

SPATIAL DATA INFRASTRUCTURE – THE REBATE PROJECT

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INTRODUCTION

Geographical references are necessary in almost every public administration activities. Maps and data associated to locations are daily used for planning and resources administration, services and it defines public or private policies. Knowledge through information permeates all spatial intervention process. Using GIS becomes essential today for administration, analysis, decision making in a large range of activities.

Digital data are the key to take advantage of the potential that computers bring to the space analysis. They are previous requirement for handling great volumes of data, in several forms, and for using visualization techniques that allow to understand the past, the present and to project the future. Being in digital format, the spatial data can be stored, manipulated and integrated, published, can generate new information and be distributed between researchers and citizens.

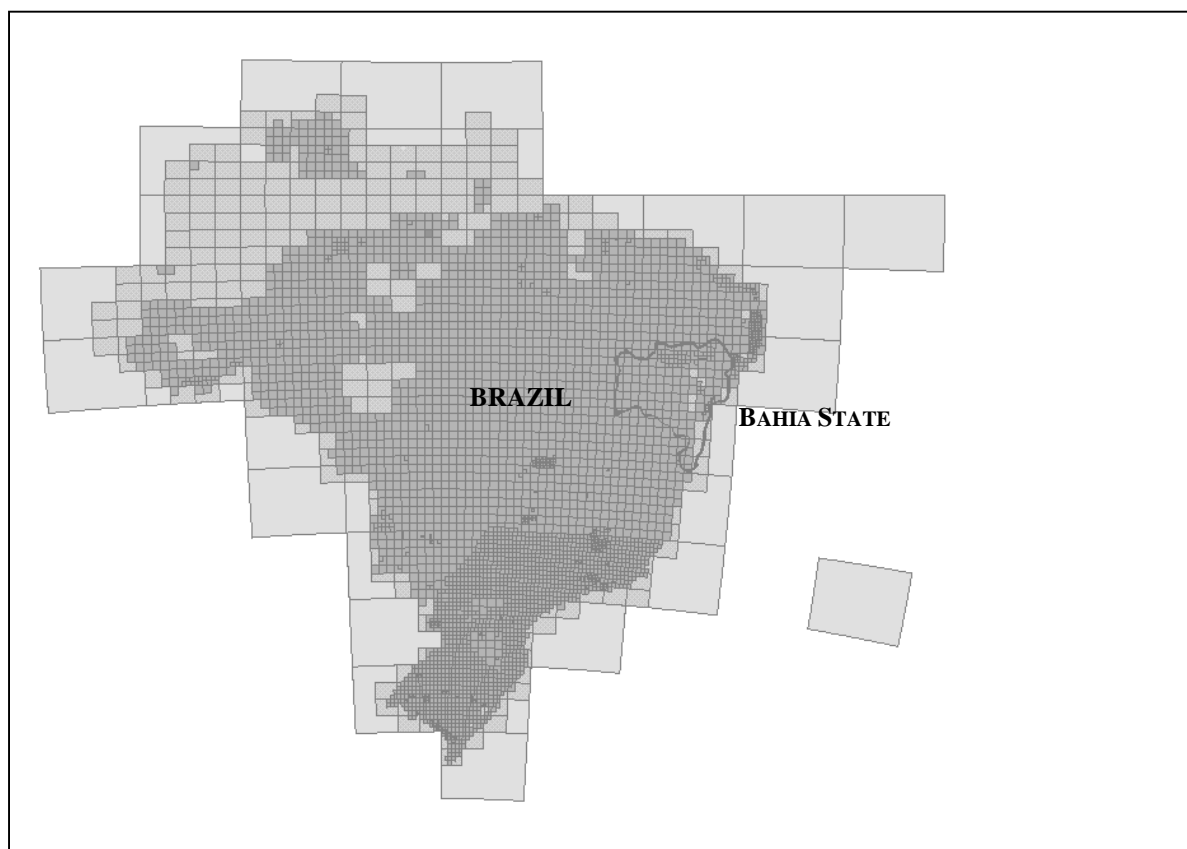
In the last decade, the information technologies development made the geographical information available for use in a digital form. This allowed analysis and supported the decision-making process in several government instances, companies, and academy, among other organizations.

