Indian Geospatial Education Ecosystem

in Support of

Geo-Enabling the Global Village – No one Should be Left Behind

By

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Introduction

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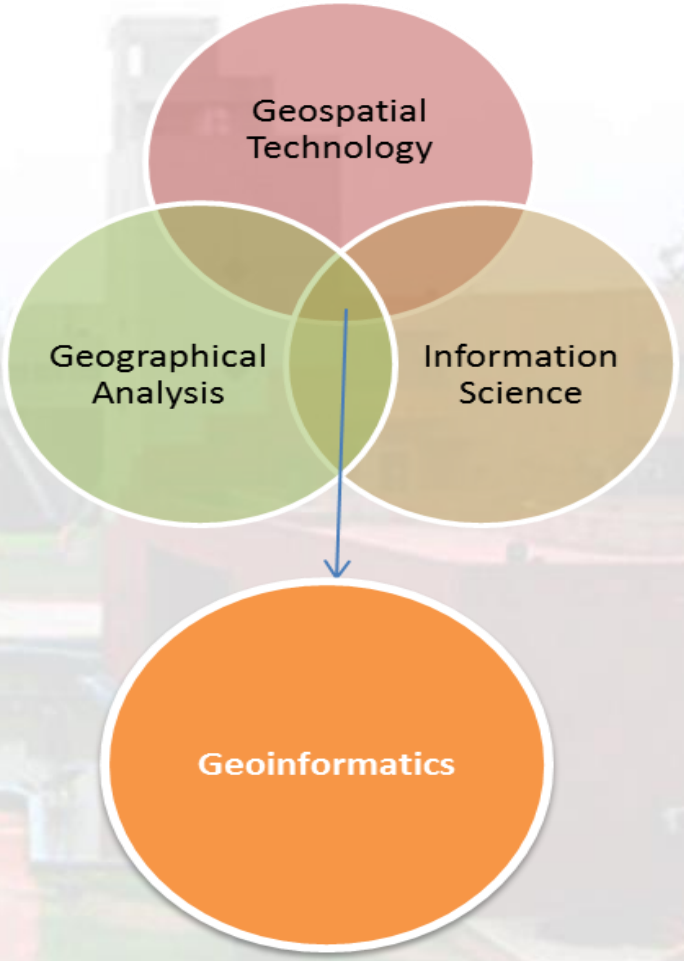
Geospatial Information

- *Geospatial Information refers to Locational Information*
- *Geospatial information is a critical component of the national infrastructure and knowledge economy.*
- *Geospatial information and enabling technologies are essential in all countries and sectors to make decisions on national policy and sustainable development.*
- *It integrates and leverages a wide variety of government services. All countries and all sectors need geospatial information for sustainable development.*



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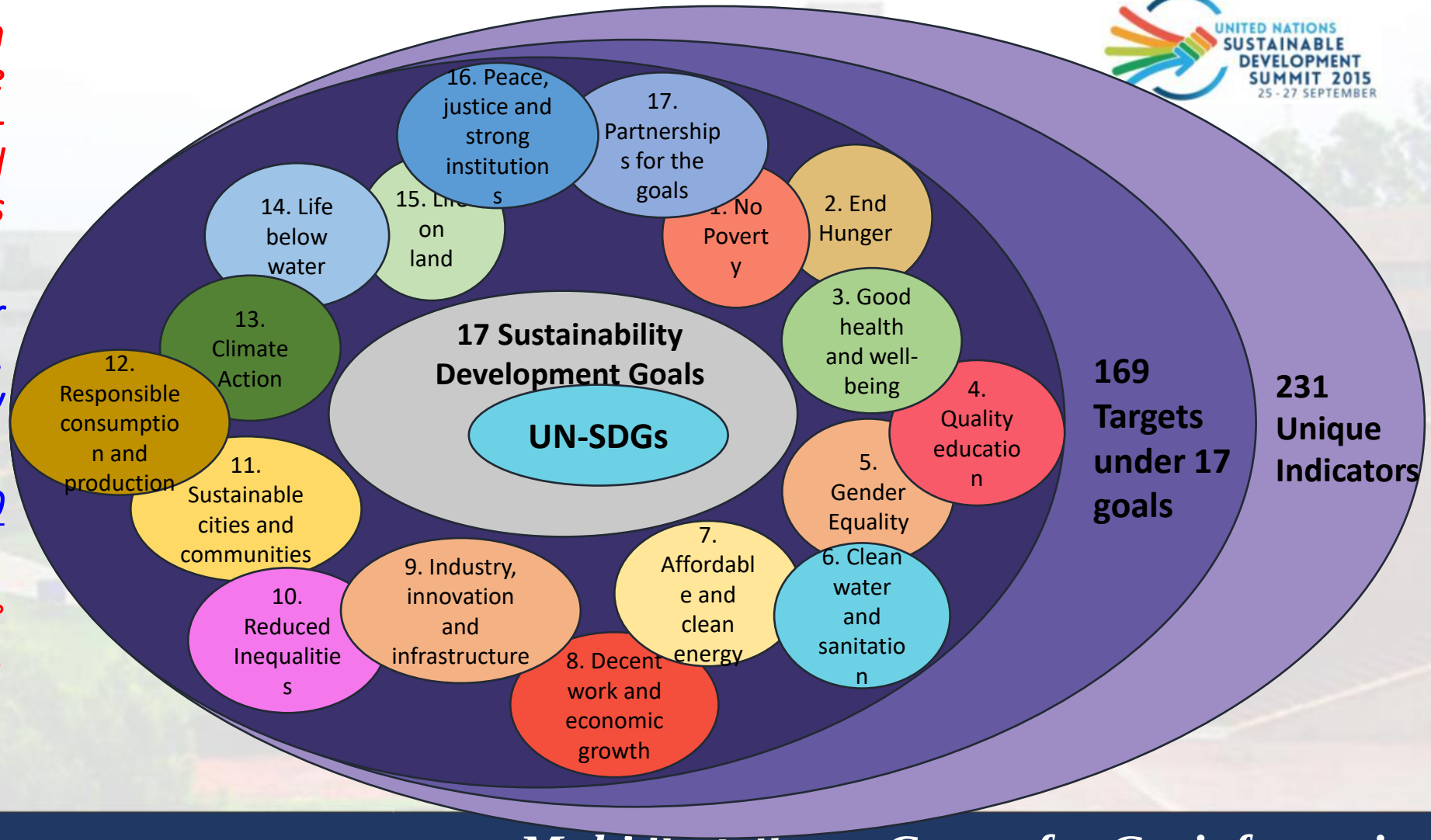
UN Sustainable Development Goals

- *In 2012, UN adopted an united policy to manage and transform the socio-economic and environmental dimensions of humanity and planet.*
- *The blueprint to guide us for the next 15 years, transforming our World, by 2030*
- *Includes 17 goals, 169 targets, and 231 indicators.*
- *Implementation will require good policy, science, technology and data.*



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UN SDGs and India

- *Indian Parliament organized several forums on SDGs.*
- *NITI Aayog, with the Prime Minister as its chairperson, is leading implementation*

❖ *Goals & targets mapped to central ministries & major schemes.*

❖ *A digital knowledge hub has been created for capturing government best practices.*

❖ *An Action plan has been released to fast-track national development goals, mirrored in the SDGs.*

- ***Ministry of Statistics & Programme Implementation** has prepared indicators for monitoring SDGs.*

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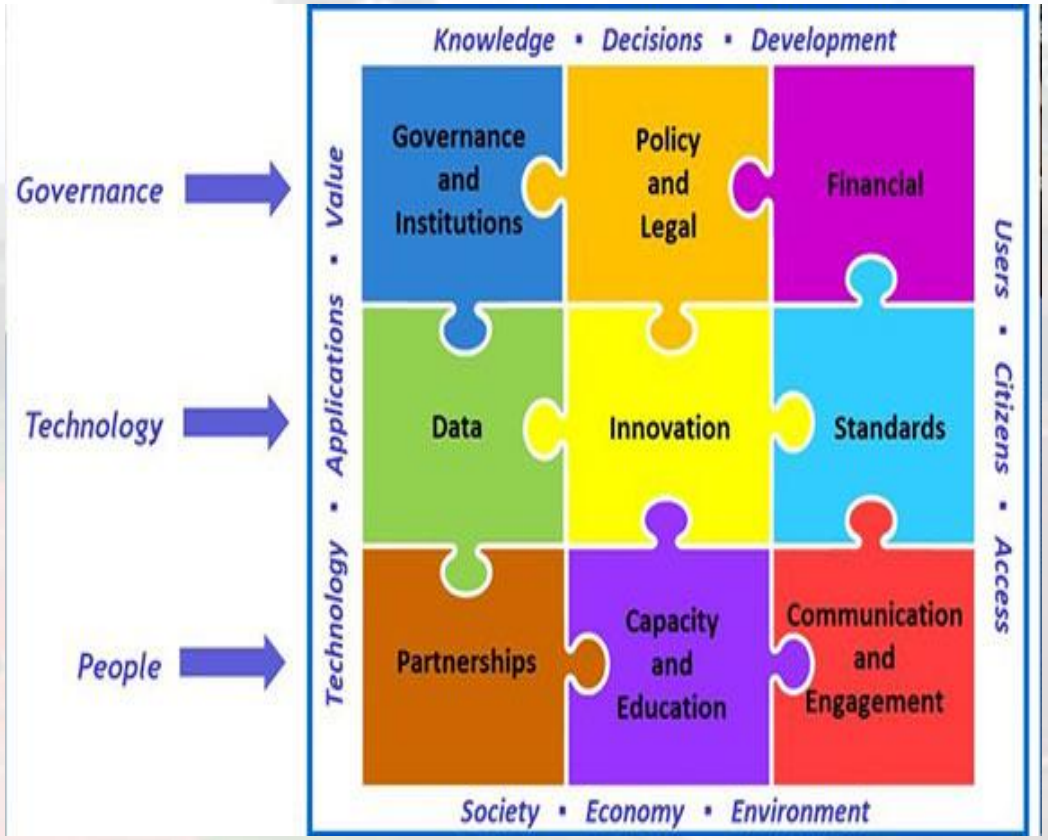
UNGGIM and IGIF Framework

