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GEOMATICS EDUCATION IN INDIA – A VIEW POINT

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ABSTRACT: INDIA the world's destination for skilled manpower, continue to produce human resources for various fields ranging from Arts to Science and Technology. Remote Sensing, which is a vital field in Spatial Science, is gaining momentum in India at a faster pace. This paper discusses the necessity of formal education in the field of Spatial Sciences, the problems and prospects of Geomatics education in India subcontinent with respect to the present situation, existing programme and facilities in the context of latest trends in education, quality of the programme, skill development, sufficiency of the qualified persons and scope of research. This paper also discusses the vision statement of space programme with respect to the infrastructure at present and facilities provided. Also it describes about the adequacy of qualified persons to meet the demand and the policy option with respect to the future direction. The difficulties faced by the Educational Institutions which conduct / plan to introduce Remote Sensing and GIS courses in their programme list is brought out. It is an indisputable fact that except for very few Institutions, there is lack of awareness and interest among Indian Universities in the usage and training of Remote Sensing and GIS Technology. Educational avenues in the field of Remote Sensing and GIS that are available at National level are listed out in the content of the paper.

Introduction

In the era of Information Technology with rapid advancement in computing, decision making has become more informed and scientific. For planning at National level, with rapid and reliable assessment through Information Technology, has become the order of the day. Some of the essential fields of application of space technology like

- Natural Resource assessment, development and management.
- Disaster management
- Meteorological monitoring etc.,

Is the proof for indispensable nature of the space technology in day to day life. The total cumulative expenditure on space research till the end of Eighth Plan period (from the inception in 1962-63 to 1996-97) is Rs.7431.67 Crores. The approved 9th Plan provision is Rs.6511.72 Crores for Department of Space which is a considerable amount in the National Budget. The Table: 1 shows the area-wise distribution of funds by Indian Space Research Organisation (ISRO). Apportionment of funds for space research is huge but the availability of manpower to work for it or the number of manpower produced by the educational institutions to work in space technology is meager. Figure : 1 shows the space program in the India from the year 1997 to 2004.

India, world's destination for quality manpower, continues to produce human resource in variety of fields ranging from arts to science & technology. Geomatics, which is a vital field, is gaining momentum in India at a faster pace. Geomatics is a collective term applied to what were previously independent fields of study such as cartography, photogrammetry, and remote sensing, geodesy, GIS and other mapping sciences. Geomatics is defined as:

…a field of activities, which, using a systematic approach, integrates all the means used to acquire and manage spatial data required as part of scientific, administrative, legal and technical operations involved in the process of production and management of spatial information. (Canadian Institute of Geomatics, 1995).

This paper discusses the necessity of formal education in the field of spatial sciences. The problems and prospects of geomatics education in Indian sub-continent with respect to the present situation, the difficulties faced by the Universities offering these courses and educational avenues and infrastructure available for the same are brought out in this paper.

AREA-WISE DISTRIBUTION OF FUNDS (in Million $US)			
	ACTUALS	REVISED ESTIMATES	BUDGET ESTIMATES
	1998-1999	1999-2000	2000-2001
Operational Satellites	131.72	169.71	182.78
Rocket Development	114.63	118.05	164.77
Space Applications	20.61	30.00	30.93
Satellite Development	14.55	16.89	27.90
Direction and Administratio	9.71	24.93	15.69
Space Applications	7.04	8.47	8.31
Total	**298.27**	**368.05**	**430.38**

Table: 1 Annual Budget for Indian Space Program

Formal Education and Research

The need for formal education need not be emphasised in this technologically advanced era. Domain experts with specialised knowledge in each technology field is valued more for bringing out quality output in their related field. Space technology is one such field, which requires experts from various fields to take it forward successfully. India has recently entered into the list of six countries capable of manufacturing and launching space vehicles with a payload capacity of up to 2000 Kgs. It also has an edge over these six countries by cutting down the cost per Kg of payload considerably. (From US $ 25,000 to US$ 4.000). The successful launch of GSLV has taken India a step closer to realising the dream of being a genuine space power and one of the World leaders in geo-spatial technology. We have many successful remote sensing satellites and communication satellites to our pride. These cater to the world market by supplying high quality and high-resolution imageries for utilising in various fields. The reduction in cost of space vehicle launch programs by India has enabled many developing countries to go in for satellite missions. This is a break through in International space programs thereby opening avenues for new players and development of research and development.