In Brazil there isn't yet a truly SDI national project, we can say that there it is a few efforts in some states particularly on Brazil South area – the more industrialized of the country – as, for instance, Minas Gerais, Goiás, São Paulo and Rio de Janeiro. It can be said that they usually had started more for the sponsor leadership than for a conscientious and articulated action between government agencies.

According to IBGE, which it is the national institute responsible for produce and maintain cartographic data in Brazil, only 81% of brazilian territory is covered by topographic maps at 1:250.000 scale, and only 76% it is covered by 1:100.000 scale maps.

In figure 1 we can visualize cartographic data distribution in a national basis. The second largest rectangle show regions covered by 1:250.000 cartography and the smallest rectangle shows regions where there it is maps in 1:10.000 scale.

Figure 1. Cartographic data distribution in Brazil



The Bahia State is one of the largest of Brazil: in population it is fourth and it is the fifth in territorial extension, being a little bigger than France. Its dimensions justify the investments in spatial information technologies but the state competence in these technologies is still very incipient and it has been growing without including a project that already rationalize the investments done.

THE REBATE PROJECT

Concerned about this situation, the Federal University of the Bahia State had conceived a project of cooperative net to lead these questions involving a group of public (state and municipal) organizations, besides the private sector.

REBATE project (in Portuguese - Rede Baiana de Tecnologias de Informação Espacial or Bahia Network of Spatial Information Technologies) is a tentative of establish a common stage between organizations dealing with spatial data, and spatial information technology, so they can share resources and spatial data, while they maintain specific interests. This project was proposed by Federal University from Bahia and it was sponsored by national and local agencies.

The proposed network is a not-profit organization, constituted by a group of institutions, that share technologies, human and material resources. REBATE is characterized as a cooperative net, integrating high-level researchers and technicians, and geographical information infrastructure. This can reduce the costs for the associates, because they can dedicate their

efforts with end activities. The project was supported by several organizations, like Salvador city hall, metropolitan planning agencies, electric power company.

The main goal behind this project is to join several capabilities around a common target. The main target is the creation of a technological stage in Geomatics in Bahia State, qualifying technicians, inventorying actions projects and infrastructure, and diffusing information between state and municipal institutions, establishing foundations for a cooperative action in geographic information.

Technology is no longer an obstacle for the use of GIS in Brazil. Nowadays in our local situation the institutional design became more important than technological design. First phase of project was already done. It was produced a report that summarizes current status of Geomatics in Bahia organizations (Pereira, Rocha, 2002).

The report was based on a research accomplished from June 2000 to March 2001. The research produced a diagnosis of the state training degree in spatial information technologies. The investigation took into account aspects related to personnel's formation, teams training, installed hardware and software, policy on use and maintenance of spatial databases.

The research presumed that experience in dealing with GIS projects it is recent in the state, beginning in the nineties, and the difficulties come from three kinds of problem: lack of knowledge, lack of qualified personnel and lack of spatial digital data.

We can understand the lack of knowledge as a lack of information in technological aspects (potential, problems, needs) and in disciplines related to the space knowledge as Geography, Cartography, Geodesy, Topology, Space Data Modeling, Remote Sensing, etc.

Lack of technical training is other obstacle, directly associated to the previous. The solution would imply to develop a new culture in organizations and adopt training programs for different kinds of professionals, including the responsible persons for policies formulation and project coordination, planners (system users), programmers and analysts (information technology), technicians (system operators) and educators (training). Basically, they should exist, depending on the organization's size, professionals involved with coordination, operation and system maintenance (being included here items as technology, database, specific applications development) and users.

The lack of available digital databases and policies that didn't allow a large digital data dissemination – even if produced by public organizations – turns the data producers key part for the progress of GIS use in projects of any nature. GIS projects involve a great volume of resources, being important a cautious project that takes into account the institutional, policies and economic organization's characteristics. Thus, the reflection about the more appropriate inter-institutional design has been assuming an importance comparable to the technological choice itself.

