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**Department of Electronics and Information Technology
Ministry of Communications and Information Technology**

**RECORDS OF DISCUSSIONS HELD DURING THE NATIONAL CONFERENCE ON
GIS (GEO-SPATIAL INFORMATION SYSTEM)**

Venue **Conference Hall 1007, Electronics Niketan, New Delhi**

Date **20th February, 2015**

Time **09:30 Hrs**

The National Conference on GIS (Geo-Spatial Information System) that is an integral part of the Digital India programme was held on 20th February, 2015 under the Co-chairmanship of Secretary, Department of Electronics and IT and Secretary, Ministry of Earth Sciences, Government of India. The list of participants is at **Annexure 1**.

2. **Additional Secretary (e-Gov), Department of Electronics and Information Technology (DeitY)**, welcomed the participants. He briefly explained that Digital India is all about bridging the digital divide between have and have-nots so that inclusive growth can be achieved. He said that holistic approach on implementation of GIS needs to be finalized so that GIS is optimally utilized by Citizens, Planners and Policy makers. He further stated that location data will keep on growing exponentially and related services will demand geospatial data with more accuracy and higher resolution. He further said that Geospatial data set the context for citizen's demographics which can help Government in evenly distribution of resources. He stated that though a lot of progress in GIS has been made both at National level and at some States but

the GIS is yet to realize its full potential. He emphasized on the GIS to be made a part of workflow of each Government/ Private projects. He then requested President and CEO, NeGD to explain the expected proceedings of the workshop.

3. President and CEO, NeGD stated that the workshop will lead to brain storming discussions on five focus groups, for which, participants from various Government Departments and Industries would be evenly distributed.

4. Director, NRSC stated that the data collection and data processing of ~600 GB per day is being handled by NSRC. He then said that the GIS ecosystem comprises of three things namely data, software application and content. He also said individual requirement needs to be differentiated and therefore overarching framework needs to be developed so that mapping standards fir Survey of India, thematic mapping and maps from private sectors could be leveraged. He also informed that 70% of thematic mapping of India is already done. He then explained value addition provided by Bhuvan in natural resource management and by Android based Drishti in watershed management. He apprised that NUIS has helped in master town planning for 152 towns, which would be extended to 4041 towns. He also apprised that National Database for Emergency Management with resolution less than 1 m has been made operational by MHA but is currently not open to Public. He stressed on the flexibility of the GIS platform so that Citizens, Government and Private Players can add layers of their choice for their specific usages. He apprised that the Govt. of Andhra Pradesh is already doing house tagging using GIS. He cautioned that an idea of regulator on GIS would be a non starter.

5. Surveyor General of India stated that there are three sources of geo-spatial data namely map, satellite and from field. The requirements from earlier times have changed over a period of time. Unlike earlier times, the requirements in terms of accuracy, resolution and high ened

modeling has increased substantially. He also said that specific modules for specific needs to be developed.

6. Secretary, MoES stated that India is growing rapidly and the challenge is how to sustain the growth. For this, he suggested that there is a need to understand aspirations of citizens, accountability of government and delivery of services. He suggested a robust GIS that allows resource planning and utilization, decision support and web enabled online access. He counted that there are a large number of GIS applications developed in the country but the problems are most of these applications are data centric and technology centric rather than decision centric. He also said that Tsunami Warning Information System has been developed in a record time of 6 months. He stated that utility of the GIS for fishermen have proved to be very beneficial and the impact is in tune of Rs 34000 Cr contribution to GDP. He stresses on the need to address the economic impact of GIS so that policy makers/ decision makers could be convinced in implementation of GIS in their domain. He then suggested nine critical points to be considered while doing the deliberations in Focus Group discussions.

1. Database should be created as most of the primary databases are not GIS ready.
2. Data, image and index on the database should be updated automatically on regular frequency.
3. Geo-sensors and Wireless-sensors should be used. New technologies may be required say for measuring soil moistures.
4. How to integrate and harmonize GIS data coming from different sources.
5. How to handle Data Modeling and Data mining.
6. Robust networking is required for connectivity. NKN must be discussed and strengthened.

