

SURVEY & MAPPING IN INDIA
THE REGULATORY FRAMEWORK
A Report Written for Directions Magazine India

by

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INTRODUCTION

This is a report on the policy framework that regulates the Geo-spatial industry in India. Survey and Mapping (S&M) is all about measuring and mapping of the land, and using this information for many different purposes. Traditionally, maps support activities relating to land, from studying the topography for planning military maneuvers to detecting changes in urban sprawls, monitoring road construction, digitizing land records, or mapping aquifers and surface drainage. Today, digital map services are available on many devices and location applications are built on maps, of which, *Google Maps* is most widely used.

The objective of this paper is to evaluate the regulatory framework within which the Indian S&M Industry functions and the impact it has on the usage of maps on corporate and individual users. This report reflects the status of the S&M Industry in India today. It is based on past reviews of existing policies and interviews with practitioners in the S&M Industry. It draws on comments made by participants of the Panel Discussion *Survey and Mapping @ Cross Roads* on 10 July 2014 at the conference *Survey India 2014*, held in New Delhi. Here is the link to the

audiovisual Part 1 <http://www.youtube.com/watch?v=AXS5FeoLPHc> and continuation in Part 2 <http://www.youtube.com/watch?v=WXSKndJVzBg>. The concerns expressed by the participants related to the many regulatory agencies, difficulty in accessing maps and the inconsistent way in which policy guidelines are applied. Some stressed the inappropriateness of policies within a changing technological environment. Overall, there was a demand for review in the policies.

There is conviction in India that Geo Services can play a significant role in governance, industry, economic and social life; and consequently the policies that influence their functioning require to be understood. The general economic impact of Geo-spatial technology is well documented (Oxera: *What is the Economic Impact of Geo Services*, 2013) and will not be repeated here. Quantitative estimates of the size of the Geo-spatial Industry market in India has been made in the past (Feedback Ventures: *Financial Strategy for NSDI*, 2005, and BCG: *Putting the Indian Geo-spatial Services Industry On the Map*, 2013).

Literature on map policies includes *Restriction on maps: A denial of valid geographic information* by S. V. Srikantia. This is a comprehensive analysis of the Map Restriction Policy of 1967 (Current Science, vol. 79, no. 4, 25 August 2000). An incisive analysis of the National Map Policy 2005 is to be found in *India's National Map Policy Guidelines: A new move(ment)* (My Coordinates, 2006).

The first part of this paper lists and documents the chief objectives of the S&M policies. Since laws, orders, directives, guidelines all emanate from policies, and together influence the functioning and perceptions relating to the disciplines, we bring them together here. In the second part, regulations within the policy framework that impact the functioning of the Geo-spatial products and services industry are highlighted. Here the emphasis is on using empirical examples to examine the effectiveness of these policies. Finally, in the light of changing S&M technologies, recommendations for review of the policies are made.

THE POLICY FRAMEWORK

S&M in India function under a policy framework that was put in place by several ministries of the government of India, over a period of six decades. Here we

highlight some features that affect public usage of maps and spatial data as a consequence of these policies.

The most rigorously enforced policy for the longest time in independent India is the rule prohibiting the export of all maps of 1: 250K and larger scales through any means. This is enunciated in the Ministry of Finance (Department of Revenue) Notification No. 118-Cus./F.No.21/ 5/62-Cus. I/VIII dated 4th May 1963. In conventional military exercises, these topographic maps are of strategic importance since they show relief and use a reference system to locate places. They provide height information in contours and benchmarks. By prohibiting export of these paper maps, this information could be safeguarded from enemies. The ineffectiveness of this policy today may be judged by the fact that in practice, foreign companies get digital topographic maps of India from several repositories around the world, as reported later in this paper. Indian topographic maps are offered from several portals hosted at data centres outside the country, and offer map services to users in India through the Internet.