INVOLVED ORGANIZATIONS

The research got data about the main organizations of GIS users in the Bahia State, being the great majority public organizations. The basic approach for inclusion in the research was GIS project(s) existence in process or starting at the moment the research started. There are more private organizations using GIS in the state than it was lifted up. These organizations mainly offer services to the public sector, still today the great demander in this area. Though the private companies demand has been growing quickly due to the concessionaires utility companies privatization and the technologies popularization.

The public and private organizations involved in GIS in the Bahia State can be classified in three basic patterns: data supply (and, in some cases, information supply), services supply and GIS user. This classification can be thought in terms of public or private organizations. We are using the term “organizations” instead of “institutions” because in some cases it exists a relatively autonomous GIS core dedicated inside of institution.

To classify organizations among “doers, users or viewers” doesn’t do very sense in our local context (Pereira, 1999), once the organizations producing data (doers) have to look for users; the users have to become data producers to begin their projects, while the occasional user (viewer) or the small projects frequently are made unfeasible by costly databases formation.

In Bahia State, there are some projects driven by headquartered nucleus in institutions with several purposes and degrees of relative autonomy. The most flagrant example is CONDER – Urban Development Company of the Bahia State, which started as a company focused in Salvador – the state main city – and in its metropolitan area and became a company focused on state region. CONDER, whose original mission was planning the Salvador metropolitan area, created an information system that give support to this institutional purpose and became the Salvador and neighboring municipal districts basic cartography supplier. In 1993 the system started using GIS technologies, and so CONDER became the pioneer company in Bahia qualified to product and maintain geographical data – systematic cartography – on several cities of Bahia State. The organization chart of the company doesn’t still reflect this situation being the GIS nucleus as a department of the company.

Also the PMS – Municipal city hall of Salvador has several GIS projects driven by several teams, with several training degrees. The research verified there wasn’t an institutional PMS project or GIS coordination, being each sector responsible for modeling and to convert its own data as well as for technological aspects. The municipal projects are apart, although a great synergy exists among the involved technicians. Today the PMS makes effort to change this situation, as we will see later.

Only two organizations could be classified as supplying geographical data according to the explicit institutional objective: IBGE – Brazilian Institute of Geography and Statistics and SEI – Superintendency of Economic and Social Studies of Bahia have as institutional objective the production and popularization of data and geographical information – although as we saw CONDER plays an important role in this field. Could still be distinguished an company called CBPM – which purpose is to promote the advancing of mining in Bahia State – with its explicit politic of mineral data production and diffusion.

Companies already carry out the service supplier’s role as PRODASAL – Data Processing Company of Municipal city hall of Salvador and PRODEB – Data Processing Company of Bahia State but the services refer to the information technologies not characterizing truly as GIS services. The other organizations can be classified as users with the condition done above – some have to change in data producer to supply the lack of geographic basic data.

PROJECTS OF GIS

More than 70% of the researched organizations had projects in process. Two facts can explain this situation: GIS projects usually last a long time and these technologies were introduced recently in the state.

Only one organization declared to have a concluded project, now in modernization phase. Some companies were receiving resources to start new projects.

Other common characteristic to most, about 2 thirds of the projects, was development strongly supported by external consultant. It shows that the previously mentioned lack of training it is a reality and there it is a need for training technical teams more effectively.

A third of projects were focused in Salvador or in its metropolitan area. Other third collected data for the territorial state area. The remaining ones were punctual – areas or specific areas – or municipal. This is explained by the readiness of digital data in Salvador and its metropolitan area (CONDER) and by their specific potential markets for utility companies, nowadays the great GIS users in urban projects. Besides possible economic explanations, the few projects registered to others areas can also be debited to the lack of data, total or partially.

Most of the projects dedicated great effort in data conversion activities. That is demonstrated by the fact that a great number of persons interviewed, when asked about GIS software used they mentioned to use graphic packages like AutoCAD, Corel Draw, Microstation and Maxicad. It corroborates the lack of digital databases research premise. The use of technologies associated to the Digital Cartography still prevails among the projects. Then we can conclude that the organizations spend more resources for acquiring spatial data than to processing them in order to produce geographical information.