- *UN has evolved a Geospatial Information Framework called IGIF to wholistically address all issues related management of a country's dynamic Geospatial economic, social and environmental needs*
- *IGIF comprises three connected documents*
- *Part 1 is a strategic policy guide - strategic policy guide for Member States to reference*
- *Part 2 is an Implementation Guide - 'what' actions can be undertaken to strengthen geospatial information management*
- *Part 3 is a Country-level Action Plan.*



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Geo-Enabling the Global Village – No One Should be Left Behind

- ***Geo-enabling** means adding Geographical and Locational information to datasets i.e. to add latitude, longitude and elevation information. This helps visual analysis of static or dynamic activities, processes & phenomena.*
- ***Geo enablement** is a State of being enabled using location information and consists of three important aspects-*
  - *Embedding and leveraging the power of location and geography within workflows and business process.*
  - *The act of deriving and utilising geographical spatial information along with non-spatial information.*
  - *Dynamic and temporal visualisation of both spatial and non-spatial information.*
- ***Global Village** – refers to an interconnected world at the community level for addressing their socio-economic and environmental needs, wherein the connection is established through computers, TV sets, internet, IoT and associated infrastructure, hardware and software.*
- ***No One Should be Left Behind** – This is the fundamental objective of the UN SDGs to provide equal opportunities and access to a quality life to everyone across the globe*

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Indian Geospatial Ecosystem

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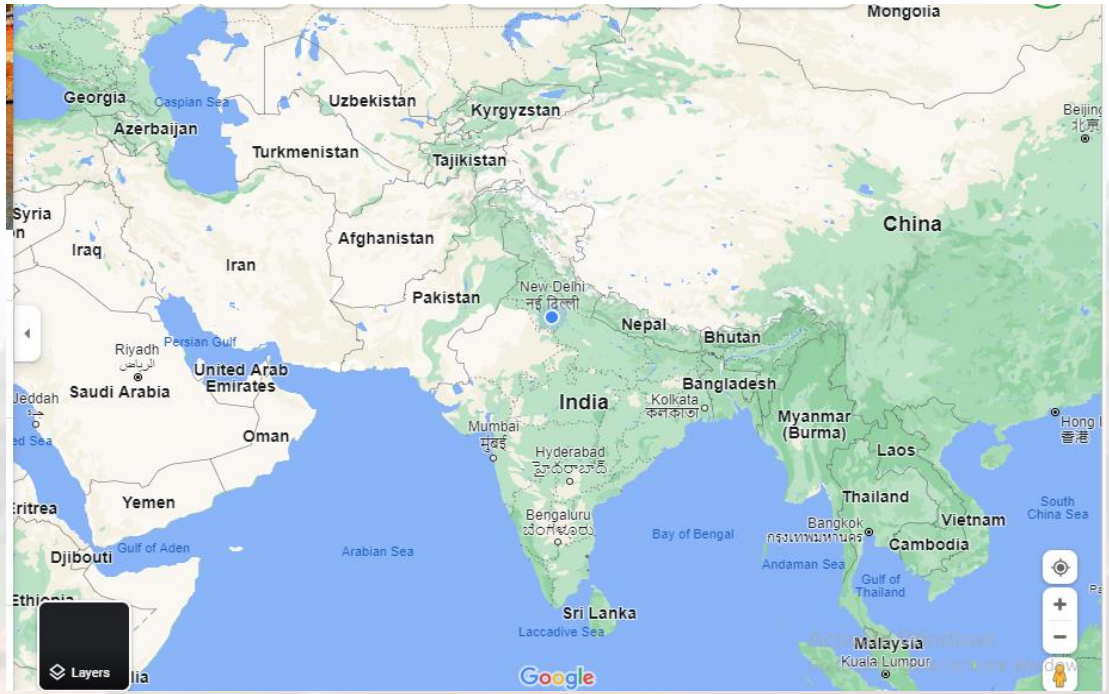
Indian Geographical Landscape

- *India, a union of states*
- *Population - over 1.4 billion*
- *7th largest country in the world,*
- *Landmass area of 32,87,263 sq km,*
- *Multiple terrains (Himalayan Glaciers. Deserts, Indo-Gangetic plains, peninsular plateau, southern tropical rainforests, coastal belt and islands.*
- *28 States and 9 Union Territories – each having unique demography, geography, landscape and language.*



- *Land frontier - 15,200 km, Coastline of the mainland, Lakshadweep Islands and Andaman & Nicobar Islands - 7,516.6 km.*
- *Major Land use – Agriculture - 1.4 million sq kms*

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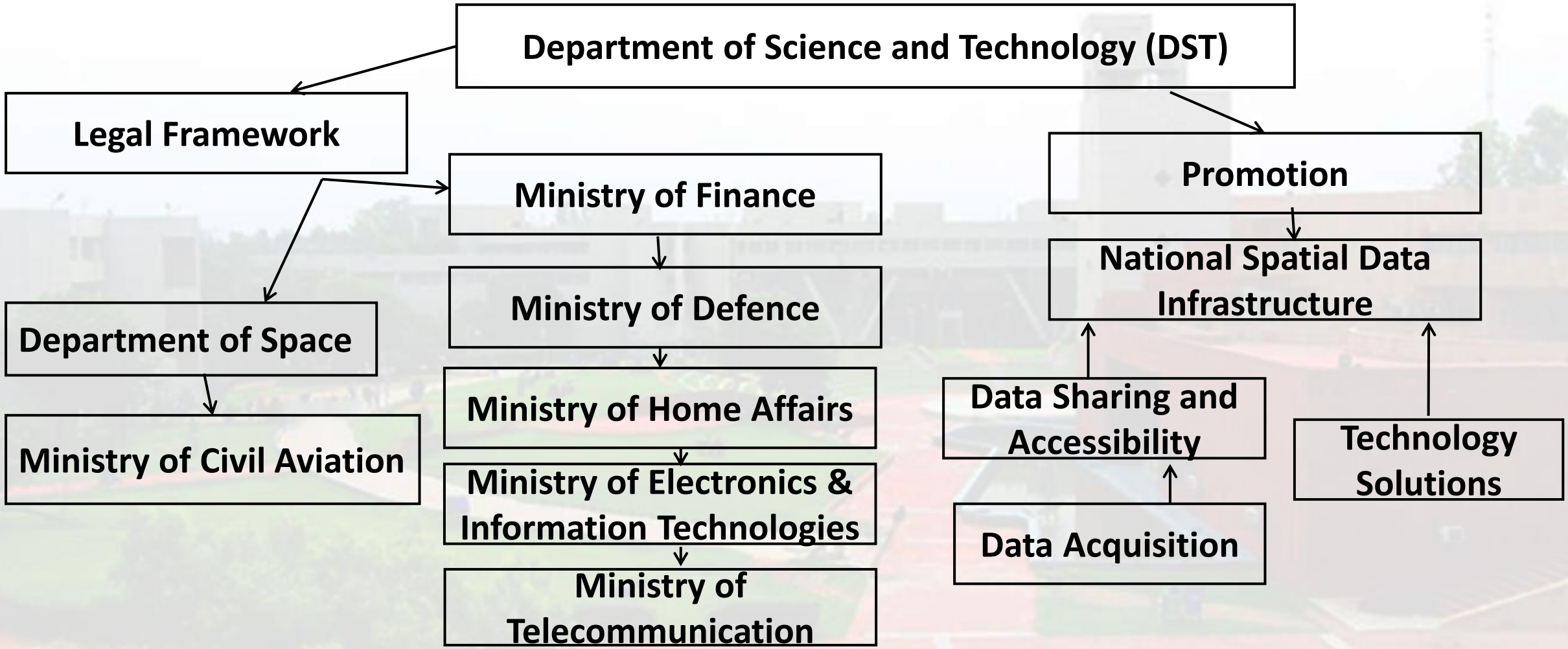
National Geospatial Governance Framework



