GIS IN INDIA – OPPORTUNITIES FOR INDUSTRY SERVICES

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First Semester

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EO/GI- evolution over four decades

- Government- private ownership shift
- Blurring boundary of military and civil commercial systems
- Performance uplift (Life, reliability, orbital capacity, sharper images)
- Growth in number of actors and variety of data
- EO as driver of expansive GIS applications
- EO, GIS and Positioning convergence
- Easy and wider access- even on mobile phones
- Open access policies for high quality data
- Bigdata – EO data buckets
- Small satellites revolution-

high resolution, high cadence

HIGHER PERFORMANCE
EXPANSIVE
APPLICATIONS
CONVERGENCES
UBIQUITY
PRIVATE SYSTEMS

Key features of these trends in EO

- Large proliferation of Earth observation missions. Developments in sensors now offer wide range of data
- Traditional players/ space agencies too are adding diverse range of EO satellite systems gathering several million square kms and peta-bytes of data every day.
- Revolutionary changes brought-in the new class of operational mini and microsatellites
- Constellations are order of the day. The DMC (Disaster Management Constellation) offered an international program led by SSTL for rapid-response disaster monitoring and mitigation, Land cover and vegetation information, Hydrology mapping, Fire and burn scar mapping, Flood monitoring etc.

EO/GI Trends

- Advances in digital data analysis and geo-spatial data fusion – with data mining and data analytics

- Emerging National GIS and even elements of a Global GIS.

- A number of inter-governmental programmes around EO/GIS have emerged and are coordinated through forums like UN-OOSA, GEO, ISPRS, and GSDI, and, these efforts have made phenomenal advances in regional and global applications development of EO and GIS.

- Geo spatial information/ their delivery are further being revolutionised by many emerging areas of ICT including smart sensors and systems, new generation of analytics, Cloud technologies, Internet of Things

- Alternate platforms like Unmanned Aerial Systems and changing user preferences.