7. How to address local issues like resources and its proper utilization and global issues like climate change, natural disasters etc.
 8. How to address capacity and capability gap both in Government and Private sector.
7. Secretary, DeitY stated that there is no dearth of technologies and standards in the field of GIS but the real challenges are in terms of utilization by Stakeholders like Central Government, State Government and Local Government. He said that there are huge varieties of applications and at the same there is huge variance. The objective of workshop is how to integrate these applications so that these remain loosely coupled and with federated database but the integrated service delivery and decision making get facilitated. He also said that expectations from the workshop are as follows:
1. To finalize the institutional mechanism to disseminate the GIS technology to States/UTs and to sensitize States on standards and GIS usages
 2. To use big data tools to get the need based information from massive GIS data
 3. To undertake crowd sourcing for sustainable growth.
8. President and CEO, NeGD thanked the Chairman and requested the representatives of selected States and Institutions to make their presentation on best usages of GIS.
9. President, AGI made a presentation on GIS representing the industry perspective. His presentation emphasized on the Federated Structure of GIS platform. The presentation made by representatives of AGI, State of Rajasthan, State of Gujarat and NIC are placed as **Annexure 1, 2, 3 and 4** respectively.
10. Thereafter, five focus groups have been formed and each group deliberated on their topic for around one and half hours. The presentation cum recommendations of each focus groups was

made in the Workshop presided by the AS(eGov), DeitY. The key recommendations are as follows:

- a) Group 1 Recommendations (Creation of the GIS platform including linkages with Business Analytics, Core Governance Processes and Citizen Services): A unified GIS Platform that aims at providing services to users of all types should be developed which is scalable and supports a high number of users with various needs. It should have the following design considerations:
 - a. Open Standard based GIS System: The platform should be built on open standards which provide interfaces irrespective of the technology stack being used by consumers and providers of GIS data and services.
 - b. Self Service for Citizens and Government users: It should provide open access to the extent possible to citizens and government users to obtain GIS data and utilize it for their needs.
 - c. Open API based collaborative platform: In order to truly accrue the benefits of the GIS data collaboration in terms of data creation, data validation and data utilization should be supported in the platform.
 - d. Linkages of Domains for work-flow enabled services, data validations: To expedite data validation workflows should be provided for agencies which can identify data sets for their domains and validate these with their own information. Also workflows should be provided to user departments who can integrate GIS based information within their workflows.
 - e. Leveraging GIS data for value-added services like

- a. Predictive and Projective Analysis,
- b. Hot spots Modeling : Trend and Impact Analysis
- f. Decision Support System
- g. GIS enabled dashboard for visualization

The proposed federated architecture will have attributes such as hosting on GI Cloud, creation of Collaborative Platform, service integration, interoperability, compatibility of Data sets and integration of multiple devices .

- b) Group 2 Recommendations (GIS data creators, aggregators, and users: Expectations, Concerns & Way Forward): The Group opined that major concern of the data Aggregators/ users is the quick availability of the base data to kick-start any GIS based project. Survey of India has made available the base data but it is on the scale of 1:50000 which, the group felt is obsolete and hence such data for public usage must be updated to at-least 1:10000. The group also felt that there is no policy on Standards of GIS and hence different creators are following different formats. It was also informed that a policy on these standards is under process at DST as part of national GIS initiative (draft not yet cabinet approved).

While recognizing that technology exists for even real time update, the group stated that there are no overall incentives for keeping the data updated at any frequency. There were different view on ideal frequency, some participants felt that one-two year old data may fit the bill and is also practical to achieve. However some participants felt that at the minimum quarterly updations are

needed. There was agreement that the particular situation / project will dictate the frequency of update and also the urban data would need frequent update than rural data.

The group was unanimous in its expectation from Survey of India which are inclusion more field features, provide details upto cadastral (1:4k), lead in defining standards, contribute to an ecosystem which can take up specific needs/ tasks, accredit surveyors (towards base data), creation of infra for all the above, taking lead in infrastructure wrt automated production mapping systems.

From the data aggregators perspective, it was felt that there should be Strengthening of institutional setups, mechanisms and process wrt: Human, financial and other resources; Capacity-building; Technology; Legal framework.

From the data users / aggregators perspective, it was felt that the focus should be on

- a. REPOSITORY: In terms of what kind of data lies with which agencies. There should be higher level of General awareness and actual availability of exhaustive lists of data sets in public & private sectors with frequent updating as required .Available data layer list should be published time to time

- b. PLATFORM: In terms of State Designated Agencies / SDI/ State GIS in all states, which currently is available only in few states. These would then individually hook up to the national platform.

In terms of Data Creator the focus should be on

- a. Active and open engagement with Survey of India through AGI; Mapping Agencies; and also NSDI.
- b. Views of Group 3 [in terms of policies] should be taken.

c) Group 3 Recommendations (Enabling Policies for National GIS):

- i. Institutional Framework: The discussion contemplated on building one regulatory authority under the aegis of PMO to oversee all aspect of spatial data acquisition, production and dissemination. Service Level Agreement among all stakeholder agencies for data sharing, access and services, also the group discussed ownership of the IPR of the spatial data and responsibility for updating and maintenance. The group has suggested the following institutional framework -

- a. PMO -

- i. National Geo-Intelligence Agency (foundational data and vector layers)

- ii. DeitY should be the principal Nodal agency

- b. National Cyber security to be embedded

- ii. Acquisition (Aerial & Terrestrial): The group recommended need of a comprehensive policy for data acquisition, access, sharing and use that would provide for data acquisition through multiple techniques such as LiDAR, Aerial Photography, UAVs and High Resolution Satellite Imaging. The policy should also cover hosting of content on a web/cloud platform and involvement of Private Sector in data acquisition, production and dissemination. Due deliberations are required for Licensing Policy, Open Data Policy, Creation of Task Force etc. The group also recommended on purchase of imagery and other geo content from the producers both Government and Private Organizations.