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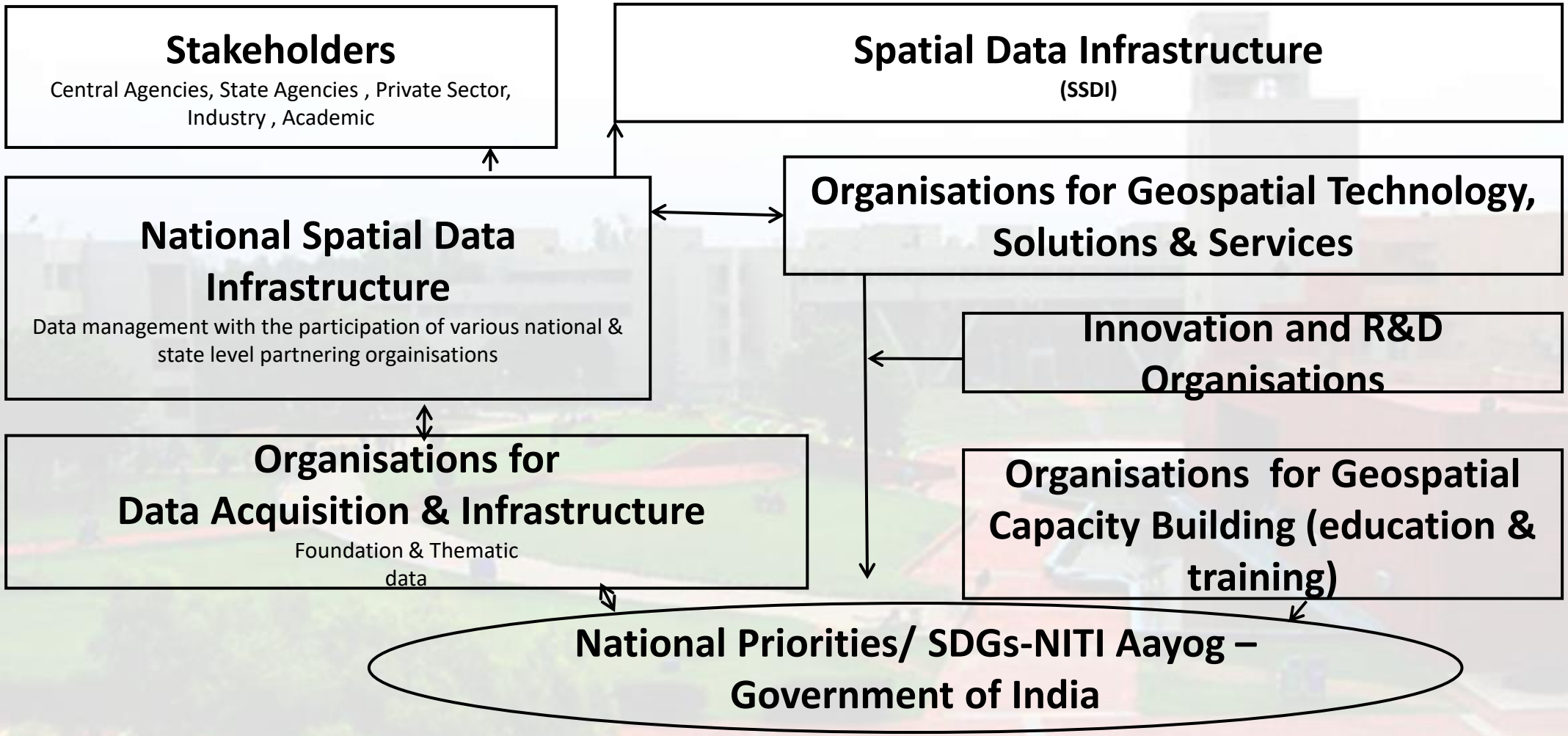
Governance – Institutional Arrangements



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Indian Geospatial Policies Framework

Ministry and Policies	
Ministry of Science and Technology - National Map policy (NMP) (2005), National Data Sharing & Accessibility Policy (2012), National Geospatial Policy (Draft 2016), National Geospatial Guidelines (2021)	**Department of Space -** Remote Sensing Data Policy
Ministry of Finance - Rules prohibiting export of all maps of 1:250K and larger scales (2005), Courier Imports and Exports (clearance) Amendment regulations (2010)	**Ministry of Home Affairs -** The Criminal Law Amendments Act 1961,Act No.23
Ministry of Defence - Restriction of Sale, Publication and distribution of Maps (2017), Policy on digital data of Topographic Maps (1967), Policy of Aerial Photogenic Survey Aircraft borne Remote Sensing (2006)	**DGCA, Ministry of Civil Aviation -**Civil Aviation Requirement (Car) (2012), Operations of UAV-Air Transportation Circular 328 of 2016, Requirements for Operation of Civil remotely Piloted Aircraft System (RPAs) (Draft- 2017)

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National Agencies: Data acquisition, Management & Services

Civil Geospatial Agencies

- National Atlas and Thematic Mapping Organization (NATMO)
- Survey of India (SOI)
- NGP/NRDMS and NSDI division
- Department of Space
  - National Remote Sensing Centre (NRSC)
  - ISRO Satellite Centre (ISAC)
  - Space Applications Centre (SAC)
- National Hydrographic Office (NHO)
- National Centre of Geoinformatics (NCGI)
- Geological Survey of India (GSI)
- Forest Survey of India

Defence and Security Geospatial Agencies

- Military Survey
- Defence Image Processing and Analysis Centre (DIPAC)
- Directorate of Signal Intelligence (DSI)
- Directorate of Air Intelligence (DAI)
- Defence Intelligence Agency(DIA)
- Directorate of Naval Intelligence (DNI)
- Aviation Research Centre (ARC- RAW)
- National Technical Research Organization (NTRO)
- Intelligence Bureau (IB)
- Defence Geoinformatics Research Establishment (DTRL- DGRE)
- Centre for Artificial Intelligence and Robotics (CAIR- DRDO)

National and State Remote Sensing Centers organized under the aegis of India Space Research Organization (ISRO), Department of Space (DOS)

National Remote Sensing Centre

- Regional Remote Sensing Centre (5 regions): Karnataka (South), Rajasthan (West), West Bengal (East), Delhi (North), and Maharashtra.

State Remote Sensing Centre

- Arunachal Pradesh, Assam, Chhattisgarh, Gujarat, Haryana, Himachal Pradesh, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Manipur, Mizoram, Nagaland, Odisha, Punjab, Rajasthan, Sikkim, Tamil Nadu, Telangana, Tripura, Uttar Pradesh, Goa, Andhra Pradesh, Uttarakhand and Bihar
- North Eastern Space Applications Centre: Shillong, Meghalaya
- Space Applications Centre: Ahmedabad, Gujarat.

National Spatial Data Infrastructure (NSDI)

- Under National Resource Data Management System (NRDMS) & NSDI division at Department of Science & Technology (DST)

State Spatial Data Infrastructure (SSDI)

- (6 states +1 UT)
- Bihar, Karnataka, Madhya Pradesh, Odisha, Uttarakhand, Haryana (semi- functional), and Delhi
- Under development (2 states): West Bengal, Jammu & Kashmir
- Proposed (3 states): Mizoram, Nagaland and Tamil Nadu

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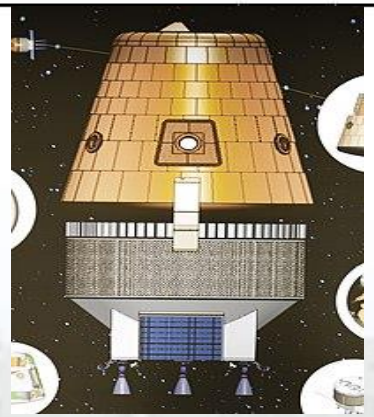
Indian Geospatial Technological Capabilities

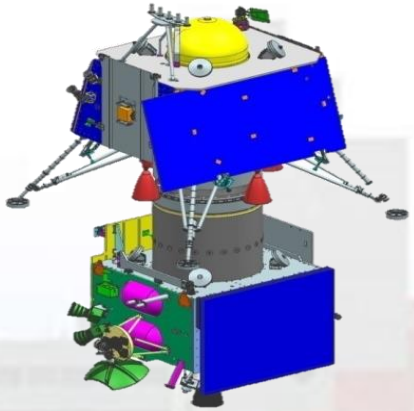
PSLV-C35

GSLV Mk III

Satellite Launch Capabilities

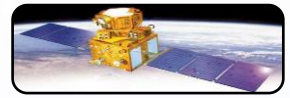


Gaganyaan Manned Mission

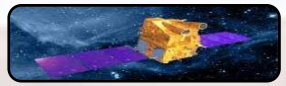


Chandrayaan

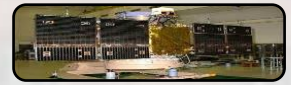
Satellites (year)



Resourcesat-1 (2003)



Cartosat-1 (2005)



Cartosat-2 (2007)

Resourcesat-2 (2011)

Chandrayaan-1 (2008)

Remote Sensing Satellites

- ***Indian IRNSS/GNSS Capabilities*** *- Indian Regional Navigation Satellite System (IRNSS) is an independent regional navigation satellite system being developed by India to provide accurate position information service covering the Indian landmass and regions extending 1500 km from its boundary, which is the primary service area.*

- ***Indian Geodetic Capabilities*** *A "National Centre for Geodesy" (NCG) at Indian Institute of Technology, Kanpur. The major objectives are as , Setting up of an International GNSS Service (IGS) Station at IIT Kanpur, Establishment of three geodetic very long baseline interferometry (VLBI) stations in India, Installation of a Doppler orbitography and radiopositioning by satellite (DORIS) station at IIT-Kanpur, which becomes one of the International DORIS service (IDS) stations, supporting geodetic, geophysical, and other research studies*

  a. *Installing corner reflectors for improving interferometric synthetic aperture (InSAR) radar techniques used in crustal deformation*

