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Activities of IBGE to Build the Brazilian SDI*

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ACTIVITIES OF IBGE TO BUILD THE BRAZILIAN SDI

Abstract

In Brazil, the Presidential Decree 6666 of Nov 27th, 2008 has established the legal framework for the Brazilian spatial data infrastructure enterprise. This paper reviews the Decree's major points and definitions, the key roles to be played by the governmental institutions explicitly mentioned in the Decree, among which the Brazilian Institute of Geography and Statistics (IBGE), the Action Plan that has been developed aiming at implementing the INDE, the building strategy and a suggestion of an organizational and managerial model for the INDE.

The legal milestone of Brazil's SDI - INDE

In the planning of public policies, whatever the government level (federal, state or local), the State must rely on quality data and information about its territory to be both efficient and effective in achieving its mission. Ultimately, this whole process is funded by resources coming from the taxpayers who, in return, should be the main beneficiaries of the government's policies and services.

In Brazil, it is known that **geospatial data and information (GI)** are largely produced, maintained and acquired by public sector organizations of all governmental spheres. Notwithstanding, it remains difficult to the user to find what geospatial data sets are available out there, what their features are, where they can be found, who are their maintainers, and how can one access and eventually get them. In other words: GI do exist in large volumes in Brazil's governmental organizations, but can hardly be found or accessed even by decision-makers of the public sector.

Hence, the very first requirement for a Spatial Data Infrastructure (SDI) to be established in Brazil is that **geospatial metadata** should be made fully available for the existing GI assets or collections maintained by the public sector organizations, in particular those of the federal sector, since these are ultimately funded by taxpayers of the whole country. Of course, the geospatial metadata should enable one to **find** and **explore** different data sets, as well as **access** those that meet one's needs.

Yet, to be effective, a "national SDI" (or NSDI) should not be restricted to the publishing of geoespatial metadata. Users themselves should be able to access straightforwardly, and eventually obtain (downloading or ordering), relevant and up to date GI of their national territory, including added-value geoinformation products, designed to meet varied demands and user profiles in the most effective way.

These are all quite basic but rather demanding objectives to be met by a NSDI in such a large developing country like Brazil. However, the legal framework required for achieving them must be laid out by the State. The good news is that Brazil's federal government did it in the best possible way through the Presidential Decree nbr 6666 of November 27th, 2008 or, more simply, the **Decree 6666/08**. This is the legal framework of the Brazilian NSDI's enterprise, which has been named "**INDE**" (acronym for NSDI in Portuguese).

The INDE's legal framework has been created with the following objectives, as clearly stated in its 1st Article:

- To promote enough ordering in the production, storage, access, sharing, dissemination and use of the geospatial data coming from the governmental organizations of all levels, aiming the country's development;

- To promote the use, in the production of geospatial data by the governmental organizations of all levels, of the standards and specifications homologated by CONCAR (more about CONCAR below);
- To prevent duplicate actions and the waste of resources in the acquisition of geospatial data by the governmental organizations, through the release of the corresponding metadata by those very organizations.

According to the Brazilian INDE´s legal framework, all the **federal** organizations that produce and maintain geospatial data sets and information will be obligated to make their GI collections, including the corresponding metadata, publicly available through the so-called **Brazilian Directory of Geospatial Data - "DBDG"**. The only exception to this rule concerns classified or confidential data related to issues of social and national security.

The **DBDG** has been defined, in the Decree 6666/08, as a system of data servers distributed in the Internet, aimed to gather GI producers, administrators and users in the cyberspace, for the storage, sharing and access to GI and related services.

Regarding the state and local organizations of the Brazilian public sector, they will not be required to make their GI assets, neither their corresponding metadata, publicly available. But, yes, it is expected that they will adhere to the INDE´s enterprise voluntarily, as they realize the overall benefits that may outcome from their supportive decision.

The last significant introductory remark about the Decree 6666/08, that was published in the Official Diary of Brazil´s Federal Government on November 28th, 2008, is that any user properly identified through the so-called **Brazilian Portal of Geospatial Data** – also known as "**SIG Brasil**" – should be able to access all digital GI made available through the DBDG, **free of charge**.