A comprehensive data policy should allow Low altitude UAV to capture data (Ministry of Home), All other Sensors (GNSS, LiDAR, SAR) to capture data, Wireless Planning Wing/DOT (Licensing policy), Remove the existing dichotomy in licensing wherein GPS enabled mobile handset are license free while GPS devices with communication are licensed, Overcome delay in permissions, Enable easy imports of equipments so as to overcome the menace of Grey market of Chinese equipments. Govt also seems to suffer likewise for procurement for Govt, Take proactive measures to curtail smuggling of Geo- spatial data on CD. Policy should specifically deal with Ownership on the Right to Access, Security of Data, Presumption of Openness with caveats, Technological Solutions to “restrict” : price differentiation, Affordability, Accuracy, Quality, Reliability, Storage,

Update/currency, Openness to RTI & OSA, Product Liability in terms of damage/loss/ privacy, Evidence in terms of storage/traceability etc.

- iii. Access and Use: GIS Policy should aim at Opening Non military data, Making Foreign Satellite Imagery available, Ensuring Private & Government sector data be available in open access, Formulation of Encryption Policies for security, Making Amendments in IT Act, so as to cover GIS and address Security concerns, Adoption of PPP model on basis of NDA, Ongoing Upgradation, National Map Policy 2005; RS Data Distribution Policy 2001&2011 to be superceded, Amendment of Normative laws, Specific legal concerns (Design grade data in terms of criminal and financial liabilities (definitions)).
- iv. Dissemination: Government should work for multi-layers of access protocol for different level of use and this should get reflected in NDSAP also registration to common database. There should be a GIS policy for critical infrastructure to enable them to monitor and use of non-Indian satellite imagery only through one clearinghouse should be considered.

d) Group 4 Recommendations (Data standards for capturing, storing, sharing and use of geospatial data): The discussion deliberated on standards for data creation, storing, sharing and use of geospatial data which is simple yet effective.

- a. Use of Open Standards: It was unanimously agreed in the group discussion that Open standards should be used to ensure a high level of interoperability across platforms, databases, development languages, and applications. It allows stakeholders or anyone interested to download and

redistribute raw data for its use. The open standard encompasses data capture, exchange, storage, updates, services etc. It was agreed that Open standards from ISO/OGC/BIS/NSDI should be adopted for ensuring shareability, inter-operability and usability of GI and related Geo-ICT tools/ processes in various applications.

- b. Metadata Standards: Metadata is key to data access and discovery. It was agreed in the meeting that NSDI metadata standard Ver 2.0 developed using ISO 19115 data-metadata standard being evolved as BIS standards should be adopted.

The following are the specific recommendations for data capturing, data sharing, data usage, data storing–

- a. Data Capturing: It was agreed in the discussion that it will neither be feasible nor practical to impose any standards for GIS data capturing. The reasoning for that is as follows –
 1. Various agencies collect data from various sources for various applications and in various formats. As lots of data is already captured in different formats, it will not be feasible to impose any standard for data capturing.
 2. Data comes from disparate sources with varied formats, projection system, Datum etc.
 3. The accuracy of the data primarily depends on the application needs of concerned department and user needs.

4. Respective nodal agencies of Central/State/Local govt. have defined the accuracy level (in practice) for different projects.
- b. Data sharing (WFS/GML): It was recommended by the group that Geography Markup Language (GML) (ISO 19136) should be used as a standard exchange format for sharing of vector geo-spatial data. Adoption of GML requires data reengineering. At the time of sharing GML data, 2 files- one related to the underlying data model (*.xsd) and the other related to the real data (*.xml) should be used. Web Feature Service (WFS) (ISO 19142) (or products conforming to the ISO 19142 specifications) should be used as the standard interface specification for receiving and sending requests/ responses for sharing of GML data between GIS servers and clients.
- c. Data sharing for visualisation (WMS): Visualisation of geo-spatial data by the end user is key to the decision-making process. Web Map Service (WMS) standard interface specification (ISO 19128) (or tools/ products conforming to the ISO 19128 specification) should be used between the GIS server and the client for receiving/ sending requests for sharing of the end product (map). The format for sharing the information is usually JPEG or PNG – a standard.
- d. Data Usage: There are different formats getting used for data usage. The group recommended using JSON/Geo JSON data format for usage of data or in applications.