TRAINING OF TECHNICAL TEAMS

The technical professionals involved in several projects of researched institutions possess varied formation, however engineers prevail (22%), systems analysts (18%), geographers (18%) and geologists (15%). Architects are proceeded (9%), programmers (5%), graphic designers (1%) and biologists (1%). The remaining of the technical body is composed of administrators, librarians, cartographers, economists, sociologists and statistical.

For its time, the engineers are present in 13 of the researched institutions; the geologists as well as the analysts are in 8, and the geographers meet in 5 of them. We can classify the technicians in professionals involved with space administration and planning (engineers, architects, planners - 33%), professionals of Geosciences (geologists, geographers - 33%) and professionals of information technology (23%). Other professionals arrive at 11%. These values consider the professional's college degree.

When we consider specific training for GIS, the concern prevails with accumulation of abilities, because 41% of the researched institutions declared to train its technicians in software that they operate. A smaller, even so significant portion, declared that its technicians have been qualifying in master's degree, particularly, in GIS Specialization (7 institutions). It demonstrates the influence exercised by Federal University of Bahia – that offers this kind of course since 1996 – on the training policies practiced in the state, driving to formation of competencies in a new landing that implies, for besides the ability to operate software, the capacity of handling underlying concepts. It is important to remind that this competence is, generally, linked to the possibility of more radical innovations, allowing new producing manners.

Surprisingly, the number of institutions that declared to participate in congresses or symposiums (16%) is smaller than the ones that pos-graduate its technicians (24%), due to the lack of local events and/or for its restricted popularization among the institutions that are devoted to GIS in the Bahia State.

To complete the picture of training policies in GIS, it would be interesting to know if it exists a concern in a way to transfer technology to the internal teams in the projects accomplished with consulting support. There is a significant number of researched institutions that brought

that type of external knowledge to their job (67%), however the present research didn't contemplate the forms as technical teams internalized that knowledge, nor if such concern ever exists.

PRODUCTION AND EXCHANGE OF SPATIAL DATA

It is verified that just two institutions are spatial data producers, serving most of the researched institutions: IBGE and CONDER, the first supplying basic data for projects in the state territory, the other providing basic data for urban areas, mainly in Salvador and in the Metropolitan area.

In the ambit of the Municipal city hall of Salvador, FLMF is a foundation that became the great responsible for distributing the Cartographic Base produced by CONDER, to other municipal institutions. In the ambit of the State, SEI intends to distribute the base that it is digitalizing from several data sources. In the future, with the GIS diffusion and the spatial digital database that SEI prepares just now, it is hoped that this institution will become the great basic cartography supplier for the State.

The CONDER would turn available the cartography regarding the main municipal districts, which were produced by CAR, a company that has as objective the regional planning and municipal articulation. So, CONDER has been specializing in municipal basic cartography, also in the ambit of the state, but in a different degree from the SEI, that is concerned about the municipal territory as a whole. It can be said that SEI provides data to aid regional planning and CONDER supplies data to aid cities management.

It wasn't verified the existence of great data exchange among the government's institutions. COMIN (mining company) just give its data to CBPM, that turned them available to the public. SEI uses data produced by DERBA – department that manages road stations, airports, etc. The SRH – Superintendence of Water Resources mentioned the agreement with SEI to introduce the cartographic state base. In general, great synergy it is not observed in the spatial data production and use, even among institutions at the same government area, what makes difficult the knowledge on the territory and on the technology improvement.

On the other hand, it is observed that the lack of basic spatial digital data has been guiding the formation of multiple digital databases using topographical maps from IBGE, accessible in analogical format. Besides, field study and aerial survey are quite used by organizations for create and modernize their databases, reflecting this lack of available spatial data. Then, a profuse production of heterogeneous digital databases should be expected, bringing difficulties for shared administration and integrated knowledge of territory.