GIS TECHNOLOGIES HAVE GREAT POWER OF INTEGRATION……

"INTEGRATE" TO A COMMON FRAME TO BUILD A NATIONAL GIS

"INTEGRATE" GEOGRAPHICALLY TO A SEAMLESS – NATIONAL GIS

"INTEGRATE" TEMPORALLY AND UPDATE REGULARLY

"INTEGRATE" FOR INTER-OPERABILITY ON A "COMMON" NATIONAL GIS STANDARD

"INTEGRATE" MODELS AND PREDICTIVE GIS ANALYSIS

"INTEGRATE" INTO DECISION-MAKING PROCESS

"INTEGRATE" BENEFITS FOR CITIZENS, ENTERPRISE & GOVT

Commercial EO systems

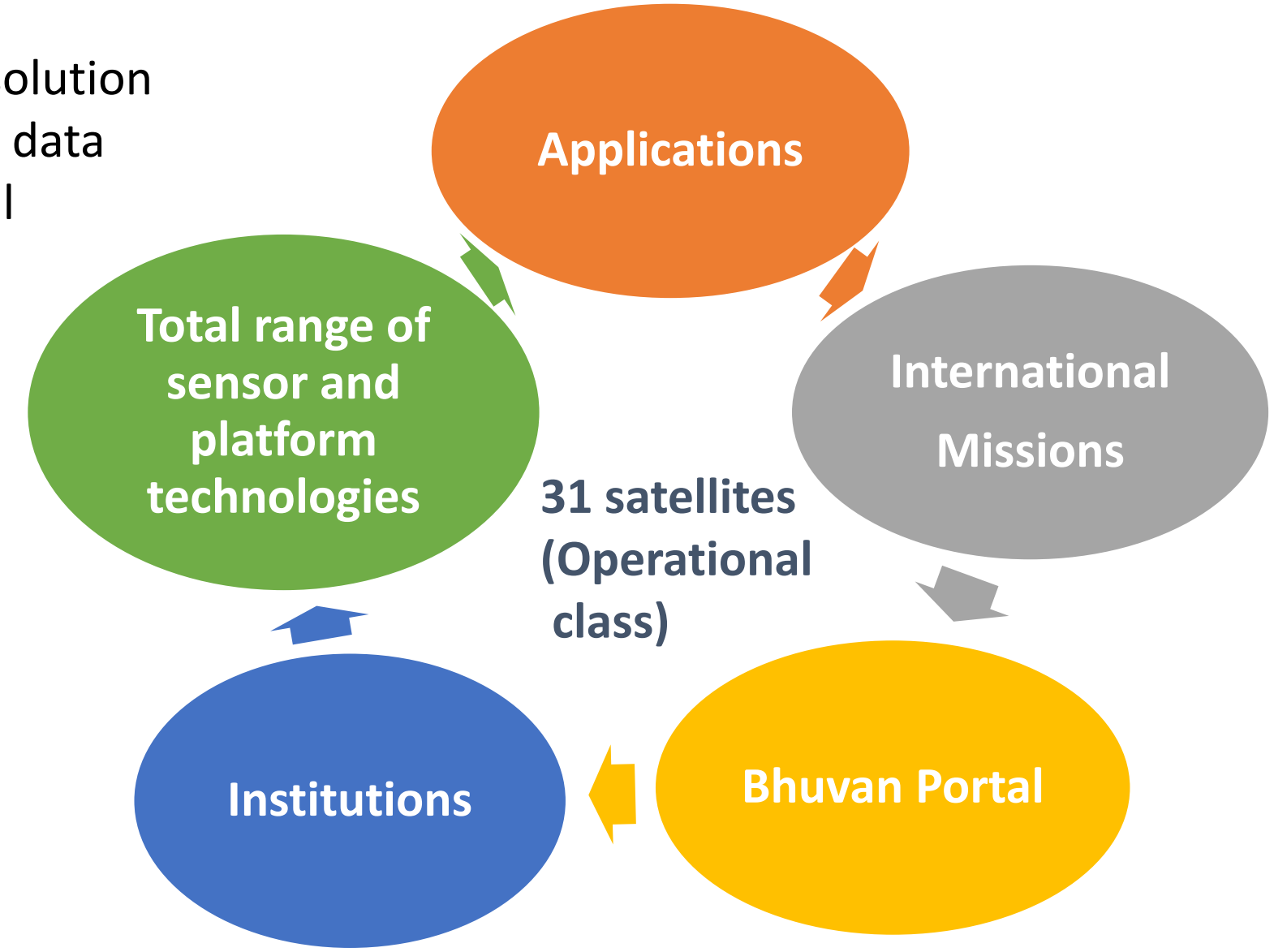
- Commercial EO satellites rapidly emerging (DigitalGlobe, SPOT, Pleiades, KOMPSAT-3, TerraSAR-X, RapidEye, Imagesat and more recently Skybox, PlanetLabs, UrtheCast, Spire, BlackSky, Planetary Resources and many others).

- Commercial small satellite imaging market is projected to grow from 15 million USD in 2015 to 164 million in 2020

- During the decade of 2016 to 2026, an average 200 small satellites for earth observations are projected to be launched annually

Indian EO Programme

Sub meter resolution
Multi spectral data
Hyper spectral
SAR
Terrain data
…….



Indian EO

- **Wide capabilities – Missions for land, ocean, atmospheric observations;**
- **Capability of spatial resolutions of <1m/2.5m/5.8m;**
- **Panchromatic-stereo/multi-spectral and microwave sensors;**
- **26 days repeats with revisit of 5-days capability;**
- **IRS satellite class of ~700-1500 kgs;**
- **Cadence based data access not yet available - traditional ordering and delivery systems;**
- **Analysis Ready Data Portal to be implemented**
- **High level competition from commercial Highres imaging systems of 0.3m and quick delivery systems of Landsat/Sentinel/Planet and others.**