The key roles of IBGE and CONCAR in building the INDE

The Decree 6666/08 highlights the roles that two federal organizations – **IBGE** and **CONCAR** – will have in building the INDE. These players and their key roles will be reviewed herein.

The **Brazilian Institute of Geography and Statistics - IBGE** is a governmental institution reporting to the **Ministry of Planning, Budgeting and Administration**. Besides producing demographic, social and economic statistics on a nationwide basis, IBGE is also responsible for mapping the country´s territory systematically. IBGE´s mission is to reveal the country with information needed for territorial knowledge and for the exercise of one´s rights as a citizen. IBGE is one of the chief GI producers of Brazil´s public sector.

IBGE´s production comprises reference data categories (v.g. geodetic control, political boundaries, hydrography, transportation routes, vegetation cover, etc.) that may be packed in topographic maps in different scales; and information databases, from which thematic maps of natural resources and environmental information can be generated. The Directorate of Geosciences (**DGC**) is the IBGE´s core-business unit in charge of its geoscientific and mapping production. It´s expected that most of this production will be shared and disseminated through the INDE.

The **National Commission of Cartography – CONCAR** is also affiliated to the Ministry of Planning, Budgeting and Administration, and comprises the great majority of the geospatial data producers and maintainers of Brazil´s public sector, including one representative of each of the following: 19 Ministries; IBGE itself; the Army´s, the Navy´s and the Air Force´s mapping branches; one Association representing the private sector companies which provide air survey and mapping services; five regional forums representing the federation´s states.

CONCAR is the directive organization that sets the rules and standards for, and coordinates the **National Cartographic System of Brazil**. All of CONCAR's major decisions originate from voting sessions that can only be held when at least half (rounded to the next integer) of the Commission's representatives are present, featuring what's called a "plenary session".

Besides having a representative in CONCAR, like any other of CONCAR's members, IBGE also plays the role of CONCAR's Executive Secretariat. The President of CONCAR is the Secretary of Planning and Strategic Investments of the Ministry of Planning, Budgeting and Administration. The Deputy President of CONCAR is the President of IBGE.

According to the Decree 6666/08, IBGE will be the DBDG's **administrator**. The DBDG has been conceived to gather geospatial data producers, administrators and users, relying on an open, scalable and distributed architecture that will expectedly make use of the OGC (**Open Geospatial Consortium**) standards for web services.

The DBDG will comprise map, file and catalog servers located in the facilities of the geospatial data producers pertaining to Brazil's public sector. Of course, IBGE itself is one of the key GI producers and administrators of Brazil's federal sector and, as such, is expected to become one of the main DBDG's data and service hubs.

Yet, the INDE's legal framework has also assigned to IBGE the mission of **developing, launching and maintaining** the "**SIG Brasil**" geoportal, through which users will have access to a whole gamut of geospatial data search services, based on their metadata, as well as other kinds of web based geoservices. The SIG Brasil geoportal has been thought out to be the official gateway to the DBDG's distributed resources. IBGE has also been assigned the duty of applying to the Ministry of Planning, Budgeting and Administration, the request for **financial resources** in support of the INDE's implementation and maintenance.

On the other hand, CONCAR is expected to play a directive and normative role in the scope of the INDE, by setting up the technical standards and specifications upon which the production of geospatial data and metadata for the INDE (and for the National Cartographic System) must be based on. Also, the directives for the DBDG's implementation must be provided by CONCAR.