The Map Restriction Policy of the Ministry of Defence (letter no. F.7 (7)/64/D(GS-III) dated 25th August 1967, restricted the dissemination of topographic maps, aerial photos, trigonometric and geophysical data for large parts of the country. This had a far reaching effect on the mapping culture of independent India and perpetuated the perception among many that maps were a security threat. This policy restricted maps of the north and entire north-east of the country and a 80km buffer along the international land and coastal boundaries of the country. The largest cities, including Mumbai, Chennai, Kolkata and Kochi, are located in the restricted zone. As a consequence, maps have not been updated routinely to record urban explosion in these expanding cities. This policy was amended partially over time and some small scale maps were released for public use.

In 2005, The National Map Policy (NMP) set out rules that regulate mapping in India. Authored by the Ministry of Science and Technology, it sought to define the limits within which users can access and use Indian map products. The Survey of India, as the nodal map agency, implements the Policy and has listed specific Guidelines for the purpose. The new Open Series Map (OSM) for public distribution of maps was introduced under this policy. Export of topographic maps

at 1:250K and larger scales remain prohibited. Belying the industry's expectations, distribution of OSM maps was limited by content and territory. A large number of map sheets along the international boundaries, accounting for about 40% of the country's area, still remain restricted.

SOI digital map data can be distributed only to Indian citizens, institutions and companies. This was a positive step, a change from the earlier stance that no digital data could be distributed. A few companies have been able to access data for value addition, the first being Eicher, who created road and city maps of India in the private sector for public distribution. Foreign companies cannot source digital maps from SOI.

With limited access to SOI topographic maps, in the last two decades there has been increasing dependence on satellite images. With imagery becoming available in digital form, it was easily sourced from the Internet, directly from suppliers. It was popular with Geo-spatial professionals for performing analytical tasks and map making. But in 2011, the Remote Sensing Data Policy (RSDP – 2011) of the Department of Space came into being and made sourcing imagery from overseas clandestine. The RSDP, while making ISRO the sole supplier of satellite images in India, deals primarily with procedures for acquisition and distribution of satellite images, from Indian and foreign sensors.

RSDP – 2011 identifies the National Remote Sensing Centre (NRSC) as the nodal agency enforcing the Policy. Satellite images of 1m resolution and larger can be acquired quite simply, though the private sector still needs approval for purchase. Purchase of images less than 1m resolution by Indian and foreign corporate and individual users require to be cleared by an inter-agency High Resolution Image Clearance Committee (HRC). The HRC includes representatives from Ministries of Defence, Ministry of Home Affairs, Survey of India, NRSC and ISRO, among others. Clearance is given on a case to case basis and there is no specific period within which clearance will be granted or rejected.

The National Data Sharing and Accessibility Policy, 2012 (NDSAP-2012), facilitates access to Government of India owned shareable data. The Policy applies to all data and information created, generated, collected and achieved using public

funds provided by Government of India directly or through authorised agencies by various Ministries / Departments/ Organisations/ Agencies and Autonomous bodies. It thus applies to Geo-spatial data also. However, it is primarily for exchange of data between government departments on secure networks, to enable the functioning of data centres and organizations of the government, like the National Spatial Data Infrastructure (NSDI).

The idea of a NSDI was mooted in 2000. However, it faced two problems. One, the government departments that created maps and would contribute to the NSDI did not have approved procedures to do so, and two, their maps were still on paper and required to be converted to digital before they could offer them to the NSDI. Both these problems have been addressed through the NDSAP-2012.

Publishers of maps are regulated by The Criminal Law Amendment Act 1961, Act no. 23 of 1961 (17 May 1961). This states that 'whoever publishes a map of India, which is not in conformity with the map of India as published by the Survey of India, shall be punishable with imprisonment which may be extended to six months, or with fine, or with both'. Occasionally, maps published overseas may represent the boundaries of India, especially disputed international boundaries, as different from that published by SOI. When such maps are imported, Customs confiscate, mask or destroy them. This practice is in accordance to the Courier Imports and Exports (Clearance) Amendment Regulations, 2010 (Notification No. 75/2010- Customs (N.T.) dated 12th August 2010) and strictly enforced.

THE REGULATED INDUSTRY

From a highly restrictive map sharing culture at the time of Independence, in the last ten years, policies have very slowly opened up the use of some categories of maps and satellite images among government departments.