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Indian Geospatial Technological Capabilities

Geoportals

•*Many Ministry/ Departments of Government of India -Geo-portals for data sharing, briefly described as follows:*

Survey of India Online Maps Portal

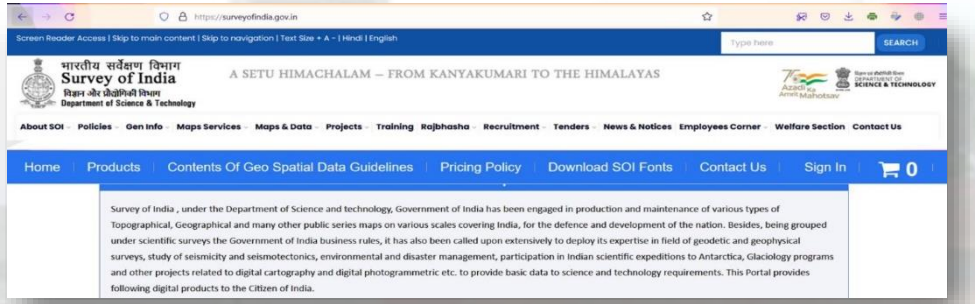
• *The portal provides access to SOI maps and digital datasets.*

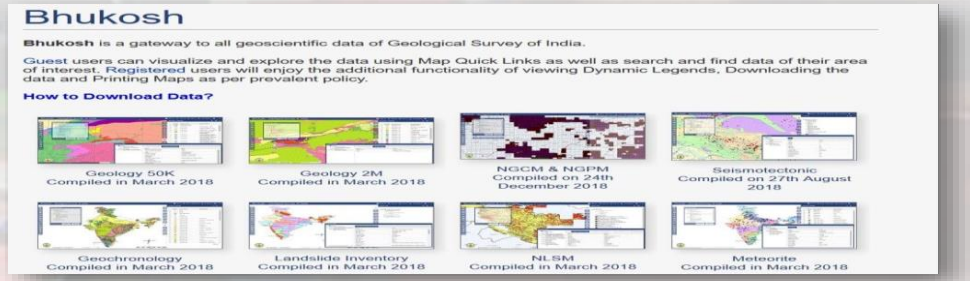
GSI Maps Portal – Bhukosh

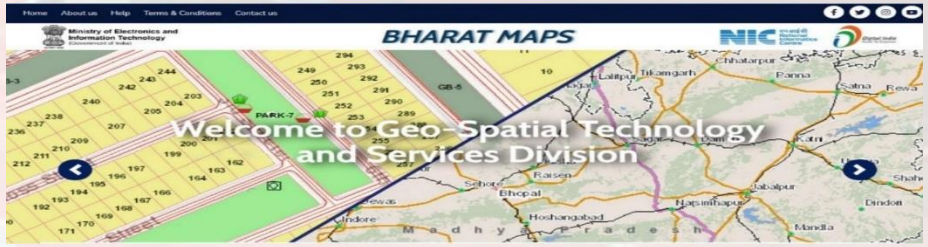
• *It is an open-source geospatial web-portal of GSI, ministry of mines, to visualize, explore, search and download multi-thematic geospatial data*

BHARAT Maps

Multi-Layer GIS Platform depicts core foundation data as "NIC MAPS", an integrated base map service using 1:50,000 scale reference data from SOI, ISRO, FSI, RGI and so on.







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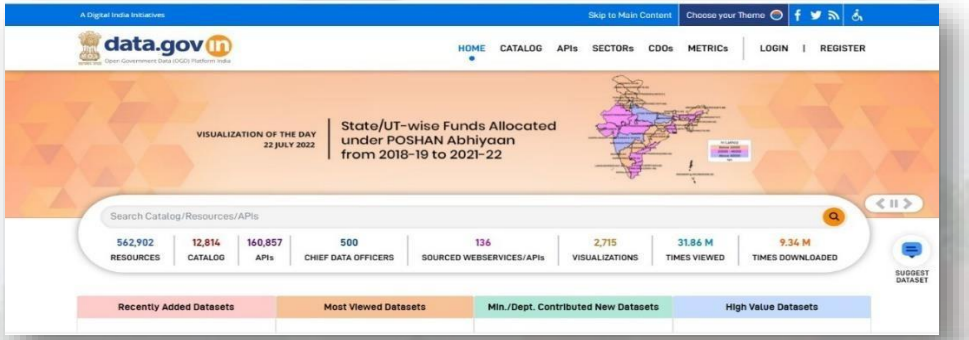
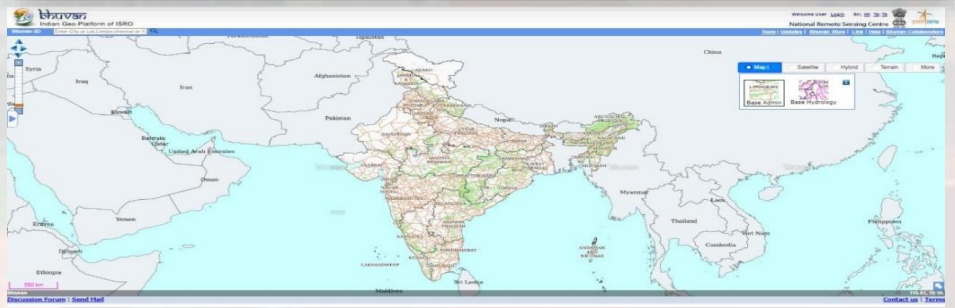
India Geo portal

- *This portal is developed by NSDI where the data of various national agencies through interoperable geographic information services like Catalogue Service on Web (CSW), Web Map Service (WMS), Web Feature Service (WFS), and Web Processing Service (WPS) is available for users.*



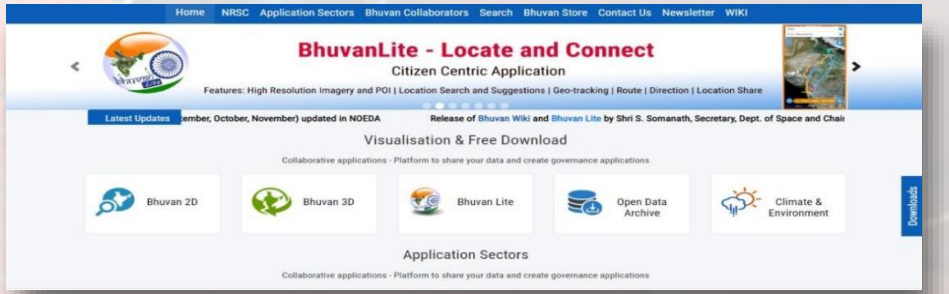
BHOOMI Geo Portal

- *The portal is developed by National Bureau of Soil Survey and Land Use Planning (NBSS&LUP), maintained by the name soil information system by National Centre of Geoinformatics.*



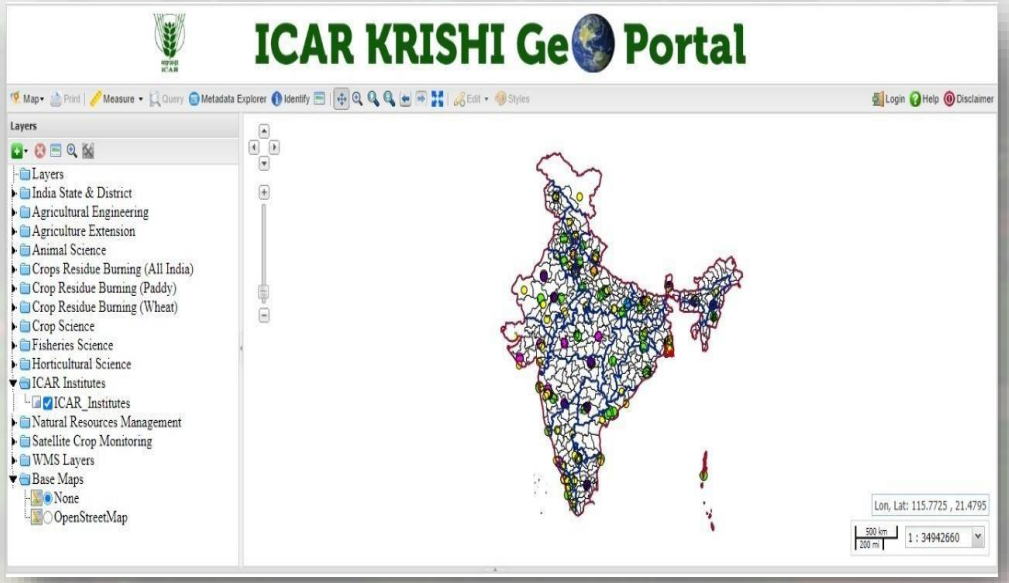
BHUVAN Web portal

- *NRSC-ISRO launched the beta version of its web-based GIS tool, Bhuvan, provides multi-sensor, multi-platform and multi temporal images*



KRISHI Geo Portal

- *An initiative of Indian Council of Agricultural Research (ICAR), this portal is a data repository system for Experiments/ Surveys/ Observational studies, Geo-spatial data, Publications, Learning Resources.*



VEDAS-Visualization of Earth observation Data and Archival System

- *Developed by ISRO, VEDAS is an online geo processing platform that optical, microwave, thermal and hyperspectral EO data covering applications particularly meant for academia, research and problem solving.*