The Decree 6666/08 has assigned to CONCAR yet another key duty, which is that of submitting to the Ministry of Planning, Budgeting and Administration, within 180 days from the Decree's publication (term expired on May 27th, 2009), an **action plan for the INDE's implementation**. This action plan should provide answers to the following, among other issues:

- The deadline for the full implementation of the DBDG and the SIG Brasil geoportal;
- The deadline for CONCAR to homologate standards and specifications for geospatial metadata;
- The deadline for the GI producers and maintainers of the government's federal sector to make their GI asset's metadata available to CONCAR, and to store these metadata in their respective servers (for publication through the SIG Brasil geoportal);
- The deadline for the beginning of publication of geospatial metadata, and for the SIG Brasil geoportal to start offering its related services (for data discovery and access);
- The rules for the publication, through the INDE, of metadata concerning new projects or the acquisition of geospatial data.
- An estimation of the financial resources required for the INDE's implementation, based on the assessment of IBGE, including the DBDG and the SIG Brasil needs, the development of standards, dissemination of the INDE's enterprise, capacity building and the promotion of partnerships with governmental organizations of all levels.

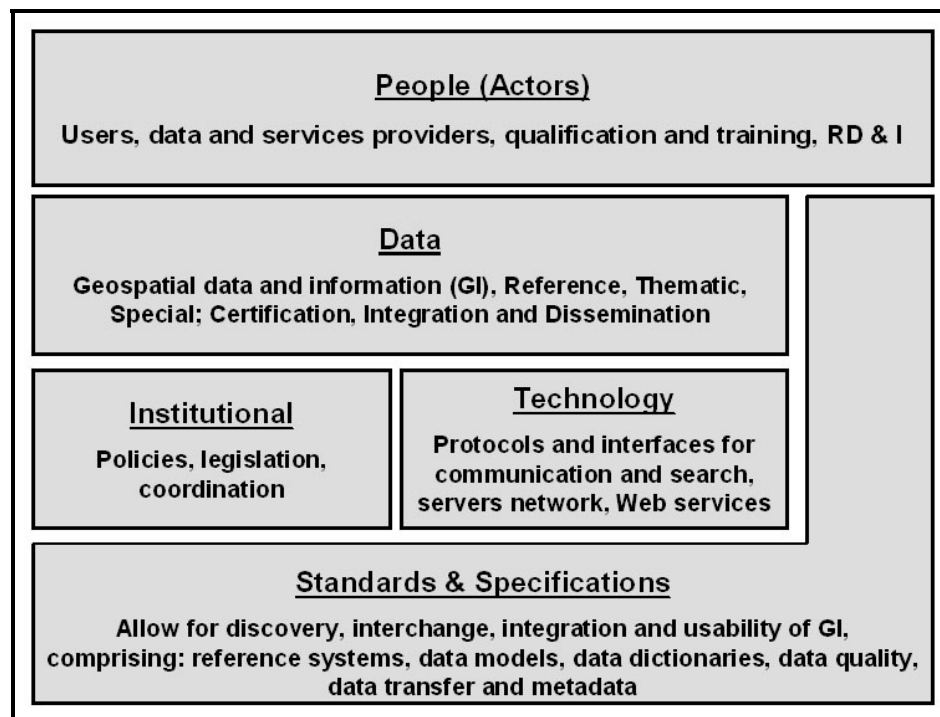
The INDE´s Action Plan

The "Action Plan for the Implementation of the National Spatial Data Infrastructure" of Brazil – or, more simply, the **INDE´s Action Plan** – is a 200 page document that has been developed by a group of experts created by CONCAR at the end of 2008, named **CINDE (Committee for the Planning of the INDE)**. CINDE was formed in the two first months of 2009 under the coordination of IBGE. It ended up with the following composition: 110 representatives of 27 organizations of which 22 of the federal sector, three state secretariats, one local (municipal) planning agency and one university.

The first version of the INDE´s Action Plan was approved during a CONCAR´s plenary session held on May 27th, 2009, fulfilling the deadline established by the Decree.. A revised version of the **INDE´s Action Plan** is scheduled to be released in early August, 2009.

The base components or foundations of an SDI, as referred to in the Action Plan, are shown in figure 1: **actors (or people), data, institutional, technology, standards & specifications**. For building the SDI, this conceptual model translates into three implementation dimensions: **human** (GI producers and users, human resources), **organizational** (legal framework, organization and management, institutional strengthening) and **technical** (data and metadata, standards and specs, technology).