- e. For Raster data, GeoRaster or any other open formats may be used. For Terrain data, Lidar, Sonar ISO Standards should be used.
 - f. Data Storing: It was recommended by the group that no proprietary formats/ specifications for databases should be used for storing data. NoSql data model with geography semantic support may be considered for storing data as it conforms to the Open Data standards. It was also agreed that the chosen database should have support for powerful queries including free text, geospatial taxonomy relationships and object components. ISO standards like ISO 19103 (Conceptual Schema Language) and ISO 19109 (Rules for Application Schema) are two important standards for developing the standardized application schemas for sharing with the end users/ machines.
 - g. Other Recommendations:
 - 1. While sharing Geo spatial data, due care should be taken to provide the details of Datum and projection information in a standardized format complying with ISO/OGC/BIS BIS/NSDI standards.
 - 2. In order to avoid redevelopment of standard specs, BIS may co-brand available standards from ISO/OGC for expeditious adoption.
- e) Group 5 Recommendations (Capacity-building requirements for implementing Geo Spatial Governance): The group deliberated on building capacities at the

institutional and organizational level and came up with the below recommendations for strengthening the private and public sector institutions-

- Identified the capacity building requirements for each of the major e-Gov roles and students detailed as below-
 - The Leadership level should be sensitized to best practices of GIS, while creating spatial awareness at National and International levels. A one day sensitization program can be designed for the same. The Leadership can also read about GIS via magazines like GEOSPATIAL world, Directions Magazine, My coordinates etc.
 - The Government representatives (CEO / CTOs) should be imparted short courses on Geo informatics spanning 2 to 3 days, focusing on IT, geography, geospatial technology and associated domain knowledge. Such courses shall enable them to understand and think spatially. Such trainings can be availed from ISRO, IIRS Dehradun, Anna University, C-DAC, NIST etc.
 - Government employees at the Implementation level require to be trained in Project Management, Public Procurement and Vendor Management for Geospatial Technology. They should have knowledge of the latest on goings of the geospatial industry, latest survey technologies and can refer to journals like GIM international. They may attend short term course for 5 days on Geospatial application. Such courses are available at ISRO

(RRSSC, SRSAC, IIST), NIFM, Anna University, IIRS Dehradun, C-DAC, NIST etc.

- Technical resources working under the strategic control of the Government need to develop knowledge in IT and Geospatial domain. They may avail pursue PG level courses e.g. ten month diploma in GIS and IT, two year M.Tech/ 4 year BE degree in GIS being provided by IIRS, Anna University etc. More PG level courses need to be developed for building capacities in the Geospatial domain.
- Students can be trained as per the guidelines of MHRD for, National Task Force on Geospatial education. Provision for taking GIS Class 11 onwards as an optional paper can be made. Industry participation should be encouraged for offering internship, research opportunities to students.
- Existing Geospatial education infrastructure in academic institutions should be strengthened.
- Skill up-gradation programmes should be conducted for faculty in order to align their knowledge base to current and new GIS technologies.
- Capacity building should be undertaken at departmental training institutions like FTI, NPTI etc. so that they can further conduct refresher courses for serving officers.
- Engagement with the private sector should be undertaken continuously and proactively for augmentation of GIS resources.

- Institutional arrangement need to made in order to facilitate production and exchange of harmonized Geospatial datasets
- Institutes working on GIS skill training in the fields of agriculture, mining, disaster management etc. should be strengthened
- Using available connectivity through NKN, a national Geospatial research and training grid should be established for sharing case studies, training material etc. so that virtual GIS training capacities can be built.
- Various E-Courses and modules need to be developed.

The group also discussed about the various steps Government can take to strengthen Geospatial capabilities at Government Organizations. The group came up with the following recommendations-

- A GIS index needs to be created
- Guidelines for usage of GIS in Government Projects should be developed to resolve implementation issues
- The Government organizations in India need to be educated so that they are able to consume services hosted on the GIS platform.
- A separate cadre for Geographic Information Officer (GIO) should be created to build and retain geospatial competencies in the departments.
- A Policy framework should be prepared to support the development exchange and application of Geospatial data existing in some countries
- A hub and spoke model for GIS capacity building can be undertaken up to the district level

- Provision to depute Govt. officers for post graduate GIS courses can be made.
- A body for registration/certification of GIS engineers should be institutionalized by the Government

It was suggested during the GIS workshop that at the graduate level, students should be provided the opportunity to pursue papers on GIS, Mathematics and Geography simultaneously which would help in building international quality Geospatial talent in India.

11. After discussions, the following recommendations have been agreed in the Workshop:
 - i. GIS, Gujarat should be replicated in all States/ UTs.
 - ii. A comprehensive report including implementation plan would be submitted by each Focus Group.
12. Director (Programme Management), NeGD, DeitY thanked the Chairman and participants of the Workshop for their contributions to the discussions.