It is a not very rational use of the resources and the data becomes not portable. It is also an obstacle for the technology diffusion once the institutions should be disposed to invest a very significant sum to acquire and maintain spatial database, independently of the result that it intend to reach with the GIS technology.

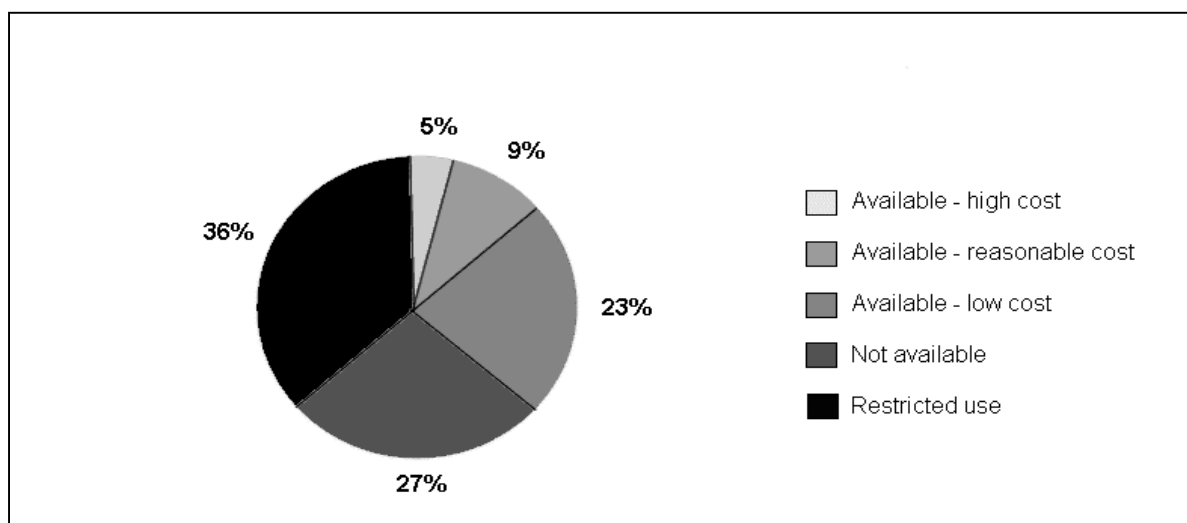
ACCESS TO THE PRODUCED DATA

Sharing geographical data can bring significant economy in time, energy and resources. Data public access is a subject that should be discussed. A lot of organizations whose main purpose it is data production see public access as a way of financing the costs of the data collection. On the other hand lack of clear public policies dealing with access and financing of geographical data collection/production makes things worse.

There are different forms to turn available data produced by them: some simply don't turn them available or it turn data available by means of bureaucratic and not very transparent processes; few of them give free access. The data can also be available with or without obligation, in a reasonable cost or at a high cost. This way, prices policies practiced can also constitute another form of restricting access to existent spatial data.

What we understand for reasonable cost, in this case, it is cost that doesn't exceed the base acquisition cost. High cost refers to costs that induce to own investments in acquisition and conversion from analogical data to digital ones. The figure below shows this situation.

Figure 2 - Data availability



A reading of the figure shows that among 21 of researched institutions only 7 allow free access to their spatial data. Among them, we meet IBGE and CONDER, which restrict some data and give free access to other ones.

The first, actually, restricts the access to the most of data produced by it, once to turn them available the user has to report to higher stage of appeal, not located in the Bahia State. The second practices free access, but just for data that don't belong to the digital systematic cartography.

In the CONDER case, the access to digital systematic cartography depends on institutional adhesion to the INFORMS – System of Urban Geographical Information of the Bahia State. This system was conceived like a great corporations condominium particularly for concessionaires utilities, being prohibited (implicitly) access to smaller users – liberal professionals, researchers, planning or engineering offices. An additional difficulty comes from the fact that institutions and companies should undergo the CONDER directors endorsement, once they should justify use that they intend to give to acquired space database.

The policies of spatial data access practiced by CONDER possibly cause obstacles for GIS diffusion in the Bahia State that depends on this data source, as we previously saw.