Figure 1 – The Components of a SDI



(source: The INDE´s Action Plan – Chapter 1)

The INDE's Action Plan comprises eight chapters that have been assigned to eight working groups, each one having one or two chairs within the CINDE committee. The working group's overall production has been coordinated by a general Chair from IBGE. Chapters 1 to 7 relate to the aforementioned components and dimensions, and explore them further from various perspectives. Chapter 8 is the Action Plan itself, built upon the foundations developed in the preceding chapters.

The Action Plan's chapters are the following:

- Chapter 1 – Spatial Data Infrastructures: the Concepts
- Chapter 2 – Backing Information for the INDE's Action Plan
- Chapter 3 – INDE's Actors: Identification and Functions
- Chapter 4 – Geospatial Data and Metadata
- Chapter 5 – The Brazilian Directory of Geospatial Data
- Chapter 6 – Capacity Building
- Chapter 7 – Dissemination and Communication
- Chapter 8 – The INDE's Action Plan

The two first chapters aim to provide the conceptual framework and the necessary backing information, collected from extensive bibliographic research, in support of an SDI implementation. These are the chapters that provide general guidelines for the INDE's Action Plan, taking into account the valuable experience of other countries that have been implementing SDIs in the last years.

The core elements of the informational architecture of a SDI – **geospatial data, metadata and geo web services** – are examined in details in Chapter 1, along with some related concepts, and so are the critical success factors of a SDI.

Chapter 2 highlights the **organizational** dimension of the Action Plan, providing some relevant guidelines to the issues of **policies, legislation and coordination** implied by the implementation of a SDI. In this regard, an extensive analysis of the Decree 6666/2008 is presented, so that the principles that have guided the inception of the Brazilian INDE are clearly understood and assimilated.

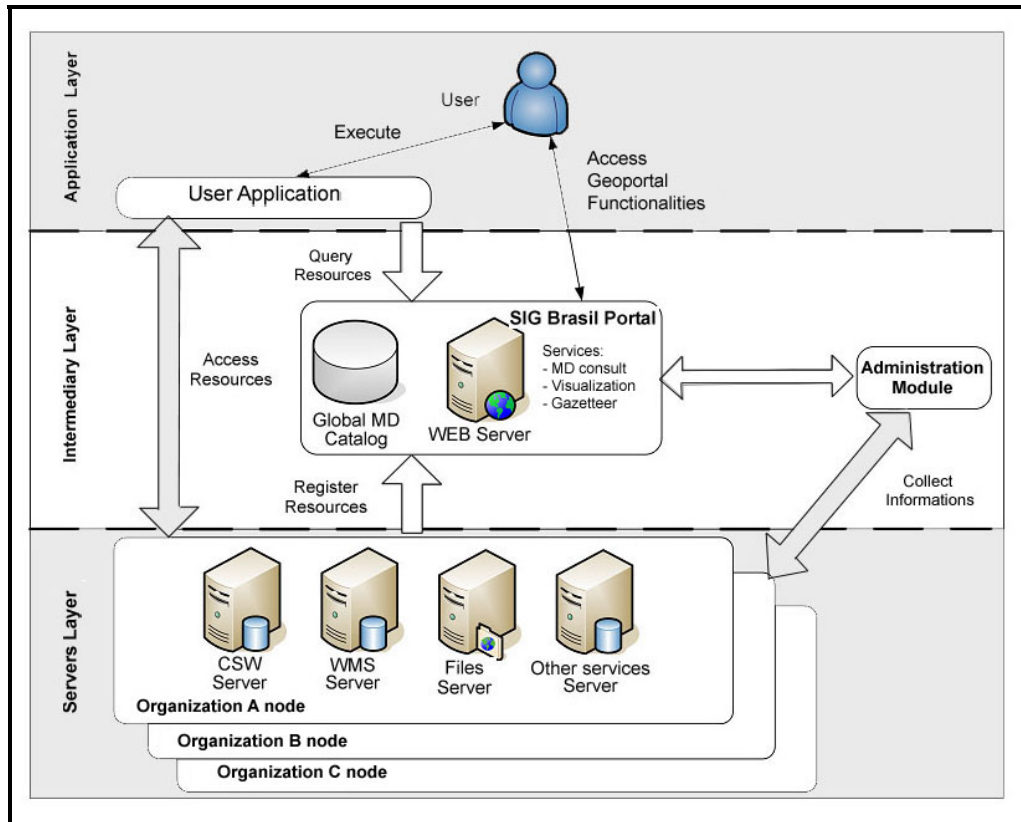
In addition, Chapter 2 provides an overview of the **implementation strategy** designed by the CINDE committee, as well as useful information required for the conception of an **organizational and managerial model** for the INDE. These key issues have been developed further in the Action Plan itself – Chapter 8. The implementation strategy will be based on three implementation or building cycles (more about this below).

