rules as a base for information exchange and construction of a multipurpose national cadaster for improving the land governance.

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