In summary, the picture above shows that the lack of data or spatial data access restriction, prices policies and the unclear definitions about State responsibilities in supporting databases costs do not favor the Geotechnology diffusion in the Bahia State.

FINAL REMARKS

Although digital databases production is a costly activity, it is common that several organizations collect the same data in the same area, city or region. Such situation demands policies that at least rationalize the spatial data production and maintenance among public entities.

To the State it would be proper to establish a more favorable environmental condition to diffuse Geomatics use among private and government institutions, through a Spatial Data Infrastructure organization able to guarantee the spatial information diffusion and access.

The SDI creation intends to avoid duplicated efforts among public organizations, to increase the quality and to reduce costs in the spatial information collection and use. In this case increasing benefits that can come from the agreement for use of available geographical data in administration activities, planning, management, research and others for which the knowledge of the territory are important.

In Brazil this subject is still not part of the government's agenda. The "Green Book – Information Society in Brazil" which it is a publication that summarizes government concern about information society and its public consequences, recognizes that GIS technologies are strategic, but it ignores institutional subjects that should be faced just now (Takahashi, 2000).

This way, Bahia State would demonstrate not to be unconcerned with the efforts that have been undertaken at an international level to overcome barriers to the spatial data exchange and geographic information interoperability, caused by several formats, lack of methods and patterns documentation and by institutional, legal and economic barriers interposed between spatial data producers and users (OpenGIS Consortium, 1998).

An "ideal" SDI, according to United States National Academy of Public Administration must have a few requirements like: a common spatial data foundation based on a set of themes and scales widely accepted available for all geographical area, which other geographical data can be referenced; this core data must be easily accessible at no or low cost; this data must be updated and maintained according to accepted standards and quality measures; Geographical data can be integrated with many other data sets to produce information useful for decision makers and the public. In this situation cost of generating, maintaining, and distributing such data are justified by public benefits and/or private gains; overlap and duplication among participating organizations is avoided wherever possible and spatial data generation, maintenance and distribution should be shared by different government level and by private sector (GSDI, 2001).

In our situation beside diagnosis presented earlier in these pages there are others problems like, for instance, lack of common spatial data foundation, common patterns or common quality measures. Responsibility for generating, maintaining, and distributing geographical data is diffuse, so duplication of efforts and data sets very often happens. To build a consistent SDI it will be essential to face another kind of difficulty related to motivation, leadership and coordination. It will be necessary to build a consensus process based on common interests and a common vision (GSDI, 2001).

A first step towards this direction was already given. Nowadays the Office of Planning, Science and Technology of Bahia State guides proposal based in those recommendation to create a coordination for a State Spatial Data Infrastructure, gathering technologies, policies and personal necessary to increase the geographical data sharing among all the government levels, private sector, third sector and academy. Some people in Bahia State believe that a very strong SDI has to be building in a gradual manner. Then the Office of Planning, Science

and Technology of Bahia State proposed the State Commission of Cartography how the forum that will catalyze the SDI setting up.

Also the Municipal city hall recently settled a Committee to build a municipal SDI coordinated by the municipal planning office and compounded for all municipal institutions.

Then a geographical information management model in a more adapted way to local context is designed just now in Bahia State and it is just possible that the Bahia State will be organized to answer to the subjects placed in this article and that have been obstructing the geotechnology diffusion in its territory, as it was revealed in the report that the research allowed accomplishing.

The REBATE project has been playing a very important role in the SDI management model designing in Bahia State. First, it produced this current diagnosis. After this, it intends to construct a SDI local model based in its members opinions and in the opinion of others state actors.

To do this, the REBATE project members are compiling a panorama of the SDI management models currently practiced in the world and the initiatives of other Brazilian states in this direction. Then the REBATE members will present typologies of the SDI management models to all the decision-makers involved with this subject in the Bahia State. Besides, it will be showed several scenarios where those typologies could occurs. This scenarios will be based on the current survey that will update the diagnosis presented here and will consider the global panorama.

Thus, the REBATE project members hope that this technological cooperative net fulfills its role as a stimulus to the state SDI building in view of the global SDI way.

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