Outside government, the impact of the regulations has been less encouraging. For example, although the OSM are for 'unrestricted' areas, the Guidelines state 'Contours & heights will not be available in restricted zones as per MOD's instructions.' So there is no clarity on the intent of making OSMs 'unrestricted'.

Here we discuss policies that affect the S&M Industry and raise questions regarding some of their objectives and effectiveness today.

Access to Web Maps and Location Apps

The number of people who use Google Maps, Bing Maps, Yahoo Maps, Rediff Maps, etc., increase every day. This is because maps are fascinating, provide location information and give a sense of orientation to the lay user. Most of these users from India have seldom used a paper map earlier. Today, many applications (apps) are built using location APIs, such as in driving directions, traffic notifications and vehicle tracking. It is time to acknowledge the benefits that accrue to large numbers of people through greater access to Web maps, for example, by using empowering apps like Travel Aid Plus. These are an important component in nurturing Geo Services businesses, which supports convenience and efficiencies in everyday life and creates jobs.

The business generated by these companies using spatial data and maps is enormous. Increasingly, the map will be viewed and apps will be built on the cleaned and structured spatial data that has been generated painstakingly from the digital map. The restriction on SOI topographical and other spatial databases of the country will result in a great opportunity lost in developing apps for varied purposes on different devices: for innumerable requirements in businesses, government and society at large.

Limited Access To Satellite Images

Views of very detailed satellite images are now available to all from the Internet. The large numbers of people who use map services from the Internet are an indicator to their popularity. For several years now, an Internet connection is all you need to see the finest images of the nation from anywhere in the world. They are available for free from websites like www.flightradar24.com and Google Earth, among others, and show places which are considered 'vulnerable' under our NMP.

Foreign companies and individuals freely source high resolution satellite data on India, quickly and at lower prices from overseas suppliers directly. But in India, the procedures of acquisition and access remain cumbersome and time consuming. The HRC requires to clear resident individuals and companies to source these same

satellite data at a higher price, with longer delivery timelines. Very few outside of government can actually avail of the high resolution Geo-spatial products. One may ask, what objectives do the RSDP regulations serve? It cannot be the case that the purpose of security is served, because Indians too can see the detail satellite views on websites mentioned above.

Often overlooked is the fact that in spite of substantial capability in satellite data processing in India, their actual usage is limited. This has largely to do with procedures of access. In contrast, Google Earth provides easy access to developers of location applications or high quality cartographic products. They have become a standard for tracking changes over time for a large number of purposes like monitoring landuse/landcover, urban spread, road network, etc., in India.

Export of Topographic Maps and Digital Data

The 1963 rule, now a part of the NMP, is undoubtedly the most widely known rule affecting the international distribution of maps of India. It applies not only to maps from Survey of India but also other map creating organizations of the government of India, like the National Atlas and Thematic mapping Organization (NATMO), Geological Survey of India (GSI) and National Bureau of Soil Survey and Land Use Planning (NBSSLUP), who use the SOI topographical maps to add their own information. Because population, soil, rocks and minerals, forests, water bodies and irrigation channels, wastelands etc. maps use topographic maps as a base, they too are presumed 'not for export' for scales 1:250K and larger.

To what extent has the suppression of map export deprived the foreign users of Indian topographic maps? The old pre-independence maps, for example, topo sheets from the US Army Map Service series U 502 of 1968 currency are available from the University of Texas Libraries website. The British Library's maps in APAC (Asia , Pacific and African Collections) has, for historical reasons, excellent pre- independence collection of topographic paper maps of India and available for consultation. Survey of India 1:250K (1970-1986) and 1:50K (1959-1988) maps are available for purchase from the EastView Geospatial website. Many other such examples can be cited.

This rule has created a rather anachronistic situation. Scanned topographic maps of India are available from several well known repositories around the world as recorded above. The Internet makes it possible to access these maps from India. If the purpose of this rule was to restrict information about India from those outside its territory, then clearly it has not served the purpose. Instead of banning export of all maps of 1:250K and larger scales, there is a strong case for exporting the Open Series Maps, so that current maps of India can be distributed worldwide.

