Design Criteria in Government Institutional GIS
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Abstract
Institutional GIS is all of those criteria that can be used in the design of an efficient and useful National Geological GIS based catalogue.

As government agencies, National Geological Surveys supports as a public good all of the regional geological information in their territories. GIS and others computer methods make a good assessment in the organization and exploitation of geological resources and facts. Nevertheless there are some criteria that could be followed, in order to warranty the successful management of the data.

1. Standardized geological and digital information
   Offers to users and developers a comprehensible structure
2. General use oriented and open data structure design
   Permits the use of dataset in specific projects
3. Use of legal or recognized data source
   Define the data liability and confidence
4. Large database managing capability
   Related to the accessibility and data management facts
5. Maps referred to the national or standard map grid reference
   The Institutional GIS, as a public good, must cover all national territory and have an specific reference in order to comply with other government cartographic agencies
6. Work structure in which data entry and production are systematic
   It is implied that a National GIS infrastructure can be made only if all of the production processes are well know
7. Dataset documented and organized in a clearinghouse system

Introduction
"GIS is a system that can store, display, manage and analyze geographical information where computing systems, trained people and specials routines play an important role". People that have never hear about GIS could find this concept a little strange, because is established a linking between ideas and things. People with experience in GIS understood that definition very well, because they found that it is very important to take in account in the GIS design, all of the last enumerated elements. The success of GIS project depends on how project designers evaluate the GIS components in the context of the project objectives.

Government agencies, technical and research institutes have special roles and responsibilities, for explaining what the Institutional GIS concept means in terms of hardware, software, database design, training production routines, etc.

Also geological surveys have social compromises and products and information services should meet the public expectation. But in the GIS case, the development of institutional spatial data infrastructure have to consider a GIS conceptual model.

Institutional GIS concept has elements in common with Corporate GIS concept. But some differences could be found when objectives are analyzed.
Institutional GIS concept is quite similar to Custodial GIS concept that Boham-Carter defined as GIS developed and maintained in large organizations that have the responsibility and custodial of large database systems that are used by a lot of user for an extended period of time.

Institutional GIS concept also take in account the ideas about Infrastructure GIS defined by Murai (1999), and follow the ideas about geological information publishing given by Bernkopf et al (1993), Schmidth (1995) and Cho (1995).

These elements distinguish the Institutional GIS:

1. Standardized geological and digital information
2. General use oriented and open data structure design.
3. Use of legal or recognized data source
4. Large database managing capability
5. Maps referred to the national or standard map grid reference
6. Work structure in which data entry and production are systematic
7. Dataset documented and organized in a clearinghouse system

**Standardized Geological and Digital Information**

Standards provide the basis knowledge for data definition, and data structures. Promote the data sharing, ensuring data integrity, facilitate the data use and exploitation (Asato 1995, Burns & Glyn 1995, Bruce et al 1999, Cerdàn, 1993, Schmidth 1995, etc.). Standards provide a common basic language among developers and users.

**General use Oriented and Open Data Structure Design**

Data taken from institutions, also in geological surveys, could be used in diverse projects and for diverse people. Then dataset taken from Institutional GIS has to have a flexible design and external users can integrate the data to their GIS projects.

For the data-structure design some advises are given:

- Identify basic data with high potential of posterior analysis.
- Cartographic object and its attributes have to be defined using complete description and neutral and general terms.
- The digitized dataset have to be the best maps available at the digitizing scale and at this time.
- Map surveys, data quality, generalization criteria, whenever is possible, have to be similar in maps of the same series or version.
- The data core of Institutional GIS doesn't need to have all of the information that exists in the area that covered. It has to be defined the basic dataset that describe the geology and regional process.
- Take in mind that this kind of GIS project has to be complete, easy to use, maintain, enhance, and extend.

**Use of Legal or Recognized Data Source**

Institution or agencies can't digitize all of the dataset that they use in their own projects. They have to share basic information as topography or names with other agencies. In all of the cases, data source has come from recognized institutions, those have legal value and qualified dataset., because end user hopes that institutional dataset are the best general information that can they found and they have similar guarantees.

In Argentina, official cartography has special regulations. Topographic maps are generated by IGM (Military Geographic Institute), and regulated by National Law n. 11.723. The Mining and Geological Survey of Argentina has responsibilities for the geological surveying of the national territory given by National Law n. 24.224.
**Large Database Managing Capability**

Hardware and software selection depends on the area that the GIS has to cover, the working scales, complexity of spatial formats to handle, how may users will work with the system, publishing, and production policy.