Basic drivers of GI demand in India

- Growing economy is hungry for information
- Burgeoning middle class and rising aspirations
- Compelling forces for participative and transparent governance
- Development agenda is moving the political action strategies
- In the scenario of an emerging economy, relatively greater impact of information is there on value building process.
- Integration of GI into many new sectors
- Potentials of citizen’s contribution

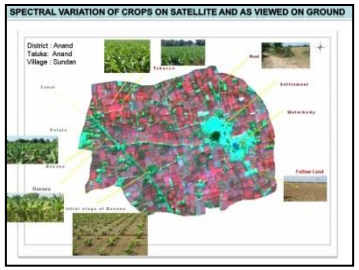
GIS Is Very Valuable to Government



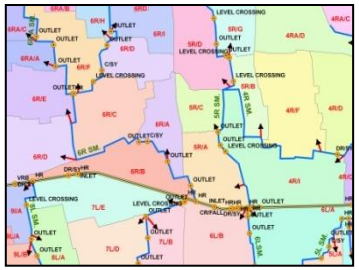
Improving Planning, Management and Decision Making . . .

. . . Providing Critical Infrastructure

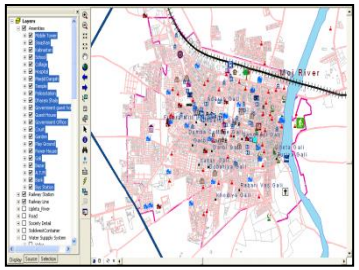
Major GIS Applications- Gujarat example



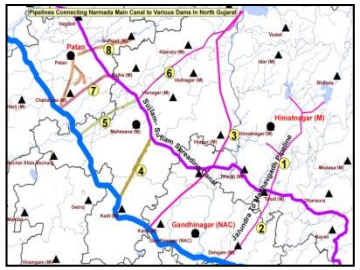
Agricultural GIS



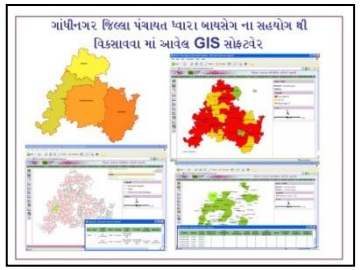
Canal GIS



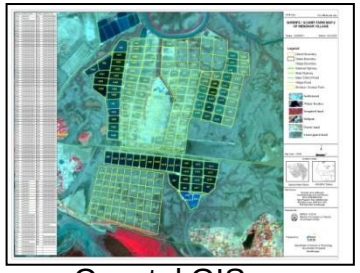
Municipal GIS



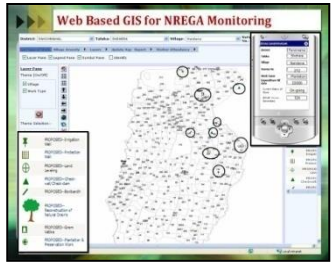
Water supply GIS



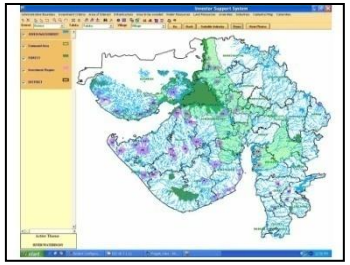
Panchayat GIS



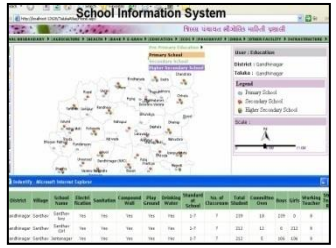