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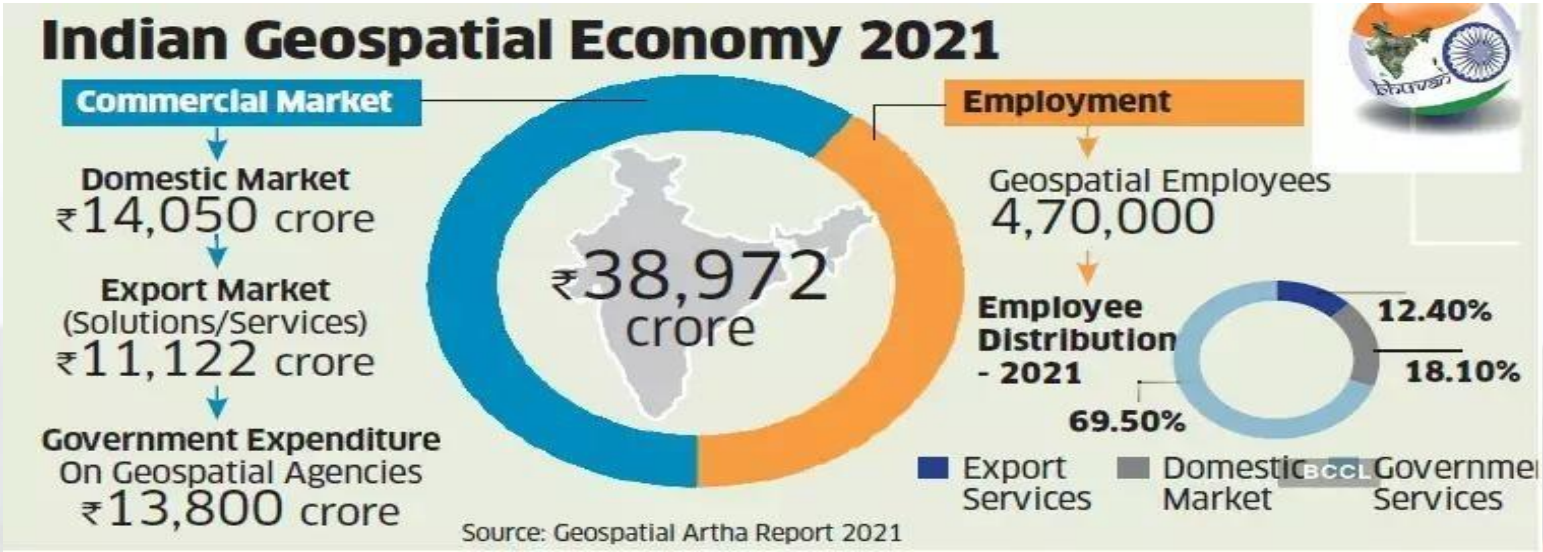
Indian Geospatial Market and Industry



- *Indian government vision – To become a 5 trillion dollar economy and 10 trillion dollar by 2030.*
- *The market grew at CAGR (Compound Annual Growth Rate) 9.82% in 2017-19, but contracted in the period 2019-21 due to Covid, now growing at a CAGR of 8.81%.*

POTENTIAL GEOSPATIAL MARKET SECTORS

- *Water Resources and Irrigation*
- *Buildings and Campuses*
- *Defense and Intelligence*
- *Land Administration*
- *Disaster management*
- *Transport Infrastructure*
- *Utilities*
- *Urban Development*
- *National Gospatial Organizations*
- *Agriculture and Forestry*
- *Others (Healthcare, Retail, Supply chain logistics)*

(Source – India Country Report)

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Indian Geospatial Education System

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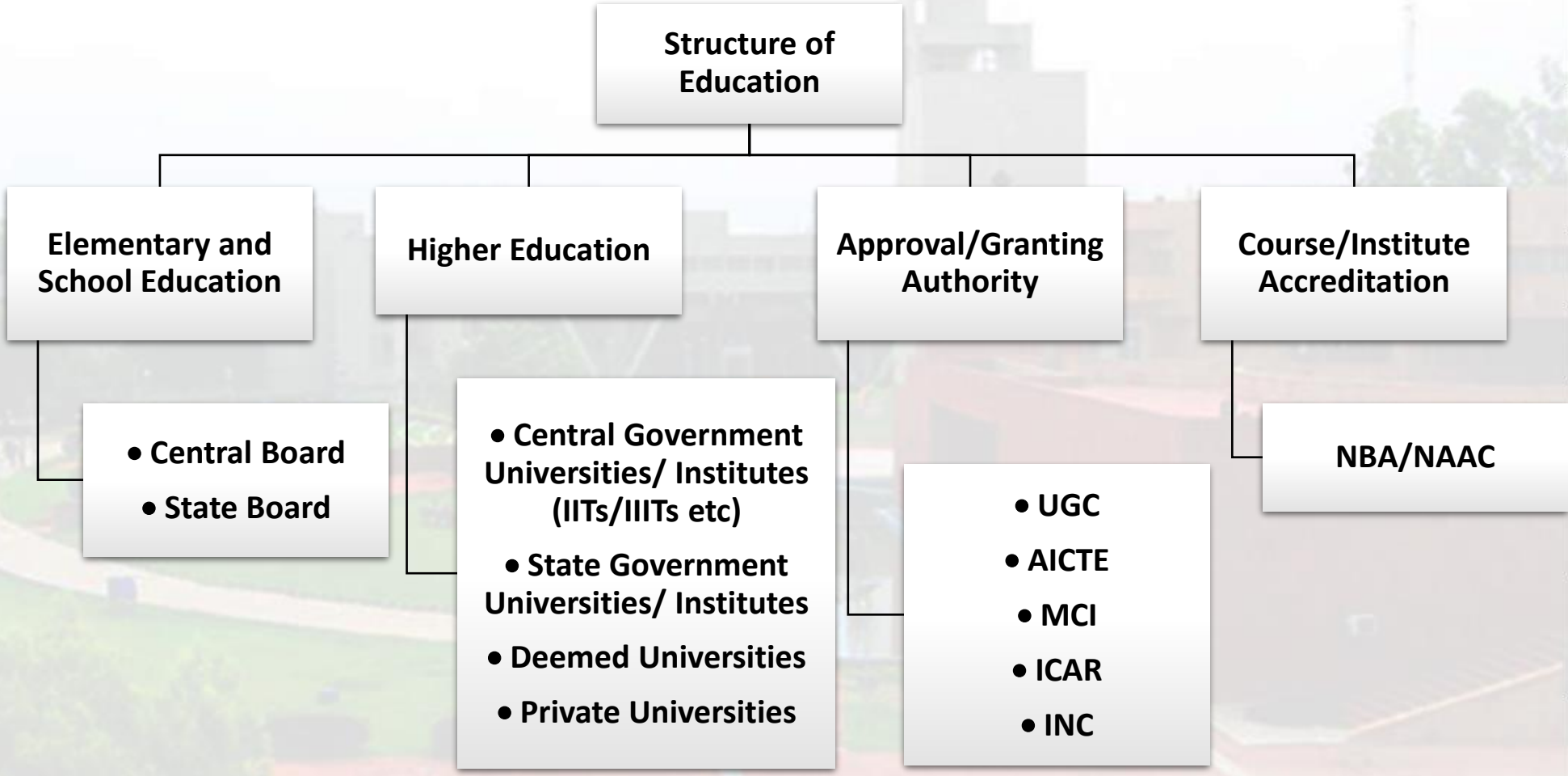
Structure of Indian Education

- *India is an Union of States with a strong Centre. Constitution has listed out through Union list, State List and Concurrent list various areas of Governance for both the Centre and States*
- *Education is on the concurrent list and both the Centre and state can make rules regarding education*