Chapter 3 is a pivotal one because it is where the INDE's actors are identified, in particular the GI producers and administrators of the federal sector. Chapter 3 broadens some of the discussions that have been initiated in Chapter 2, considering the current reality of Brazil's community of geospatial data producers, administrators and users. Chapters 4 to 7 then focus on the **technical** and **human** dimensions underpinning the INDE's implementation.

Chapter 4 is the one which describes the geospatial data and metadata that should be made available through the DBDG by their respective producers and/or administrators, who are then pinpointed in the text. It also includes a classification scheme for the geospatial data by dividing them in four groups, of which **reference data** and **thematic data** are the major ones; **especial data** and **value-added data** address more specific user profiles.

Chapter 5 focuses entirely on the INDE's technological component. This chapter presents the DBDG's conceptual, logical and physical design. Another key session of Chapter 5 is the one addressing the SIG Brasil geoportal's design. Figure 2 illustrates the DBDG conceptual design, having the SIG Brasil geoportal at its core.

Figure 2 – The DBDG's Conceptual Diagram



(source: The INDE's Action Plan – Chapter 5)

Chapter 6 presents the first version of a full featured qualification and training plan for the INDE's capacity building and analyzes the requirements for a Knowledge Management System as a support tool within the Q&T infrastructure to be put in place for the INDE. Chapter 7 introduces the first version of a communication plan for the INDE, in which the goals and objectives for achieving effective communication are established, along with communication strategies and the definition of the target audiences.

Chapter 8 is actually the core of the entire document because it is where the contributions of the previous chapters are consolidated. It brings the answers to the requests of deadlines and cost evaluations made in the INDE's legal framework. Yet, Chapter 8 goes beyond providing the answers required by the Decree 6666/08. The following themes have been addressed by the work group responsible for the Chapter 8:

- ✓ a suggestion of an **organizational and managerial model** for the INDE.
- ✓ short-term priorities for the Action Plan, including a **launch event** in 2009.
- ✓ the proposed INDE's **implementation strategy** based on **building cycles**.

- ✓ an **analytical structure** for the Action Plan, which is based on the INDE´s **components**; a set of **deliverables** is found underneath each component; the plan details these deliverables and the “**action lines**” required to produce or execute them.
- ✓ the **cronogram** of the first building cycle.
- ✓ the **implementation costs** focusing on the first building cycle, which is planned to be completed by the end of 2010.

The INDE´s implementation strategy

The implementation strategy proposed by the CINDE committee is based on building cycles along which the Brazilian SDI is intended to grow up gradually and steadily with the inclusion of new actors. These are expected to make the INDE´s informational contents and services offer increasingly useful and appealing to the users community. Each one of the building cycles have been planned to fulfil important goals of the INDE´s enterprise, as shown below.

➤ Cycle I

An important **launch event** has been scheduled to occur by the end of 2009, as part of “Cycle I”. The idea behind such event is to highlight the importance of the INDE´s enterprise to the Brazilian State and society as a whole, and to demonstrate the INDE´s applicability to the solution of relevant questions that may arise in the decision-making process for the conception of public policies.