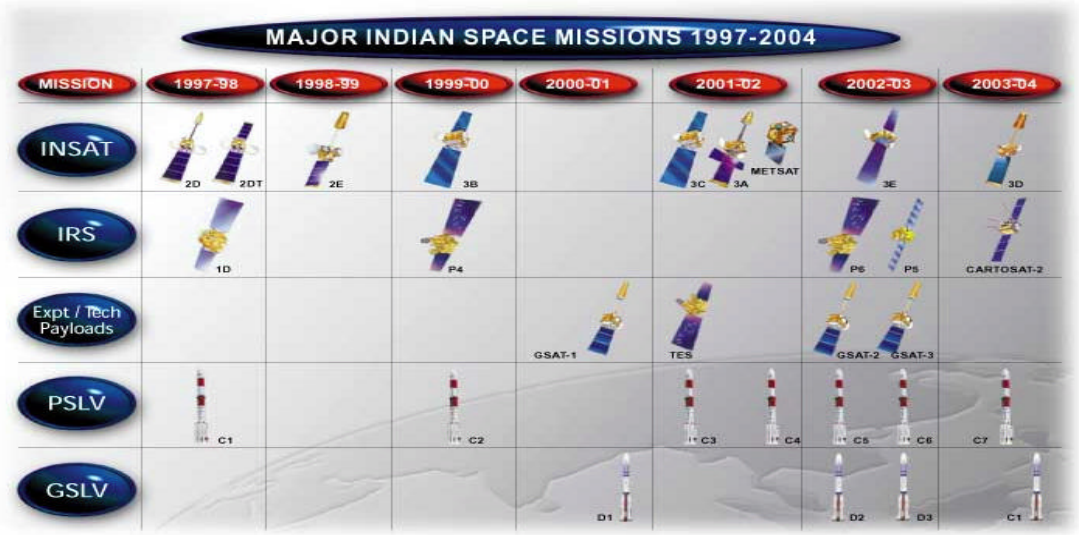

Figure: 1 Showing the Indian Space Missions

Though India boasts of having achieved a Himalayan task, it is sad to say that the formal education related to field of space technologies is in lacking. In India there are 776 undergraduate engineering institution with an intake of 1,85,758 students and 1,215 diploma level institutions having an intake of 2,11,894 (as on 4th May 2000). Very few of these institutes offer courses in GIS & RS in its Undergraduate / Postgraduate level. Out of these institutes, only a handful offer self-supporting GIS / RS training courses for working professionals and others. Around 20 to 25 institutes in India are carrying out GIS / RS activities like courses, training and research. A four-year professional Degree (B.E. Geoinformatics) is offered only at Institute of Remote Sensing, Anna University, Chennai.

Many private computer education companies have started offering courses on GIS for which they charge a hefty amount as fees. This fees is many folds higher than that of acquiring a degree in GIS / RS. The important issue like competency of the faculty, credentials of the institution and the requirement of the student is fully ignored by the takers of this course. The modus operandi of such fly-by-night institutions is to go on an advertising spree to first lure franchisees with great offers and then lure students by promising the moon at a discount thus leaving the students high and dry. This kind of franchise based RS / GIS education mission will lead to deterioration in the quality of GIS education and lead to unhealthy space education program. It should be understood that this is one such course, which requires experts with varied background and specialised in using remote sensing data for solving various problems ranging from Natural resource management to enterprise GIS solutions. Most of the times these incredulous institutions forget the fact that input for creating an Geo-information predominantly come from remote sensing data. The principles of Remote Sensing and the process involved in acquiring information from the remotely sensed data are ignored in their curriculum

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More Universities should offer courses in space technology and application related subjects such as Remote Sensing, Digital Image Processing, Satellite Communication, and Satellite meteorology and satellite remote sensing environment monitoring. These can be included in their standard graduate / postgraduate science degree programmes like physics, geology, geography, meteorology etc, and in engineering degree programmes like agriculture, civil, geoinformatics, electronics, electrical, telecommunication engineering and computer software / hardware development besides others. Research & Development efforts should be directed towards technology as well as applications.