Coastal GIS



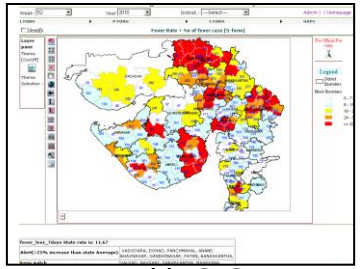
MGNREGA GIS



Investor Support System



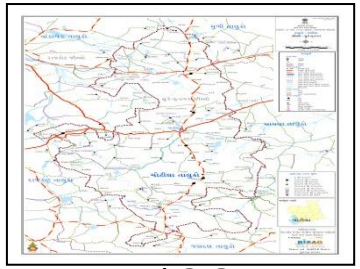
School GIS



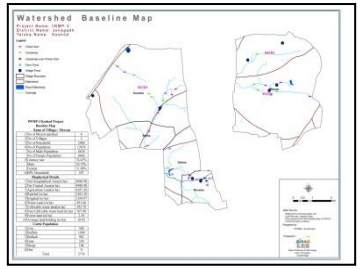
Health GIS



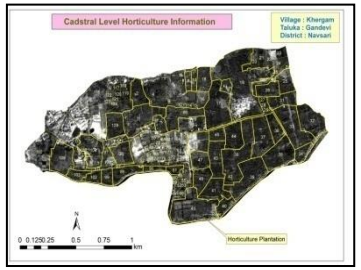
Irrigation GIS



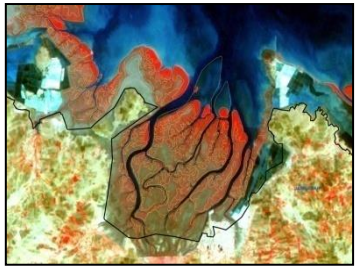
Road GIS



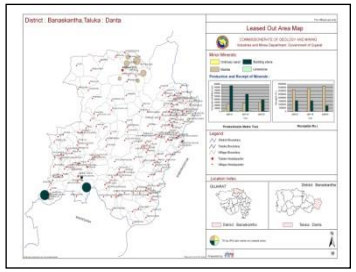
Watershed GIS



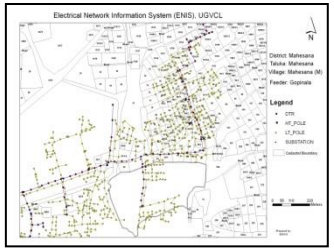
Horticultural GIS



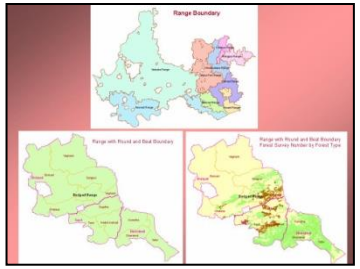
Environmental GIS



Mineral GIS



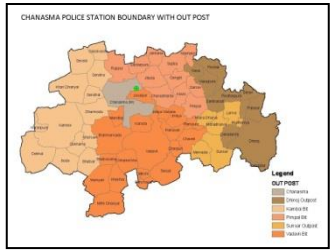
Electricity GIS



Forest GIS

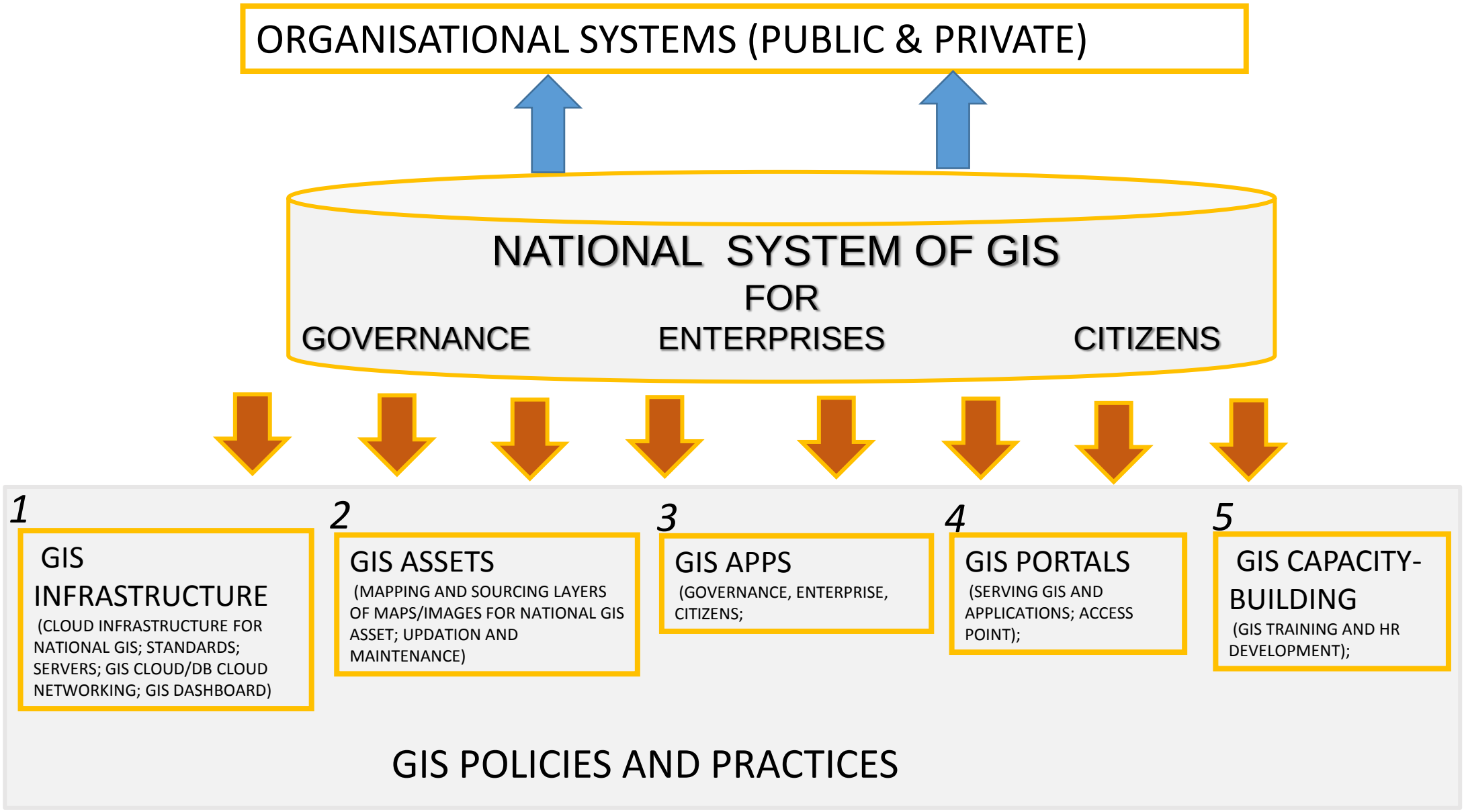


Industrial GIS



Police GIS

SOURCE: BISAG


ORGANISATIONAL SYSTEMS (PUBLIC & PRIVATE)
NATIONAL SYSTEM OF GIS
FOR
GOVERNANCE
ENTERPRISES
CITIZENS
1
GIS INFRASTRUCTURE
(CLOUD INFRASTRUCTURE FOR NATIONAL GIS; STANDARDS; SERVERS; GIS CLOUD/DB CLOUD NETWORKING; GIS DASHBOARD)
2
GIS ASSETS
(MAPPING AND SOURCING LAYERS OF MAPS/IMAGES FOR NATIONAL GIS ASSET; UPDATION AND MAINTENANCE)
3
GIS APPS
(GOVERNANCE, ENTERPRISE, CITIZENS;
4
GIS PORTALS
(SERVING GIS AND APPLICATIONS; ACCESS POINT);
5
GIS CAPACITY-BUILDING
(GIS TRAINING AND HR DEVELOPMENT);
GIS POLICIES AND PRACTICES

Applications in India

- The major applications include Agricultural crop inventories (in participation with Mahalanobis National Crop Forecasting Centre under the Ministry of Agriculture),
- Agricultural Drought Monitoring, forest fires,
- Landslides, flood mapping and monitoring,
- Gas pipeline monitoring,
- ground water prospects mapping,
- Periodic Land Use/Land Cover mapping, Monitoring of Glaciers, lakes and water bodies
- GI support and operations of Decision Support Centre for disaster management; assessment of irrigation potential;
- Space based Information Support for Decentralized Planning;
- City GIS for infrastructure development in 500 cities (AMRUT); Integrated watershed management program extending over 86000 watersheds; tracking the progress and asset creation monitoring for Mahatma Gandhi National Rural Employment Guarantee Act scheme; maintaining Geospatial database for Emergencies Management ; medium range flood forecast modelling and many others.