Partnering with S&M Industry for Large Scale Mapping

There are constraints of time and resources that restrict the extent the country can be mapped, or remapped, by SOI. But, access to a map is the first step to gathering information of unfamiliar places and it contributes to the initial studies of areas. Not having a map can sometimes lead to serious problem, as the oft cited case of the disadvantages faced by the IPKF on landing on the shores of Sri Lanka, without reliable topographic maps. In view of this, SOI may consider distinguishing between the maps created by themselves and maps created by other map makers. Different kinds of maps created by the S&M industry, based on well defined standards, should result in creating maps of different themes and scales that are now in demand but not supplied by the nodal mapping agency.

Large scale topographic maps were not undertaken till recently by SOI. Yet they are the need of the hour for activities like identifying encroachment and defining mining lease areas. The Smart Cities project, expected to cover 100 cities, will require S&M services from the initial planning onwards. This enormous amount of mapping cannot be met by Government agencies alone in a short period of time. So framing policies to encourage private companies in preparing large scale topographic maps should be actively considered.

Large scale maps have their own idiosyncratic features, which may not have been considered when framing the NMP a decade ago. The medium for construction and delivery of these maps is usually digital, since only maps of small areas can fit into sheets of paper. They store a great deal of detailed information and hold many items of data relating to manmade features, which are prone to change over short periods of time. The digital environment is also suited for making routine updates on large scale maps and permits rapid corrections.

Large scale mapping requires not just inputs from surveyors and cartographers, but a host of technologies to support data input from multiple channels, developing software to process the data for input into the system, massive secure digital storage and means of delivery to multiple devices. It requires surveyors proficient in using digital equipment, data validators, systems engineers, apps developers and digital cartographers. The huge investments in terms of expert human resources are often a challenge for organizations like SOI, which have limits to employing staff. Partnering with Industry would lead to tapping these resources and meet the objective of creating large scale maps.

Demand for Local Information

Another feature that needs now to be considered is the significance of 'local' data in taking actions in everyday life. Many instant decisions are made on the basis of local information. Knowing the opening hours of neighbourhood shops, location of restaurants with specific cuisine, parks with seating for the elderly and ATMs open after banking hours cannot be considered strictly 'developmental' activities. The Geo-spatial data to support these information needs are not gathered by government mapping agencies and are not within the purview of any of the policies under consideration here. The public is now spoilt for this kind of information and has itself become a source of such data.

At present, several companies have tried to overcome time and cost intensive conventional survey methods of capturing local data by using participatory mapping methods. Crowd-sourcing through Web interface like Google's *Map Maker*, address geo-coding and using satellite images for positional reference has become popular. New positions are introduced by GPS and the ubiquitous phone camera now serves to add geo-tagged images of field assets to maps. This form of participative gathering of data is now known as crowd sourcing and works well for populating maps inexpensively and with the knowledge that there will be some discrepancies. However, the errors can, in fact, be kept low by mediating and strictly validating the incoming data.

Many data sets including business listings are useful for the public. Their value to users increases tremendously when linked to location. Suppliers of this kind of data

are not concerned with a high degree of precision in the position of the business but require correct information regarding it. Thus the traditional view of a perfect topographic map is being challenged by correct attribute data of the place, sometimes at the cost of positional accuracy. The hand held GPS device is the commonest means of collecting this data now in the country. Topographic data (latitude, longitude and elevation of a point), in the classical sense, is collected by every user of a GPS embedded Smartphone. Smartphones may not yet be good for topographic survey grade data, but is certainly widely used for less precise purposes. Can this ubiquitous data be vetted by SOI under the NMP?

Social media is a useful channel for gathering widespread information, on the basis of which government can respond to local concerns. In one case, power blackout occurrences are highlighted by aggregating data from Twitter and Facebook feeds in www.powercuts.in. In another, the status of bad roads is documented in www.badroadsinindia.com by gathering relevant data through a Web interface.

Crowd sourcing is an inexpensive and rapid method that can be used taking advantage of the expanding telecom networks and mobile Smartphones. Its success depends on a high level of post-processing and data mediating skills of organizations that capture such data. As this process of data input is likely to increase, future map regulations need to find ways of effective mediation, while giving the data generator adequate scope to perform this function smoothly.