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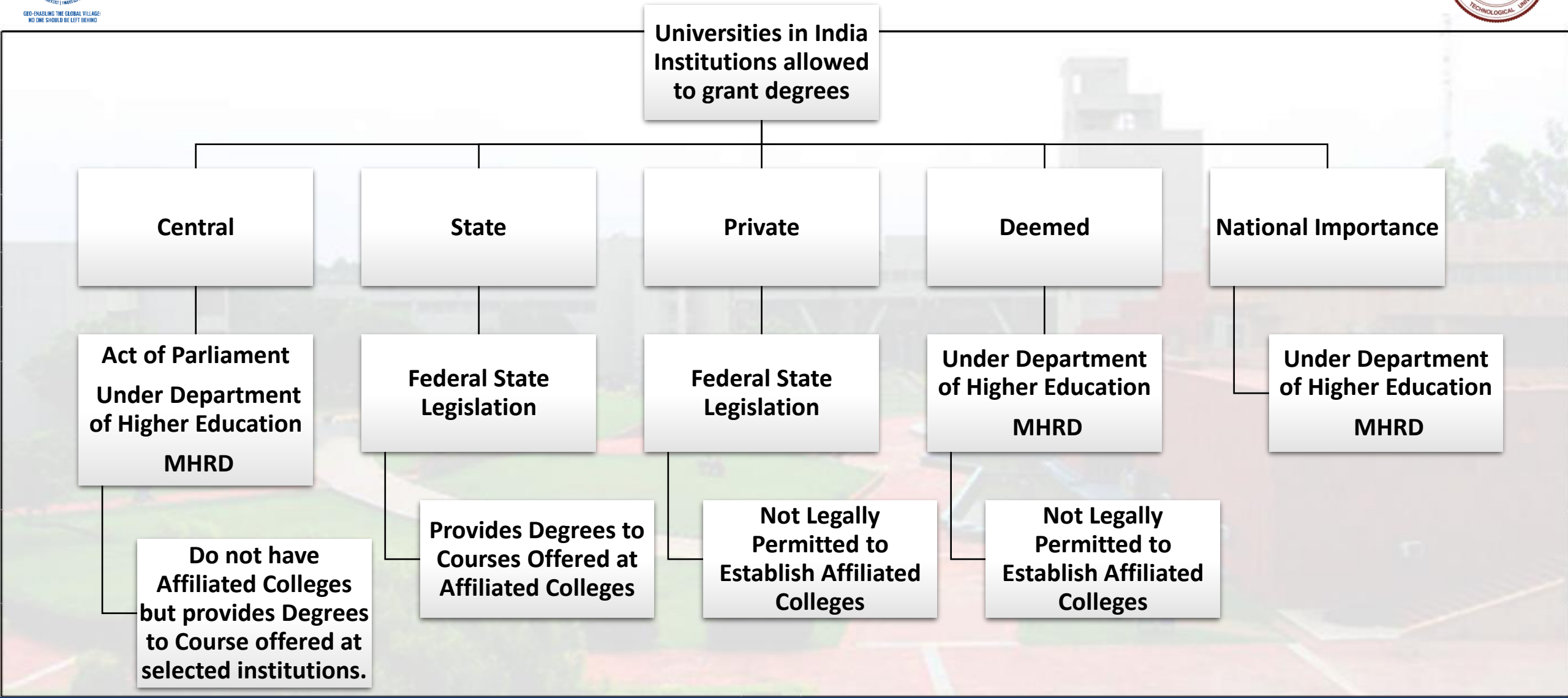
Indian Education System



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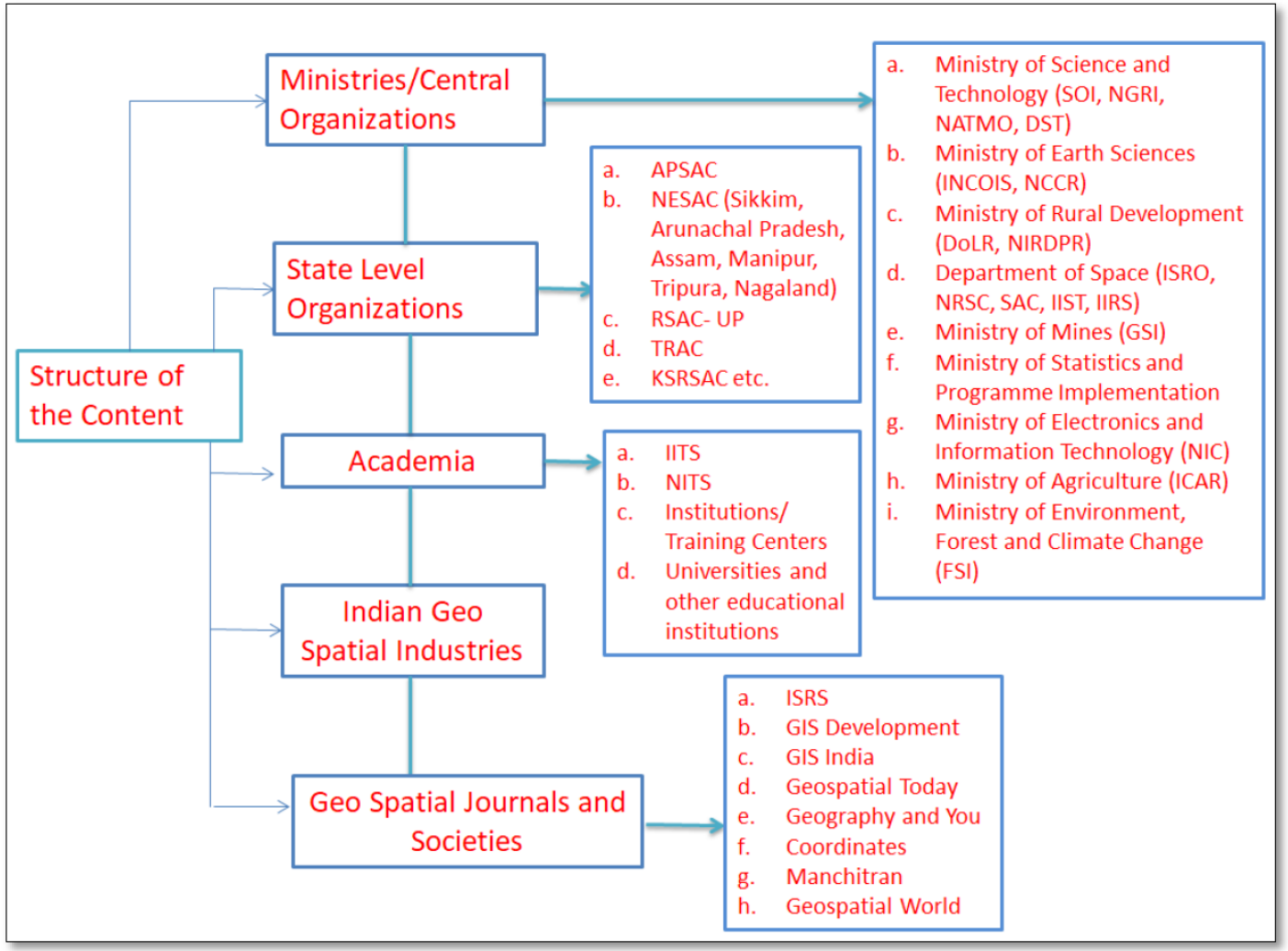
Indian Education Eco-System



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Geospatial Innovation, Research And Development

- *Geospatial domain entails a lot of research and development. The key geospatial Programmes/research institutes in the country have been established to advance knowledge base in designated functional and strategic areas by their respective Ministries -*

NATIONAL GEOSPATIAL PROGRAMME (EARLIER NRDMS).

- *Natural Resources Data Management System (NRDMS) programme was initiated in 1982 by the Department of Science and Technology, Government of India as a multi-disciplinary and multi-institutional R&D programme.*
- *Vision of the NRDMS programme is enabling people, communities and institutions of local-self Governance with requisite databases and S&T tools for informed participation in local self-governance.*
- *Under the programme, other than establishment of NRDMS Geospatial data centers, extramural research, development projects, many e-governance solutions such as Health Geographic Information Science (HGIS), Village Information System (VIS) and Revival of Village Ponds etc have been completed.*

SPONSORED RESEARCH (RESPOND) PROGRAMME

- *Space Research Organization (ISRO) of Department of Space has evolved a dedicated program RESPOND, through which financial support is provided for conducting research and development activities related to Space Science in India since 1970.*
- *ISRO has also set up Space Technology Cells at premiere institutions like IITs, IISc, and Joint Research Program with University of Pune (UoP) to carry out research activities.*

SPACE APPLICATIONS CENTRE (SAC)

- *Built in 1966, Space Applications Centre (SAC), is a major research and development center of the ISRO.*
- *The core competence of the centre lies in development of space borne and air borne instruments/payloads and their applications for national development and societal benefits.*

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Geospatial Education, Training And Capacity Building

CAPACITY BUILDING UNDER NATIONAL GEOSPATIAL PROGRAM (NGP)

- ***National Geospatial Chair Professor Scheme*** *- 15 National Geospatial Professor Positions have been also launched by the Department of Science & Technology, Government of India. The main aim of the scheme is to strengthen the Geo-spatial education and S&T at National and sub-national level in the dynamically evolving geospatial ecosystem in the country.*
- *A dedicated portal that can be accessed from (www.dst-iget.in) an innovative venture and is the first Indian portal of its kind that is a one stop resource for teaching-learning geospatial science besides networking educators, professionals and scientists. The portal provides software, tutorials for teaching GIS, digital image processing, spatial analysis, customization and new trends such as web GIS and mobile GIS using open-source software and data from the Indian sub-continent making it easy for the learner to relate to. Apart from this it has database of Indian experts who can be called upon by various institutes as a resource person. It has provided a common platform for networking of geospatial educators in the country besides providing access to a large section of society to acquire skills and knowledge related to geospatial technology at relatively cheap costs at their own pace.*
- *The National Geospatial Program (NGP) of the Department of Science and Technology has been conducting 3-day orientation programs and 21-day capacity building programs for decision makers for the last ten years that includes general orientation to geospatial technologies as well as theme specific trainings. 166 training programs of three-week duration each have been conducted across the length and breadth of the country over the last eight years benefitting over 5000 participants from academia, Government and research institutes across India.*

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Geospatial Education – Specialised Institutes

INDIAN INSTITUTE OF REMOTE SENSING (IIRS)

- *The Indian Institute of Remote Sensing (IIRS) conducts a variety of courses targeted at professionals and these range from 4 months Certificate Courses, 2 months NNRMS sponsored courses for University Faculty, 2 weeks on demand Special Courses and one-week duration Overview Course for Decision Makers.*

NATIONAL REMOTE SENSING CENTRE (NRSC)