COMMERCIAL AND NATIONAL CONSIDERATIONS IN INDIA

- Demands for RS and GI in India manifests along two branches
- The first relates to demands from government users. The other is the demand from private industry/ non-government users
- Government of India recognizes that remote sensing data is of benefit to society
- As a national commitment and as a ‘public good” the government assures continuous and improved observing/imaging capability from its own Indian Remote Sensing Satellite Programme
- All satellite remote sensing data acquisition, distribution and licensing of data for use within India has been centralized through the National Remote Sensing Centre (NRSC) of ISRO
- BHUVAN , the ISRO’s Geoportal providing Geospatial services and Earth observation data to users in public domain

India’ data demand

- The demand for remote sensing data – shows growing trend
- The number of data products disseminated by NRSC during fiscal years 2011-12 to 2015-16 were in the range of about 200,000 to 490,000,
- Average annual demand 250,000 products.
- Commercial sales ranged between 40,000 - 80,000 products,
- Two thirds of the data usage was towards resource management applications
- High resolution data to the extent of a million square kilometer (area) annually had been acquired from foreign satellites
- Commercial data demand from domestic as well as overseas could be in the range of 20 to 30 million USD and most of this value resides in the available highest spatial resolution

India’s GIS Industry

- GIS is being used in many sectors in India already including agriculture, forestry and environment, urban development, telecommunications, oil & gas, security, infrastructure, land information etc.
- The major segments of GIS industry are hardware, software, data and services. Leading international companies have presence in India in the hardware and software segments. A large number of Indian companies including a few Indian IT services companies operate in the services segment.
- International companies based in India provide geospatial data and software development services for international organizations, primarily in North America and Western Europe .

Opportunities for industry services

- **The service sector in India contributes to 66.1% of GDP. Today it is one of the sectors of Indian economy which has significant potential to grow.**
- **Consistent economic growth (7-8% in past)**
- **Growth of aspiring and consuming middle class population (547 million by 2025).**
- **India's mobile phone subscriber base had crossed one billion mark already and her smart phone imports are around 100 million a year.**
- **Rapid growth of urbanization placing tremendous pressure on infrastructure development. Turning to transport infrastructure alone, the total value of transport infrastructure projects, as of 31, Aug 2016, was 14 Trillion Indian rupees .**

Services as a predominant component of GDP

- The major drivers for services market today in India comes from E-governance programs being implemented by states and in the central government
- asset mapping, inventory and monitoring, change detection and many Location Based Services. Transformation is rapid in urban and semi urban areas and there is great demand for up to date digital land record information, urban properties and land use which have implications for taxation. Infrastructure and facility management applications too are demanding rapid services.

Service opportunities (continued)

- Higher demands for data in the higher resolution range with minimum lead time, in order to satisfy demands on services such as GIS based decision support systems, mobile multimedia, positioning and navigation services, disaster management support, rural connectivity and national security related applications.
- Indian Government has launched important developmental initiatives such as Digital India, Make in India, Smart City, Swatch Bharat, Housing for all, Clean Ganga, National Education Mission, Integrated Watershed Management Programme and National Skill development Mission programmes.