However, the launch event is also intended to bring the GI producers and administrators of the federal sector together, providing them with an extra boost for the establishment of the necessary agreements for geospatial data sharing and dissemination. After all, the INDE will only come true if these federal actors do really engage in this enterprise, working together and making their geospatial data assets available in the DBDG.

The INDE´s first cycle has been planned to last from August 2009 thru December 2010. The ultimate goal of this Cycle I is to have the bulk of the federal GI producers and administrators effectively engaged in the enterprise, and have **some** of their geospatial **data** as well as **all** of their **metadata**, available for access through the DBDG.

Those actors who have not joined the CINDE committee for whatever reason during the INDE´s planning phase will be stimulated to engage in the building process from the beginning of Cycle I. The aforementioned launch event is intended to help in this process, by fostering the players to get on board for the sake of a major objective on behalf of the Brazilian State and society.

Nevertheless, it is not only political arrangements for data sharing and dissemination agreements among the players that will receive focus in Cycle I. The essential infrastructure of hardware, software, telecommunications and facilities required for the DBDG, with its distributed architecture, as illustrated in figure 2, must be put in place. And this must also happen along Cycle I.

Yet, most of the aforementioned infrastructure should be implemented by mid-2010, because this is the deadline set, in the Action Plan, for the federal actors to make their metadata available through SIG Brasil. For this reason, the SIG Brasil geoportal, which must be implemented, hosted and maintained by IBGE, will have to be launched in July 2010. By the end of Cycle I (Dec 2010), the SIG Brasil geoportal must be fully functional.

It should be said that despite the focus on the federal actors, the engagement of players from other governmental sectors will be welcome and even fostered during Cycle I. The Decree 6666/08 makes clear that the participation of the **federal** GI producers and maintainers in the INDE´s

enterprise is **mandatory**, but the **state** and **local** organizations are recommended to get on board **voluntarily**.

Some final remarks on Cycle I are due. CONCAR has been working steadily on the development of standards and specifications for geospatial data and metadata for some years now. This is quite significant, given that no SDI can be implemented without the acceptance of some common standards that will enable the interoperability of informational contents and services, as well as the discovery and exploration of geospatial data sets and related information.

For instance, a standard for the modeling of geospatial vector data – **EDGV** (“**Technical Especification for Geospatial Vector Data**”) – has been developed under the leadership and coordination of the Brazilian Army’s Geographic Service Directorate - DSG (which is one of CONCAR’s members), and is now in its **version 2.1**.

EDGV is the official standard now in Brazil for mapping at topographic scales, along with its related technical specification named ADGV (“**Acquisition of Geospatial Vector Data**”), that describes how topographic map producers must capture vector data to comply with the EDGV standard. It must be emphasized that topographic maps in vector form have been pointed out, in the Action Plan’s Chapter 4, as a key source of **reference data** layers for the INDE.

GI producers and maintainers will not be obliged to comply with the EDGV/ADGV standards, in order to make their data sets available in the INDE’s DBDG, in Cycle I. However, reference data producers will have to make their vector data sets compliant with that standard in a certain time frame to be set by CONCAR. Otherwise, these data will not be deemed “**official**” for publication in DBDG in the future.

According to the INDE’s Action Plan, CONCAR will have to dedicate resources and to develop actions for capacity building of the public sector’s GI producers, as well as make software tools available to those producers, in order to support them in the migration or conversion of their geospatial data sets to the EDGV/ADGV standards.

CONCAR has also been working on a standard for geospatial metadata, which is based on the **ISO 19115:2003** international family of standards. The resulting profile has been called the “**Brazil’s Profile of Geospatial Metadata**” – the **MGB Profile**, which has been developed by a group of experts created by CONCAR named **CEMG** (“**Committee for the Structuring of Geospatial Metadata**”), this one also coordinated by IBGE. The MGB profile is expected to be homologated by CONCAR early in the second half of 2009, and all the geospatial metadata that will be made available through the DBDG, in Cycle I, must comply to that standard.