Geological GIS are quite different from other kinds of GIS. Samples, geological cartography, satellite images, aerial geophysical images, are some of the kinds of data that geologists have to manage. Geologist needs very powerful computers, and special software that can handle a lot of different spatial formats (p.e. arc-node, spagetti, TINs, binary raster, quadtree, etc.). Geological GIS software should manage different kinds of vector and raster formats and have database management capabilities. Specific projects will need interoperable procedures with other applications as statistical packages. This kind of GIS software is usually called as integrated geological information system (Estes, 1992; Jaques L. 1992, etc).

In government agencies, systems have to manage each sheet as a cartographic unit, and also have to manage all of the sheets in continuous space. In this context, data storing, displaying and management becomes hard. GIS software needs special spatial index system, compression tools, special management system and display methods, users and login control.

GIS software could be customized using any programming language. Processes and production could be automated, special application for common user could be made.

Most of the people agree that hardware and software must be powerful, stable and safe. Data and applications should have high availability.

If you have in mind to provide GIS service to a lot of users, is probably that you have to take in account in client-server architectures. Then depending of how complex will be the queries and applications other problems have to be discussed. What kind of client the system needs? Thin clients, fat clients, web access? Is enough 100-mb network? Centralized or distributed services?

The answers of all of these last questions will depend on the project magnitude and its specific problems, and will be solved by developers and GIS project managers.

**Maps Referred to the National or Standard Map Grid Reference**

Standard or national grids are the most common and easiest methods for cartographic indexing and organizing geographical dataset in catalogs. In the special case of institutional or regional GIS, cartographic grids should cover all of the administrative area.

Map sheets organized in cartographic grids, also have a lot of computing advantages:

- Provide the basic model for geographic dataset arrangement in a continuous space.
- Using the same tile geographical definition, agencies and institutions can easy share dataset that covers same areas.

In the continuous space concept, the tile or cell, means capture unit. Capture units also means, the same mapping criteria for all of the tile and digitizing conditions.

Other advantages are related to the geometrical self-similarity property that rectangular grids have (Laurini, 1992). Self-similarity means that grid and tiles can be decomposed in minor units with the same shape. This property permits the dataset organization at different scales and the integration of partial surveys in a spatial consistent manner.

Sometimes it is not possible to have the sheet or tile completely mapped, then people need to integrate the partial dataset to the institutional database. The best solution for that problem is defining the area project as a standard part of the complete tile. The idea is work with this kind of dataset as if it was a regular puzzle. Then future surveying can complete the left sheet area.

Commercial advertisement says that GIS can spatially integrate dataset with different boundaries, the problem is those final maps are not complete maps. Using the tile decomposition in smaller units, is possible the integration of partial projects without lack of superimposed areas.

**Work Structure in Which Data Entry and Production are Systematic**

Production systems in Institutional GIS should be like industrial production systems. All of the production processes have to be well known, well documented, and well tested. Working in industrial production systems, quality and production are guaranteed.
**Dataset Documented and Organized in a Clearinghouse System**

People who work with digital data hopes that the data can be used in different projects, thinks in data popularization, and not work duplication. Those are only true if people know very well the nature of spatial dataset, and if people know how to find the data that they need.

Standard documentation methods well known as metadata support four mayor roles: locate, evaluate, extract and employ the data (Danko, 1997). Clearinghouse systems support the entire network framework of implemented metadata systems and try to minimize the duplicity efforts.

Several initiatives exist in the world some of that are ANZLIC (Australia and New Zealand), FGDC (United States), GISER (Europe), etc.

Due to the importance of geo-spatial data, Institutional GIS without Clearinghouse systems, is not conceivable.

**Institutional GIS and Institutional Policy**

The Institutional GIS development is a hard task. If there are not institutional initiative about digital spatial catalogs, all of the efforts of GIS developers will fail.

These are other suggested items that institutional authorities and project managers will discuss if they assume the development of an Institutional GIS:

- What kind of institutional problems GIS can resolve?
- Identify groups of users and potential users
- What costs the institution will assume (hardware, software, training, computer infrastructure, development, etc.)?
- Training for specialists and geologists
- Digital products definition
- Digital publishing policy definition (which digital dataset will be sold and how?)
- Copyrights policy definition
- Training for external users especially from universities, research and development institutes
- Publishing standards
- Promotion of the development of new techniques and products

**Conclusion**

The development of Institutional GIS, in geological surveys, has to be understood as a public service, and has to provide information for all of the administrative territory. The use of digital data has to be generalized, and the standards have to insure the quality and accessibility of the institutional data. The production is insured by appropriate hardware and software selection and routines design. Good data structures and management systems designs facilitate the data use and exploitation. Nevertheless not also the defined last items warranty the success of Institutional GIS, information initiatives must be defined by the proper authorities in order to promote the development of digital national catalogs.

**References**


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