Existing Demand for Skilled Manpower

GIS market in India has grown to Rs.79 Crores in the year 1999-2000 from Rs.29 Crores in the year 1996-97. The Industrial GIS services in India are expending at 10 – 15% per annum. According to report by US based Stevens International Consulting (SIC) for electronic and computer software export promotion council, the GIS exports from India are expected to reach US $150 million in year 2005. But it is a million-dollar question whether India's produces enough GIS professionals from various specialisations to meet this increasing demand. It is evident from the increasing number of GIS & RS related companies in India that the investment in this state-of-art technology and the reliability of the Remote Sensing Technology has increased manifold. It is debatable whether the educational institutions interact with RS /GIS industry to frame or update the curriculum to produce quality GIS professionals to suit the present requirements of GIS industry. The demand for remote sensing specialists and GIS professionals is so immense and we are adding only drops into ocean.

Govt. has realised the usefulness of this technology and has initiated the extensive use of this technology in all possible fields, which in turn has opened the avenues for large-scale employment to GIS professionals. In a survey conducted by the authors about the various job openings for the GIS professionals in India, it was found that there were as many as 8–10 different positions in which GIS and RS professionals were employed. The figure: 2 shows the graph indicating the demand of various positions in the GIS / RS field.

Problems faced by Institutions

The problems pertaining to GIS / RS education were analysed by an opinion survey by circulating a specially designed questionnaire to address the problems of the

1. institutions which conduct courses on RS / GIS and
2. institutions which do not conduct or plan to conduct courses on RS / GIS.

In institutions where these courses form part of a programs offered / paper offered / lesson offered in their curriculum, faces a problem of non-availability of skilled teachers. Also these institutions lack expertise in application of these

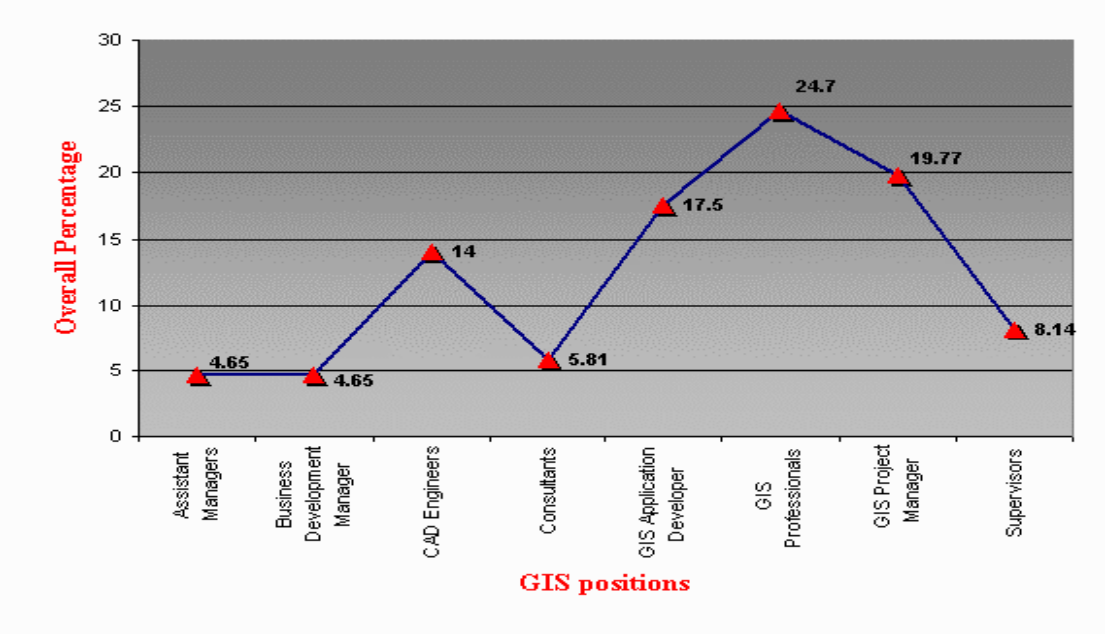

Figure:2 Showing Percentage share occupied by various posts in GIS field

technologies in various fields and also the know-how of integrating these high-end technologies with other conventional technologies.

The basics, principles and applications of GIS / RS technology are seldom delivered to the students who study courses on this. Hands-on experience in usage of GIS, photogrammetry and image processing software is still a distant dream for the students enrolled in these courses. More over the poor patronage of these program is another threat for successful administration of these courses in the Universities where this courses are offered. The universities should prepare projects on themes prioritised by development agencies for soliciting financial assistance there by improving the financial status of the university. The private sector should be allowed access to the facilities of the University / government laboratories for a reasonable cost. The partnership with private industry and commercialisation of space operations will generate income as well as open up the avenues for research and development.