➤ **Cycles II and III**

Cycles II and III are not developed extensively in the first version of the INDE’s Action Plan, whose focus is clearly on Cycle I (Aug 2009 to Dec 2010). However some major goals can be pointed out for Cycle II, that will last from 2011 to 2014, as follows:

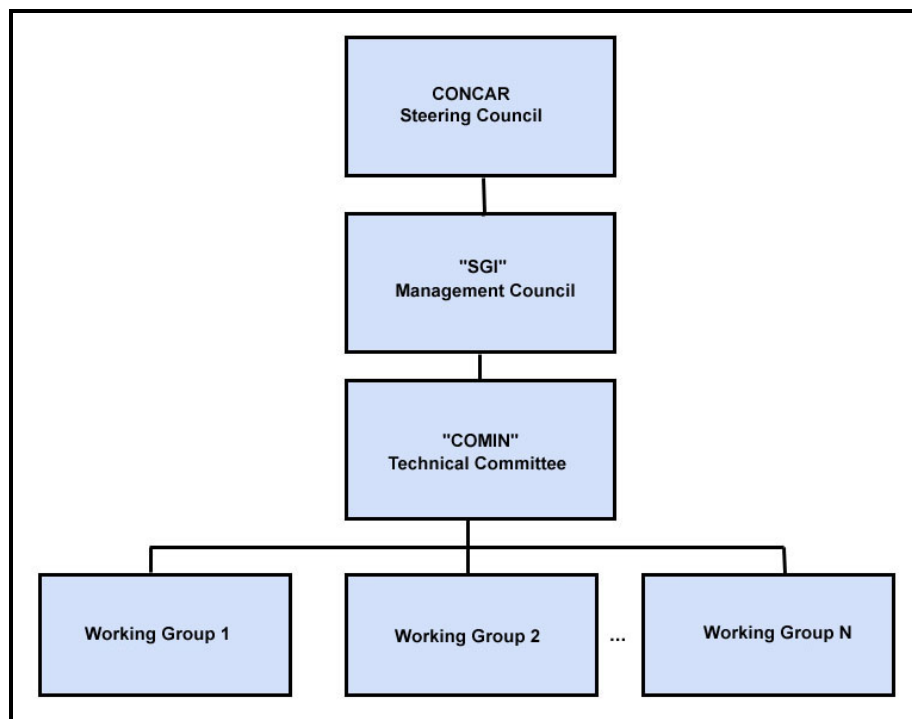
- **To consolidate** the **DBDG** in the **federal sector** and **extend** it at the most to the other governmental spheres (**state** and **local**).
- **To strengthen** the **institutional** and the **people** components, and **consolidate** the **standards & specifications** component.
- **To augment** and **enhance** the **services offer** according to the **users demands**.
- **To integrate** with **other SDIs** – continental, regional, thematic and corporate ones (including those of the private sector).
- **To disseminate** the INDE’s enterprise at the most to all productive sectors of society.

For Cycle III, which is expected to last from 2015 to 2020, the CINDE committee envisions the following: the INDE will have permeated all of the productive sectors of the Brazilian society and will have consolidated itself as a **framework** for the **search, exploration, access and use** of geospatial data and information (GI) in Brazil. Not only in support to the public sector mission, but also in support to the most varied user profiles and demands.

The INDE´s organizational and managerial model

One of the main contributions of the INDE´s Action Plan, given in Chapter 8, concerns the suggestion of an organizational and managerial model for the INDE. This theme is initially developed in Chapter 2, where the models in place in quite a few countries were carefully examined. Then, later, the Chapter 8´s working group used this information as a basis to build up a proposition, which is shown in figure 3.

Figure 3 – The INDE´s Management Structure



(source: The INDE´s Action Plan – Chapter 8)

CONCAR is undoubtedly the INDE´s supreme decision forum, according to the Presidential Decree 6666/08. The role that CONCAR has been playing with regard to the National Cartographic System of Brazil, since the Decree nbr 243 of Feb 28, 1967, has been extended to the INDE. Hence, CONCAR sets the rules and standards and also directs the INDE´s enterprise. It plays the role of a **Steering Council**.