- *Similarly, the National Remote Sensing Centre (NRSC), Hyderabad also conducts one week capacity building in Geospatial Technologies and Applications towards effective utilization of satellite data products for operational, scientific research and societal benefits for officials from various government, private, autonomous institutions, NGOs, faculty and researchers from academic institutions working in the domain of geospatial technologies and its applications.*

NATIONAL INSTITUTE OF GEO-SCIENCES & TECHNOLOGY (NIGST)

- *It has been recognized as the prestigious training institute in the field of Surveying, Mapping, Geodesy, Photogrammetry, GIS and Cartography to impart training to the Officers and the Staff of Survey of India and other Government Organizations, Private Individuals, and Scholars from other Afro-Asian countries. NIGST has been focusing on development of role-based training courses in niche technology areas.*

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Geospatial Education – Specialised Institutes

NATIONAL E-GOVERNANCE DIVISION (NEGD)

- *The National e-Governance Division (NeGD) of the Government of India under its capacity building scheme conducts workshops and trainings programs to cover sensitization of programme and project level personnel about the Digital India Programme; spreading awareness of related important frameworks, guidelines, common service infrastructure initiatives, emerging technologies and specialised training programs which are required to develop competencies in specific areas and this includes various aspects of geospatial technologies.*

NATIONAL INSTITUTE OR RURAL DEVELOPMENT & PANCHAYAT RAJ (NIRDPR)

- *It facilitates financial support under the Central Scheme of the Ministry of Rural Development, Government of India for strengthening of the training infrastructure and faculty of the institutions.*
- *NIRDPR started management education programme of one-year duration in 2015 in the form of Post Graduate Diploma Programme on Geo-spatial Technology Applications in Rural Development (PGDGARD) under CGARD (Centre for Geo Informatics Application for Rural Development) which is engaged in developing Geo-informatics technology-based planning, monitoring, modelling, decision support systems for Watershed (PMKSY), MGNREGS, PMGSY, and capacity building through training in various fields.*
- *Specialized theme specific training in geospatial technologies for government officers are also conducted by the Forest Research Institute (FRI), the National Power Training Institute, Ministry of Power and the State Administrative Training Institutes as well as the National Academy of Administration.*

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Geospatial Education at School Level

- *In India, GIS was introduced in school curriculum, as part of geography, at higher secondary stage in the year 2000 under National Curriculum Framework for School Education -2000 (NCFSE 2000).*
- *However, the adoption has been slow due to the availability of trained teachers. ESRI India is helping K-12 segment by providing workshops and hands on training on ArcGIS online and Story maps.*
- *1000+ school students have been trained through these workshops. These students are now working on projects and research work leveraging the GIS technology for interactive learning.*

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Geospatial Education, Training And Capacity Building

FORMAL EDUCATION

- *Geospatial science is taught mostly at post graduate level except in engineering courses, where it is also being taught at undergraduate level as Bachelor of Engineering (BE)/ B.Tech in Geomatics/ Geoinformatics in some of the Institutes.*
- *It is also taught as one of the elective subjects in BE Civil Engineering, B Planning courses at undergraduate level. A doctoral program in Geoinformatics is also there in some selected Institutions.*
- *The post graduate courses offered vary from M.Sc., in Geoinformatics, M.Sc. Applied Geography and Geoinformatics, M.Tech., in Geoinformatics and M.Tech., in Remote sensing, Post Graduate Diploma of six months to one year duration.*
- *There are B.Sc. Applied Remote sensing course for one year and certificate courses varying from six months to two months also taught at University level.*
- *An internet survey shows that there are 5 institutions conducted a Bachelors program (B.Tech) in Remote Sensing and GIS, 79 Universities offering a Masters program in Geoinformatics, 36 offering a doctoral program in Geoinformatics, 50 offering a postgraduate Diploma/Certificate course and 7 offering programs in the distance mode.*

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Geospatial Skill Development

- *The Ministry of Skill Development & Entrepreneurship (MSDE), Govt of India is responsible for co-ordination of all Skill Development efforts across the country, removal of disconnect between demand and supply of skilled manpower, building the vocational and technical training framework, skill up-gradation, building of new skills and innovative thinking not only for existing jobs but also jobs that are to be created.*
- *The Ministry aims to skill on a large scale with speed and high standards in order to achieve it's vision of a 'Skilled India'.*
- *It is aided in these initiatives by its functional arms – Directorate General of Training (DGT), National Skill Development Agency (NSDA), National Council for Vocational Education and Training (NCVET), National Skill Development Corporation (NSDC), National Skill Development Fund (NSDF) and 38 Sector Skill Councils (SSCs) as well as 33 National Skill Training Institutes (NSTIs/NSTI(w)), about 15000 Industrial Training Institutes (ITIs) under DGT and 187 training partners registered with NSDC.*
- *The Ministry also intends to work with the existing network of Skill Development centres, universities and other alliances in the field. Further, collaborations with relevant Central Ministries, State governments, international organizations, industry and NGOs have been initiated for multi-level engagement and more impactful implementation of Skill Development efforts.*
- *Education institutes are setting up GIS competency centres to drive GIS skilling and capacity building; e.g. IIT BHU, Punjab Engineering College, BITS, Pilani etc. GIS adoption in K-12 is beginning to grow.*
- *Many schools in the Country have setup GIS Club to enable students gain GIS skills and knowledge.*

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International Collaboration

BRAZIL RUSSIA INDIA CHINA SOUTH AFRICA (BRICS)

- *India is a member of the BRICS Working Group on Geospatial Technology (BRICS WG-GS) under the BRICS Science, Technology and Innovation Cooperation Framework.*
- *The areas of cooperation promoted under this Working Group are Geodesy, geospatial policies, earth observation and its people centric applications, human resources and capacity building, academia -industry collaboration and catalyzing geospatial technology development.*

OGC FOUNDATION of INDIA

- *The foundation raises awareness and adoption of OGC Standards in India and supports the interests and needs of Indian organizations.*
- *The OGC India Foundation also facilitates the participation of Indian members in OGC international programs. Department of Science and Technology is a permanent member.*

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International Collaboration

INTERNATIONAL SOCIETY FOR PHOTOGRAMMETRY AND REMOTE SENSING (ISPRS)

- *National Remote Sensing Centre (NRSC) is a sustaining member of ISPRS and contributes to the financial support of the society. Indian Institute of Remote Sensing has taken lead in Commission V of ISPRS for the term FY 2016-20 to support, promote and motivate capacity building at different levels of professionals, educators and students.*

INTERNATIONAL CARTOGRAPHIC ASSOCIATION (ICA)

- *Survey of India is the national member of ICA while National Hydrographic Organisation and Indian National Cartographic Association are affiliate members.*

GROUP ON EARTH OBSERVATIONS (GEO}

- *GEO champions global collaboration for improved application of Earth observations for the benefit of humankind. India is represented by ISRO in GEO as a member state while Association of Geospatial Industries (AGI) is a participating organization in GEO.*

COMMITTEE ON EARTH OBSERVATION SATELLITES (CEOS)

- *ISRO under Department of Space is one of the 32 members of CEOS and Earth Systems Science Organisation (ESSO) is one of the 28 associate members. Besides, ISRO represents India in Ocean Surface Vector Wind Virtual Constellations, which is a coordinate space-based, ground- based, and/or data delivery systems to meet a common set of requirements within a specific domain.*
- *ISRO is also participating actively in other International space forums like, GEOS, ISPRS, APRSAF, UN-ESCAP to reap the benefit of space technology. Under UN-ESCAP program, India is providing technical support for development of Drought monitoring system of SriLanka.*

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Way Forward

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Way Forward - Academics & Research at Global Level

- *Guidelines/framework for uniform SDG focused academics and research in all member nations in sync with all the pillars and strategic pathways of IGIF – for schools, under graduates and graduates with defined standard nomenclatures for various programs/courses, curriculum and course materials /text books etc*
- *Guidelines for developing standard academics and research related polices in all member nations including development of Geospatial cadres in different Govt organizations and UN funded Centers of Excellence*
- *Guidelines for development of policies for access to SDG related geospatial/non-geospatial global data to all stakeholders addressing legal issues arising out of International laws/difference in laws in different countries regarding data sharing, data exploitation and data utilization*
- *Facilitate global and regional, multilateral/bilateral collaborations amongst global academia and industry through networking and funding*
- *Facilitate global awareness about geospatial/SDG related issues through regular hybrid mode multilateral/bilateral arrangements/programs/conferences/workshops/competitions/visits/interactions organized under the umbrella of UN GGIM .*

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Way Forward - Academics & Research at Indian Level

- *Establish an independent desk/section/department at Ministry of Education, GOI to coordinate Geospatial and SDG education, research and applications both at the Central and State level ministries, stakeholders and industries*
- *Develop and implement a Geospatial and SDG focused policy for academics and research in sync with all the pillars and strategic pathways of IGIF – for schools, under graduates and graduates with defined standard nomenclatures for various programs/courses, curriculum and course materials /text books etc*
- *Give an independent identity to Geospatial Science and Technology, support, fund and encourage independent Centers of Excellence/Departments in various Universities/Institutions – at least 50 % of existing MHRD/UGC/AICTE institutions*
- *Identify Geospatial Science and Technology as an independent multidisciplinary subject which vertically connects Arts – Science - Technology and horizontally connects different domains within them*