In institutions where these courses are not offered at present, the main reasons for not having planned to introduce RS / GIS in their curriculum is the lack of awareness. It is an indisputable fact that except for very few Universities, there is lack of awareness and interest among India Universities in the usage of GIS technology. Moreover, the initial cost of setting up the laboratories related to spatial sciences is very high that only foreign grants or funds from bilateral and international development agencies will be sufficient for the task. Most of the Universities in India depend on Government and other funding agencies like (Universities Grants Commission, All India Council for Technical Education, Council on Scientific and Industrial Research etc.,) These funds barely meets the sundry expenses of the Institute. Funds from State and Central can meet only a marginal amount towards research and other developmental activities in any University. At this juncture, it the responsibility of the Universities to generate their internal revenue, thereby making them self sustaining. Universities should effectively plan to include this emerging and vital field of Geomatics and Spatial Information Science in its curriculum. It is also the responsibility of these Universities to disseminate the usefulness and importance of spatial information science to the students of various disciplines, setup GIS / RS laboratories and familarise the usage of spatial information science. As almost all the GIS software developers are providing their software at a reasonable 'educational price' and also on long-term interest free loans, these institutes can also avail these offers and plan for a better tomorrow.

Educational Avenues

Foreseeing the importance of this Geoinformatics field, Institute of Remote Sensing, Anna University, Chennai started a four-year engineering degree program (B.E) in Geoinformatics in the year 1992 apart from master's degree program M.Tech (Remote Sensing) and M.E (GeoInformatics). Except this institute, no other institute in the country offers a four-year engineering degree in Geoinformatics. This Institute actively promotes research in RS / GIS and other application areas. Number of training programs is also conducted regularly for the decision-makers from state and central government, officials from user departments, students and entrepreneurs. This Institute also maintains a

databank in which Survey of India toposheets of different scales, satellite data archives of different periods, platforms and sensors, aerial photographs of different cities districts, taluk, and cadastral maps and other reference maps of Tamilnadu State.

Another major Institute in GIS /RS is Indian Institute of Remote Sensing (IIRS), Dehradun. This institute has trained more than 4200 professionals in the field of Remote Sensing and GIS for natural resource management that includes 300 foreign participants from under developed countries. Almost all the Indian Stalwarts in the field of Remote Sensing were trained in this Institute. The Institute also has developed a self-learning 'GIS-TUTOR', a multimedia kit that provides an opportunity for an individual to learn GIS starting from basics concepts to applications. In response to the UN General Assembly Resolution (45/72 of 11th December, 1990) endorsing the recommendations of UNISPACE-82, the United Nations Office of Outer Space Affairs (UN - OOSA) prepared a project document (A/AC.1050534) envisaging the establishment of Centres for Space Science & Technology Education in developing countries. The first such centres named as Center for Space Science & Technology Education in Asia and the pacific (CSSTE-AP) was established in India in November. 1995. The centre is hosted by Government of India and has made available the expertise and appropriates facility through IIRS at Dehradun, Space Application Center (SAC) and Physical Research Laboratory at Ahamedabad. This centre is capable of high attainments in the development and transmission of knowledge in the fields of space science & technology. The centre offers Postgraduate level courses in RS and GIS, satellite meteorology, global climate, satellite communication, space and atmospheric sciences. A set of standard curricula developed by the United Nations is adopted for these programmes.

The centre for spatial information technology in Jawaherlal Nehru technological University, Hyderabad is another Institute involved in GIS education. A systematic and comprehensive GIS course structure has been developed covering basics, concepts and practical. Indian University Consortium for Geographic Information is also formed in order to have a network of Indian Universities and professional bodies for knowledge exchange. This Institute can be reached through http://www.icorg.org/spatialit The role of Indian Institute of Technology (IIT) Mumbai, IIT Kanpur, Roorkee University in GIS education is also highly laudable. Indian Space Research Organisation (ISRO) has established a network of 5 regional centers and State Remote Sensing Service Centres almost in all the states in India. The most important issue is the optimum utilisation of Regional Remote Sensing Service Centres (RRSSC) and State Remote Sensing Application Centres (SRSSC). These centres are involved in training the users of spatial technology in Government organisations. The services of these centres can be extended to the common public by conducting regular courses in RS / GIS areas. The Figure: 3 shows the distribution of ISRO's educational / research units in India.

