

## **Brazilian Universities and the Beginning of the Brazilian Spatial Data Infrastructure**

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**Abstract:** When promulgated the Federal Decree nº 6666, at November 28<sup>th</sup> of 2008, became official the Brazilian National Spatial Data Infrastructure (INDE), used to enhance the production and the use of spatial data at all over the country. Implanting INDE will ask for elevate efforts by several public services in different areas. Initiatives like this were adopted by other countries like Colombia (ICDE), United States (NSDI), Portugal (SNIG) and Spain (IDEE), and also, the European and Andean directives (respectively, INSPIRE and IDECAN). However, studies for conception and implementation of INDE, led by CONCAR, are not recent. This paper intends to approach the role of the universities, public and private, at the process to implant INDE at the country and the perspectives of change due to its establishment. A research was made to seek published or ongoing papers and projects led in Brazilian universities related to Spatial Data Infrastructures (SDI), investigating their main focuses and the research projects they are included in. Also, the main institutions for graduate and postgraduate in Surveying and Geomatics Engineering were contacted to hear them about the ongoing projects with unpublished results. Besides the Military Institute of Engineering (IME), there were replies from Catholic University of Minas Gerais (PUC – Minas), Federal University in Viçosa (UFV), Rio de Janeiro State University (UERJ), São Paulo State University (UNESP – Campus Presidente Prudente), National Institute for Spatial Researches (INPE) and Federal University of Paraná (UFPR). The Executive Secretary of the National Commission for Cartography (CONCAR) was asked to talk about its opinion about the participation of Brazilian universities at INDE implantation. Some related jobs were started, earlier or later, and CONCAR is interested in larger participation of universities in specialist committees and creating plans to enable and to hone human resources. Therefore, there is a huge expectation for the integration between CONCAR and Brazilian universities occurs properly, so the country may take profit of benefits carried on by a consistent INDE.

**Resumo:** Com a promulgação do Decreto Federal nº 6666, em 28 de novembro de 2008, tornou-se oficial a Infra-estrutura Nacional de Dados Espaciais (INDE) brasileira, visando a otimizar a produção e o emprego dos dados geoespaciais no país. A implantação da INDE demandará esforços de diversos órgãos públicos de diferentes áreas de atuação. Iniciativas similares foram adotadas por outros países como Colômbia (ICDE), Estados Unidos (NSDI), Portugal (SNIG) e Espanha (IDEE), além das diretivas

das Comunidades Européia (INSPIRE) e Andina (IDE CAn). Contudo, os estudos para a concepção e a implementação da INDE por parte da CONCAR não são recentes. Neste trabalho, será abordado papel das instituições de ensino superior no processo de implementação da INDE no país e as perspectivas de mudanças com sua oficialização. Foi realizada uma pesquisa buscando trabalhos publicados ou em andamento sobre Infra-estruturas de Dados Espaciais (IDE) em universidades brasileiras, analisando o enfoque dos mesmos e as linhas de pesquisas em que estão contextualizados. Foram contactadas, também, as principais instituições formadoras de Engenharia Cartográfica para saber sobre a existência de trabalhos em andamento sobre o assunto. Além da situação no Instituto Militar de Engenharia (IME), responderam à pesquisa representantes da Pontifícia Universidade Católica de Minas Gerais (PUC – Minas), da Universidade Federal de Viçosa (UFV), da Universidade Estadual do Rio de Janeiro (UERJ), da Universidade Estadual Paulista (UNESP – Campus Presidente Prudente), do Instituto Nacional de Pesquisas Espaciais (INPE) e da Universidade Federal do Paraná (UFPR). A Secretaria Executiva da Comissão Nacional de Cartografia (CONCAR) foi procurada para emitir sua opinião a respeito da participação das universidades brasileiras na implantação da INDE. Foi observado que há trabalhos iniciados, mais recentes ou há mais tempo, e que há interesse da CONCAR em maior participação das universidades nos comitês especializados e na elaboração de planos de capacitação de recursos humanos. Assim sendo, há uma grande expectativa de que a integração entre as universidades brasileiras e a CONCAR ocorra em tempo ótimo, de modo que o País desfrute dos benefícios de uma INDE consistente.

### ***Introduction***

The myth about spatial data acquisition and publishing would be interesting only for geographers and surveying professionals has loosing strength at latest years. Biologists, geologists, agronomists and engineers of many specializations produce and use both geospatial data and information useful to activities in other knowledge areas. Therefore, establish rules and standards to produce and publish cartographic products could not to fit to systematic surveying done as 40 years ago.

When promulgated the Federal Decree nº 6666 (Brasil 2008a), became official the National Spatial Data Infrastructure (INDE), Brazilian initiative to, in sum, optimize both production and use of geospatial data and its metadata by public entities. Due to this decree, those entities who produce geospatial data must orient its activities due to conform to standards and norms established by National Commission for Cartography (CONCAR).

Initiatives like this were adopted by other countries like Colombia (ICDE), United States (NSDI), Portugal (SNIG) and Spain (IDEE), and also, the European and Andean directives (respectively, INSPIRE and IDECAN). However, studies for conception and implementation of INDE, led by CONCAR, are not recent. Some workgroups were created to deal about the main demands related to National Cartography, gathering

representatives of its constituent entities and invited experts in related areas of knowledge. At this roster of invited people, there was a discrete participation of academic community, unlike occurred in Spain, for example. The distances across the country, the costs for transport and the personal schedules may explain the difficulties to congregate representative groups of productive and academic institutions.