FUTURE POTENTIALS

- There is emerging scenario where GI industry can play a bigger role through its interfaces with mainstream IT and mobile communication, positioning and image technologies. Opportunities are unfolding in all the market segments like Consumer services, Government, Enterprise / business. Following major fields of services hold high potential;

- Urban development applications
- Agriculture and water resources
- Land Management
- Infrastructure and utilities
- Business and enterprise level applications

- What will drive the future growth of GI services?
  - New technology areas like cloud, new generations of analytics, AI/Machine Learning, IoT, Virtual Reality and mobile communication developments.
  - More knowledge based applications like modelling,
  - auto change detection and triggering corrective actions, assets management,
  - work flow and business process improvement,
  - analytics applications in forecasting, management of large complex systems, and,
  - a host of customized applications at business enterprise level.
- Increasing needs from government as well as markets in the setting of an economically growing resurgent India presents a unique opportunity over the next one to two decades. Policy renewals to create an environment for burgeoning growth of services and capacity building is a priority that needs urgent attention to utilize the full potentials of this opportunity

New Space EO – disruptive elements

- *25–30 cm resolution is new the benchmark for commercial missions.*
- Very high cadence of global coverage at high resolution and lower costs
- Trend towards real-time geo-rectification, seaming, organising and *making* available images as they stream
- Data is made available instantly as it is acquired – almost within few hours on huge, easy-to-use, Data Portals - Direct GIS ingest and fusion;
- Concept of Analysis Ready Data (ARD) is fast emerging (being adopted by even Landsat & Sentinel)
- Strategic tie ups/ integrating with IT players for down stream services
- Large proliferation of Earth observation missions
- Leveraging the advances in Analytics, AI , machine learning and visualisation of information
- Commercial enterprises creating an edge out of the new models of public funding

New Space EO – sharper images, massive collection, access to new /latest data

No	Private EO Missions	Observations
1	Planet (US)	300 dove constellation; <20kgs each – 3m and 90 cms; Daily Earth coverage
2	Urthecast (US)	ISS based payloads; Deimos OptiSar (670/1400kg) combination; 1m SAR and optical data; Spot-scan coverage
3	Jilin (China)	60 satellites (~100-200kgs); 72cm imaging and UHD video; aims for all-weather data
4	Satellogic (Argentina)	~300 (when complete) smallsats (~35kgs); 1m XS and 2-hourly revisit
5	AstroDigital (US)	25+ smallsats (~10-20 kgs); 2.5m GSD; Daily coverage of Earth
6	NOVASAR (UK)	SAR satellites (~400kgs); SAR strip; 6m S-Band SAR small strips

Indian EO – Way Forward

- Imaging from geostationary orbit at a resolution of 50 m (new fleet)
- Third generation Resourcesat systems - vastly improving coverage /revisit
  - Wide-swath 10m and 20m imaging, revisit once in two days, and, 5 Multispectral Bands
  - Thermal imaging and hyper-spectral imaging
- Microwave imaging capability in C ,L & S bands and even in P-bands.
- Higher resolutions (beyond 0.8m -1m), constellation approach for frequent revisits (better than a day) and delivery of the products within a few hours.
- 1.25m stereo mission –improving the DEM coverage
- Ocean and atmospheric observational satellites ensuring continuity of user services.
  - (8 bands data at 360m and sea surface height daily coverage; densification of wind vectors [6hr], millimetre wave sounder and Enriching EO Missions with LIDAR based wind profiler and a precipitation Radar etc

CHALLENGES FOR INDIAN EO/GIS

- 4 major challenges :
-
- ONE Competing with real time ARD data in a e-market environment
- TWO Catering to high resolution market needs
- THREE Development of EO private sector – policies for procurement from industry
- FOUR Innovation in Image and value based services for diverse market segments including mass market applications; using Big Data, AI, machine learning etc.

CONCLUSIONS

- In conclusion, Indian EO/*GIS* needs to be:
- Matching and surpassing state-of-art EO technological trends and positioning competing EO systems of satellites/sensing/data availability/data analysis – second to none in the world.
- Positioning EO/GIS data policies on par with present day needs and standards/practices and tuned to national needs and global market systems.
- Developing an Indian EO industry and promote Indian private entrepreneurship and innovation to build/own/operate EO systems for India and global market. Areas to explore could include value chain elements such as data acquisition, processing and dissemination systems (within a few hours to within a day).
- Reinventing a missionary approach for Indian EO that brings to the fore a long-term vision and strategy for developing EO, say, for next 20 to 25 years.

Thank you



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