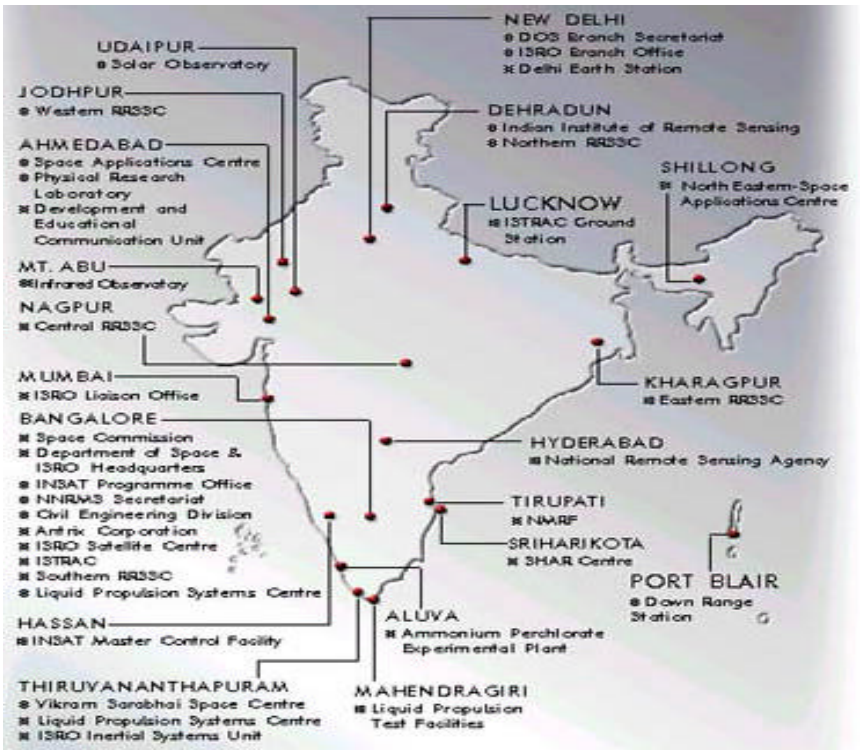

Figure:3 Showing the location of ISRO units in India

Conclusion

The effective introduction of GIS into the education process is complicated by the high cost of hardware, software and the teaching material. It has been found that almost all Universities in the developed countries generate their wealth through their advanced research in collaboration with the industry. India spend less than 1% of GNP on research and many technical institutions have been struggling for years to co-ordinate with industries. The gap between research & development institutions and the industries creates the lacuna in the technology transfer. Without a strong base of research and development, Indian industry can hardly survive in competing with the world class products. Currently there is no standard mechanism available with the technological institutions (except a few) to access relevant information from industries and governmental sources. Further, this is the right time to switch over from traditional blackboard dependent teaching-learning methods to an advanced internet based quality education. All the available material, research work should be made available to GIS learners through internet facilities and communication channels. This should be supplemented with online assignments and group discussions.

It is high time that Universities start utilising the high-end technology of remote sensing and include this specialty as one of the domains of civil engineering / geology / geography departments. The institutes along with industry, should build 'centres of excellence' in GIS to create intellectual property, which can generate income for the institution. This should be supplemented with the long-term R & D work. Also Institutions need to build a skillset database of their alumni who can be motivated to guide teams / projects. Institute should arrange sessions like "career talks" from industrialists as it will help the student community y to keep abreast with the latest situation in GIS field apart from GIS seminars and workshops.

Further the government should high level national GIS academy having a wide network of Universities, Industry and private GIS institutes. This network can also be utilised to the maximum extend possible for education in Geoinformatics. The recent formation of "Indian University Consortium for Geographic Information" during ICORG, Hyderabad in order to have a common forum for a network of Indian of Indian Universities and professional associations, is a commendable step for GIS education in India. Modalities can be worked out for ISRO to extend its technical and moral support to many non-technical Universities, which offer courses in Science degrees relevant to space technology application.

Distant learning and web-based programme can be organised with state remote sensing service centers acting as practical laboratories. As a final word the institutes involved in GIS education must understand that " Communication and Co-operation" are the two major aspects in providing effective GIS education.

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