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Way Forward - Academics & Research at Indian Level

- *Increase penetration of Geospatial Science and Technology as a subject in schools, undergraduate and graduate level (both technology and non-technology courses)*
- *Develop an independent Geospatial Cadre in Govt Organisations, Academic and research Institutions, and include Geospatial Science and Technology in all Exams of higher education and research such as GATE, NET etc and Exams for appointment/recruitment such as UPSC Civil Services Exam.*
- *Facilitate global and regional, multilateral/bilateral collaborations amongst global academia and industry through networking and funding*
- *Develop awareness about geospatial/SDG related issues through regular hybrid mode multilateral/bilateral arrangements/programs/conferences/workshops/competitions/visits/interactions organized under the umbrella of UN GGIM .*
- *Establish a regulatory body for accreditation and promotion of Geospatial Education through Govt/Non-Govt parties*
- *Establish incubators in at least one third of MHRD/UGC/AICTE Institutions to nurture Geospatial startups*

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Thank You

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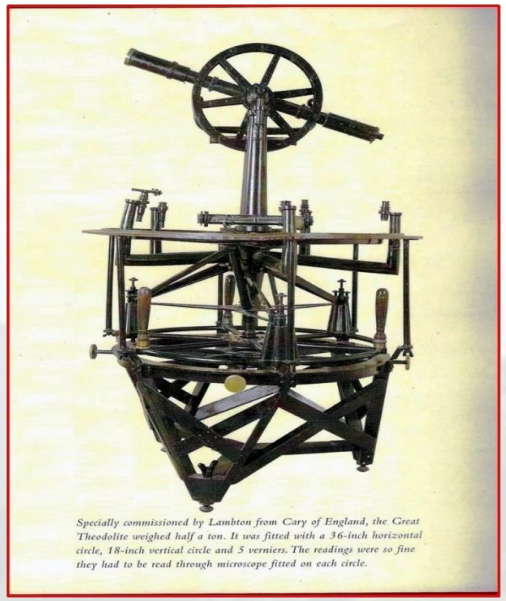
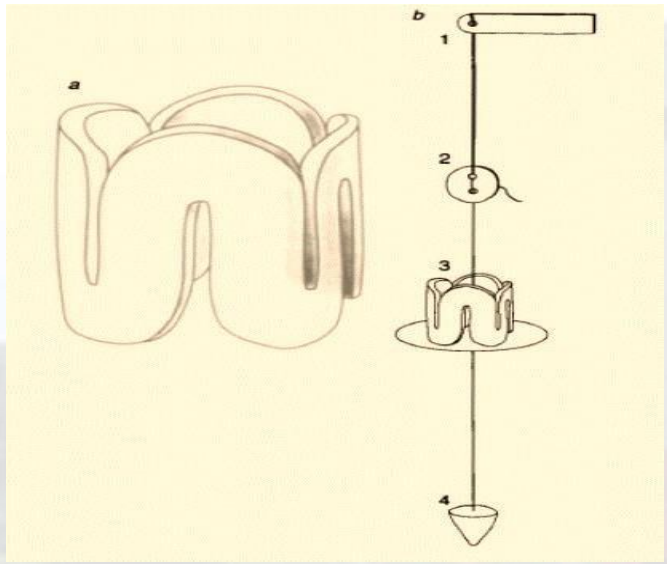
History

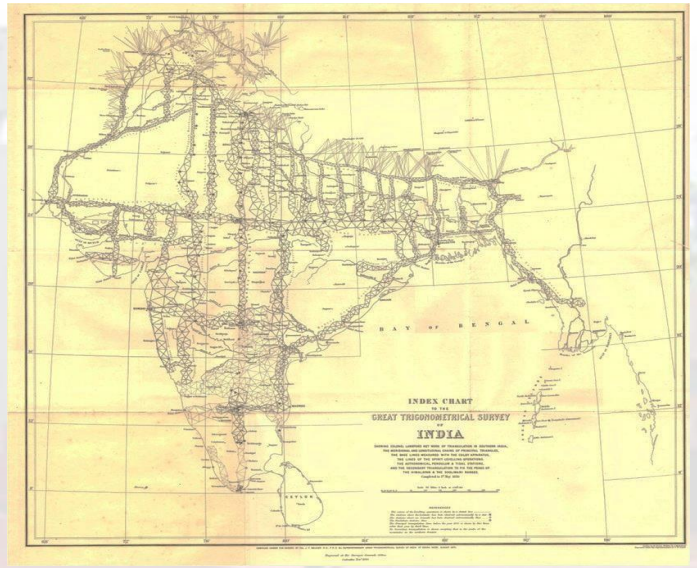


Great Theodolite, 1830

Astronomical Instrument (1830)



Indus Civilisation Survey Instrument (2200 B.C.)



Great Trigonometrical Survey (1802 - 1840), 38 years Long Survey

- *Longest known history of spatial data collection.*
- ***Local Administration** - District Gazetteer in each district (the lowest administrative unit), which spatially used to maintain the records of the local assets and infrastructure.*

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Geospatial Applications And Solutions

Sector-wise Applications

Urban Planning

•*Urban Planning Following initiatives have been initiated for mapping urban areas, smart cities development and infrastructure development. Examples are*

(a) Pradhan Mantri Awas Yojana

(b) Atal Mission. *GIS based Master plan development of 500 cities (Scale -1:4000)*

(c) Smart Cities. *Setting up GIS infrastructure to drive urban transformation initiatives.*

(d) City Master Plan. *Digitization of city planning through developing GIS based master plans and mapping the water utility network*

Agriculture

• *Agriculture is a priority area for the Government. GIS oriented watershed-based development for crop irrigation, soil and water conservation etc are encourage such as -.*

(a) Integrated watershed Management Plan (ISRO and Ministry of Rural Development, Accelerated Irrigation Benefit Program (ISRO-Ministry of Water & CWC).

(b) Horticulture Assessment and Management using geo-information by ISRO and Ministry of Agriculture.

(c) Agriculture insurance claims.

Water

• *GIS is an integrato Tap' and also for water resources management and Clean Ganga Mission.*

•*l Establishing of GIS based state level water data centres for all water management (consolidated at national level) – watershed management, aquifer mapping, surface and ground water management.*

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Geospatial Applications And Solutions

Sector-wise Applications

Climate Change and Disaster Management

- *Climate change is one of the key focus areas of the United Nations' Sustainable Development Goals (SDGs).*
- *India has employed Geospatial technology for improved environment understanding, strategic decision making, monitoring of climate change and ascertaining future risks.*

Transportation

- *Transportation infrastructure is leading in the utilization of GIS across major initiative viz. Railways is using GIS for national level asset management and drone based surveys for mapping the infrastructure.*

Rural Development

- *GIS is extensively being used in following government initiatives to address the rural development. These initiatives aim at generating employment and socio-economic development of the area by creating/ monitoring infrastructures & assets in rural area of India and providing services for amenities.*

Homeland Security

- *M P Council of Science & Technology (MPCST) and GRP is developing web GIS based applications for quick and effective crime investigation.*

Infrastructure

- *Land is one of the most important factors in economic development today and must be managed well to enhance socioeconomic conditions of communities. In this part geo-informatics, ICT and space technology inputs have been used to create the Web-GIS based Odisha Land Bank for industrial development, and compensatory afforestation is elaborated.*

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Geospatial Applications And Solutions

Sector-wise Applications

Gati-Shakti Project

- *National Master Plan for Multi-modal Connectivity, essentially a digital platform to bring 16 Ministries including Railways and Roadways together for integrated planning and coordinated implementation of infrastructure connectivity projects.*

Health Sector

- *In various Government initiatives such as Ayushman Bharat and Pradhan Mantri Jan Arogya Abhiyan, Geospatial technologies are supporting these programs for effective implementation.*

Citizen Services

- *Automated Warnings at Unmanned Level Crossings by ISRO & Indian railways.*
- *Paperless Tickets for Mumbai Suburban Railway (by ISRO & Western Railway).*
- *Geo-spatial inventory of Post offices (by ISRO and Ministry of Communication).*

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Geospatial Solution For Addressing Covid-19 Crisis

- *In India, various government agencies like National Disaster Management Authority (NDMA) and remote sensing/disaster management departments/district magistrates in states like – UP, Jharkhand, Odisha, Karnataka, Maharashtra, Manipur have been utilizing GIS technologies to manage the pandemic.*
- *In the context of COVID-19, agencies are integrating data from multiple sources for operational intelligence.*

Mobile Application: Aarogya Setu

- *It has been developed by the Government of India for real time tracking of COVID-19 infected patients. The App is being used in contact tracing of the suspected COVID-19 cases, reducing time and error in manual identification, helping the Government to take necessary timely steps for assessing risk of spread of COVID-19 infection, and ensuring isolation where required.*

NDMA (National Disaster Management Authority) Dashboard

- ***NDMA** has developed a dashboard that helps in keeping the track of the number of cases of COVID-19 reported in the country.*
- *The dashboard showcases the total number of cases reported in India as well as the world.*
- *It also brings the number of cases reported and the ones that resulted in the death of the patient.*

National Research Development Corporation (NRDC).

- *A Govt. of India Enterprise has been supporting the development of Digital and Molecular Surveillance platform, which is crucial to detect the genetic sequencing of the virus which can be used to develop the vaccine to treat and possibly mitigate COVID-19.*

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