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Certification of geospatial data

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Geospatial data, also known as spatial data, geo data, geographic data or GIS (geographic information system) data, are a collection of facts or information that 'pertains to a geographic location and characteristics of natural or constructed features and boundaries on, above, or below the Earth's surface; especially referring to data that is geographic and spatial in nature' (www.dictionary.com). In the simplest terms, they refer to data that contain spatial elements and topology with location characteristics. They are often accessed, manipulated or analysed through GIS. Thus, the definition can be expanded to include spatial, temporal and thematic aspects that permit characterizing any entity in space and time[1].

In 1960s space technology was initiated in India, providing enormous satellite spatial (raster) data with a mission to contribute to the national development and play an important role in solving problems of the common man. Since then, over 100 satellites have been launched to provide datasets, which are used as input to develop geospatial data. Similarly, progress has been made in GIS database generation and increasingly identified to support dissemination of GIS data. Today, users rely heavily on digital sources like data warehouses, spatial data portals and libraries, whose numbers have increased with time. Thus users have a wide range of sources that can provide such datasets. The spatial data infrastructure (SDI) and open geospatial consortium (OGC) standards address metadata requirement and data integration.

In spite of these developments, there remain issues in the development and usage of GIS data. One of the challenges is inter-operability of such data which could be addressed by following SDI norms at different levels (e.g. National SDI or State SDI)[2]. The other challenge is compliance of legal usage of spatial data, development and sharing, which is true for many countries, especially developing countries. The main content missing among many geospatial data is source information and its authentication, which is subsequently related to supply of GIS data (including development, acquisition and compilation). For long, survey agencies (like Survey of India) played a main role for generation, authentication and publication of such geographic information. But such agencies are not able to update and match the digital data requirements as changes on land surface are occurring at much faster pace. And for most of the themes, geospatial database generation is costly and labour-intensive.

In such a scenario, private players have come into play to generate and use these datasets, but have limited options to share such. At present frontier technologies like global positioning system (GPS), remote sensing inputs and citizen sensor concept[3], have revolutionized surveying and production of rapid and accurate geo-enabled data. The big data concept (variety, velocity and volume) adds to such massive and constant flow of details and information. This could be the solution for updating maps more seriously and making them more accurate[4]. Many of the datasets available freely, such as volunteered geographic information (VGI) are often questioned for accuracy and authenticity. Such challenges limit their usage for scientific exercises and contribution to policy analysis[5]. This results in duplication of data-generation efforts as each consultancy service and data utilizer prefers generating these in its respective warehouse[6,7]. The availability of cheap manpower in developing countries supports such silos. Thus we are not able to move beyond data generation to leap onto data handling and analytical tools. However, time demands this for science, society and system.

Thus the GIS community needs the concept of certification of geospatial data. Certification refers to 'confirmation of certain characteristics of an object, person, or organization'. Such confirmation is often provided by review (in/external), audit or evaluation. In the context of geospatial data, it would include documentation and implementation of spatial and non-spatial data quality assessment, which would allow judgement of updates, usage and sharing. Certification of geospatial data will ensure frequent usage and also as a factual and good data quality measure. Certification or certificated data would also eliminate risk of any liability, law suits against developers and the wide range of users. This would underpin potential implication of spatial data quality[8–10].

Certification would also facilitate maintenance and timely upgradation of spatial data for a variety of usages. It

would enhance the level of conceptualization and mensuration provided by the geospatial datasets[9]. Conceptualization signifies the scale and standard of abstraction of the selected theme, related objects or the real world. Mensuration, on the other hand, signifies modified aerial unit problem, the specification of measuring methods and requirements for capturing details. Certification will bring confidence among data generators and users regarding error, vagueness and ambiguity, if any[11]. Therefore, certification would ensure users not only about technical, administrative and service details of the dataset, but also timeline of updates taken.

Certification could consider the details of Technical Committee 211 of the International Standardization Organization (ISO/TC211), like 19113 (Quality principles), 19114 (Quality evaluation procedures) and 19115 (Metadata)[12]. The data quality elements like completeness, consistency, continuity, contiguity, geometric and positional accuracy and temporal and attribute accuracy should be essential components for such certification. Geospatial data used in the country must be constantly rigorously tested and updated to ensure fitness. The format can be developed using the NSDI/SDI norms and also using sophisticated tools and techniques. Thus, generation of database at multi-production houses would be optimized. The Government agencies holding the provision of authentication of spatial and topographic details for classified locations owing to strategic reasons is well appreciated. However, for other geographic regions, such hurdles for research and development could be overcome.

Some of the major initiatives towards this are National Map Policy (2005), National Spatial Data Infrastructure (2006), State Chief Secretaries Conference (2011), National Mirror Committee on 'Geospatial Information' for ISO TC 211 by Bureau of Indian Standards and National Data Sharing and Accessibility Policy (2012). But none of these directly stresses upon the certification of geospatial database. The newer concept of the regulatory authority of geospatial data [The National GIS (NGIS) Mission and Indian National GIS Organization (INGO)], is an effort to bring together all the geospatial data-generating agencies on a common platform and provide geospatial data services to all stakeholders and public at large. The certification of geospatial data under the NGIS 'service-oriented framework' would facilitate geospatial services for the larger benefit of the country.

It is appropriate that data quality be maintained at all stages of geospatial database generation, maintenance and usage. It is more important to update the map for any changes that have taken place on the ground. In dynamic landscapes, updating the information on spatial and temporal domain needs to be certified before use. Such certification would authenticate reasons and logic of any type of change done to the data, while adding, editing and updating them. This is not only useful for in-house data development, but also for data customers and users at all levels, which will certainly enhance research and development capabilities using geospatial data at the national level.

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