Therefore, any model proposed for the organization and coordination of the INDE´s enterprise must take into account the prevailing legislation and also the CONCAR´s statute, which, of course, relies on the current legislation. According to its statute, CONCAR is allowed to create "Technical

Subcommissions” and “Specialized Committees” (CINDE and CEMG are just two examples of committees created by CONCAR).

Hence, the CINDE committee has suggested the creation of a “**Subcommission for the Management of the INDE**” which has been provisionally named, in the Action Plan, **SGI**. This is the body that would be in charge of general management and coordination of the INDE, with a clear emphasis on the organizational dimension of the INDE’s implementation (handling issues of **coordination** and **institutional strengthening**).

The SGI’s role is that of a **Management Council** and its members would be a subset of CONCAR. One of the attributions foreseen for the SGI is to support the Secretary of Planning and Strategic Investments of the Ministry of Planning, Budgeting and Administration in his duty of promoting data sharing agreements and partnerships among the public organizations of all governmental spheres (this duty has been defined in the Decree 6666/08).

Working under the guidance of the SGI, there would be a “Specialized Committee”, comprising a group of technical chairs that would handle the **operational, logistical** and **technical** side of the INDE’s implementation.

This Committee would have a coordinator and 12 technical chairs to address the issues of the Action Plan’s components (two chairs for each component): **Management, Standards & Specifications, Data, Technology, Capacity Building** and **Communication**. The technical chairs that undertook the task of developing each one of the Action Plan’s chapters are natural candidates for these positions.

Finally, there would be **Working Groups** created to **execute** some of the “**action lines**” foreseen in the INDE’s Action Plan, working under the **leadership** of the Committee chairs. These Working Groups would have variable composition rather than fixed. The Working Groups should be composed by representatives from the various INDE’s actors, and they should also be able to count on the contribution and support of consultants and experts from Universities, Research Institutes, private companies and so forth.

Some examples of Working Groups (WGs) that might be created according to the Action Plan: Geospatial Data WG, Institutional Strengthening WG, Standards & Specifications WG, DBDG WG, Data Hosting WG, Capacity Building WG, Communication WG, and others.

Conclusions

The government must play a leading role in the overall coordination and implementation of the Brazilian INDE. In this regard, a lot of hard work has been completed towards the INDE’s implementation, even though this is just the beginning of a challenging and long term enterprise.

The Brazilian government has taken the first major step in support of the INDE with the Decree 6666/08, in which the key roles of both CONCAR and IBGE are clearly set, as well as that of the GI producers and maintainers of all governmental spheres. The guiding principles of the Brazilian INDE have been established.

Also, an Action Plan is now available to guide the Brazilian INDE’s implementation, and it has been done with the effective support of many organizations and people. It should not be seen as a finished and unchangeable document though. The first version of the INDE’s Action Plan is just a base document to be reviewed on an annual basis, as the INDE’s overall conception evolves along time.

A lot of relevant technical work has been achieved by CONCAR on behalf of a successful implementation of the INDE. There is a standard already set for the modelling of geospatial vector data, a technical specification for the structuring of that kind of data and CONCAR is now close to homologate the Brazil's metadata profile for geospatial data.

On the other hand, the private sector is also expected to play a key role in the INDE. Whereas CONCAR will have to keep up its work of setting the standards and protocols to be followed by data producers and service providers in order to ensure contents' and services' interoperability, the private sector will certainly have much to do in support to all productive sectors, which will need to comply with those standards and protocols. All of this should foster the economic activity around the INDE's enterprise even more.

Another role that the private sector is expected to play concerns its capacity for creating new added-value products and services, that should fit to the wide variety of user profiles and demands emerging from the INDE's enterprise, thanks to the increasing volume of geospatial data and information that will be made available and accessible to the users in an organized way.

[For further information, please visit <http://www.concar.ibge.gov.br> or contact concar@ibge.gov.br]