Brazilian universities are shelters of professionals who carry different levels of experience, acquired along years in contact with college environment, teaching, orienting and managing academic or institutional projects. But, since 2000 to 2008, when Ministry of Education was inserted as a constituent of CONCAR (Brasil 2008b), the universities had no official representation at that Commission. Surely, the contact with the productive activities is not as intense as the one got by the National Cartographical System entities, but implanting a local, regional or global IDE demands actions in **Education**, **Training** and **Research** (Warnest 2005), activities directly related to universities.

### ***Education and Training***

Considering that public universities are comprehended by the aforesaid decree, becomes necessary to adapt contents taught in courses related to geospatial data production, to geographic information systems (GIS) and spatial databases, for example. In same way, projects, dissertations and thesis should be oriented to create products ready to interlock to INDE, so the information obtained could be used in public interest applications. Despite the new projects, every projects involving geospatial themes should be gathered to populate the databases.

By adopting specific norms and standards, every public entities that produce spatial data must receive proper training to gather and store existing data and the methodology to produce new datasets. It's also necessary training people responsible for support in computational infrastructure for warehousing and publishing geospatial information.

Counting 27 states, more than 5,000 cities, and the federal entities, it's noted the huge demand for training programs and for people to apply them. Colleges of Surveying Engineering, Geography and other similar would have a fundamental role at this process by relaying knowledge even in faraway towns.

### ***Research***

Before the submission of this paper, a few articles were found approaching Spatial Data Infrastructures (SDI) published by Brazilian universities programs. The most of papers found describe basic concepts, computational architecture to support SDI and specifics demands to integrate different data sources, including semantic aspects, usually followed by local or regional case studies. However, step by step, this subject gets

stronger and some researches are ongoing, specially, at geographical data computational management area.

May be emphasized the initiatives of Informatics College at Catholic University of Minas Gerais (PUC – Minas), where there are jobs about subject developed since 2005, highlighting themes related to computational architectures, for example, Services Oriented Architecture (Oliveira *et al.* 2008). The Federal University of Minas Gerais has some recent ongoing projects oriented to gazetteers, lead at Department of Computer Science.

Other institution with ongoing researches about IDE is the Informatics Department of Federal University in Viçosa (UFV), also in Minas Gerais, where the approaching is developed over GIS and Spatial Databases research lines. Other Colleges in this University are beginning to store their data in SDI and, with INDE becoming official, all UFV began to adhere it.

Talking about Colleges of Surveying Engineering, has been observed a reactive (not resistant) behavior to the integration to INDE. That's because ongoing projects and researches about IDE and, particularly, about INDE, are still incipient. In contact with the Colleges, it was noticed that the initiatives to adapt the disciplines and to propose projects related to INDE were waiting its complete regulation, although all of them were tracking remotely the process of proposing and implementation. The São Paulo State University (Campus Presidente Prudente) informed that the ongoing projects are oriented to consult the existing specifications published by CONCAR to be accustomed to new standards.

At the Military Institute of Engineering (IME), Rio de Janeiro, a research project for graduate students was led to analyze the metadata profile developed by CONCAR (IBGE, 2009), that gathered a lot of experts in a workgroup dedicated to propose a metadata profile for all the country, based on ISO 19115. The results of this project are being used to develop a software to retrieve existing stored metadata and to create a interface to ease the user to complete the profile for grid products (digital images).

Two dissertations related to SDI were presented in 2009 at the Geomatics Masters Course of Rio de Janeiro State University (UERJ). First of them was oriented to acquire geographical data by Digital Photogrammetric Methods, according to the data structure proposed by CONCAR, storing them in relational databases (Borba, 2009), leaving a paper as contribution (Borba *et al.*, 2008). The second one approaches the creation of a SDI for applications at Amazon, not related to the National one (Costa, 2009).

At Federal University of Paraná (UFPR) there is an ongoing doctoral thesis in Geodetic Sciences approaching the international standards adaptation to Brazilian SDI. The research, despite to imply the participation in an important congress for geotechnology

at the country (CAMBOIM *et al*), it's still necessary a more accurate orientation for the research, as said by the advisor.

The National Institute for Spatial Researches (INPE) plays the role of university, because of Master and Doctoral courses in Remote Sensing, and the role of producer, because of creation, processing and broadcasting of products based on orbital images. Its participation in INDE have focused the impacts that the changes may cause to the ongoing processes. However, INDE has not been inserted at academic activities.

Other contacted colleges did not replied to the contact was made up to the date this paper was submitted. So, there's no ways to comment about the existence of initiatives about integration of both teaching and research programs at those entities.

### ***Expectations***

Now that INDE became official, CONCAR got a series of obligations just like public entities producers and users of geospatial data. So CONCAR is working to implement the INDE practical activities. It's undeniable that impacts are expected when robust geospatial datasets, produced along many years over a large territory country like Brazil, are gathered and standardized. It will demand efforts to be spent by several institutions acting in several knowledge areas.

According to the CONCAR Executive Secretary, this plan must foresee the increase of relationship between the Universities and INDE. The great opportunity is analyze and propose changes to specifications presented for public opinion poll. Besides, it's been studied the creation of a Committee for Qualifying and the convocation of volunteers experts for participation at the CONCAR established Committees activities. This way, a great impact is expected due to the INDE both implementation and consolidation, with large possibilities to Brazilian universities act.

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