Security & Depiction on Maps

The NMP points to concerns for the security of the country and the guidelines reflect this. To what extent can these guidelines be implemented in current times, when technologies, digital communications and devices change rapidly?

Underlying the policy is the assumption that map developers in the private sector can only value add or resell SOI's own maps. There is no acknowledgement of *creators* of map products in the private sector. But surveyors and cartographers do create map layers and most times these are, in the layman's language, Points of Interest and navigable roads. They create map products for different uses, viz., development, tourism, convenience, safety, entertainment etc.

Some places in the country are identified as 'vulnerable' in the regulator's perception of national security. SOI and MOD are part of an approval/ vetting process to ensure that no civil and military Vulnerable Areas and Vulnerable Points (VA's & VP's) are shown on OSMs. The lists of VAs & VPs necessarily change as time goes by and therefore there is concern that the data captured by S&M industry through survey methods and crowd sourcing may be transgressing on places identified as vulnerable. This is possible, particularly since the list of vulnerable places is 'classified' and not disclosed to the public.

Security issues cannot be ignored, so it is important to find ways to expeditiously implement the guidelines relating to vulnerable places. Methods to speedup backend processes by MOD to clear VAs & VPs collected by the S&M industry must be devised. One way of excluding these places from a public map is by the regulator to maintain comprehensive master databases of VA & VP. Points of Interest or area names surveyed by industry or crowd sourced will be matched with this database and exclude classified items. This will reduce delays in vetting data and ensure uniform application of rules.

India has a well defined and officially accepted international boundary. To ensure that all maps of India reflect this official boundary, maps require to be certified by SOI before publishing. The NMP states that if the international boundary is depicted on the map, certification by SOI will be necessary. Several foreign companies that publish atlases, globes and digital maps from other countries, do not go through this process and often require to void the unacceptable sections when imported to India, as discussed earlier. This author recently received copies of *The Times History of the World in Maps (2014)* which had one map which did not conform to the international boundary of India as depicted by SOI. The 'objectionable' section, Pakistan Occupied Kashmir, shown as a part of Pakistan, was cut out of the page by the Customs authorities and the book released.

It is suggested that the certified international boundaries of India are made accessible in digital form to all by SOI itself. This has been the practice for small scale paper maps. The digital boundary files of India could be offered in different technical specifications and would have the stamp of approval from the regulator.

This will enable SOI enforce one official international boundary for India and also make it possible for all to show it accordingly. In the absence of such a certified and approved international boundary file, foreign publishers cannot show a uniform boundary.

Aerial Survey & Defence Concerns

Though earlier limited to the Defence establishment, the domain was opened to civilians in 2006. Yet, capturing ground data by means of aerial survey methods is negligible in India today. While there is no policy or law restricting aerial photography either by Indian or foreign companies, demand for aerial survey service has remained low.

The MOD and MHA play an important role in vetting applications for flying over areas for the purpose of capturing data by camera, and other sensors like LIDAR, from aircraft or UAV (Unmanned Aerial Vehicle). Seven copies of *Application for Grant of Permission for Aerial Photography/Remote Sensing Survey* must be completed and submitted to the Director General Civil Aviation to get permission to fly. This detail form is downloadable from dgca.nic.in/forms/aer-photo.pdf.

The procedure to receive this clearance is not transparent to the public and the process is time consuming. Once the permission is obtained, further delays may take place in sourcing control points from SOI and in the case of small areas, the density of points could be woefully low.

Aerial photography is perhaps the best technology for large scale mapping and for land survey for the purpose of cadastral mapping and change detection. It is suitable for capturing topographical data in difficult terrain where terrestrial survey is not possible. Photographic equipment can be carried by UAVs as well, besides air planes. Thus it is an activity that deserves attention and promotion for the purpose of mapping mountains, marshy plains and deltas, oceans or forests, and especially for extensive cadastral mapping. Not of least importance is the fact that the same ortho-photos can be used for multiple purposes.

RECOMMENDATIONS

There is urgent need to review the S&M policy framework to align with technologies, public expectations and support government in delivering services. It is time to streamline the procedures to implement them. Here are some recommendations for review and urgent change.

- 1 The time has come to frame one overarching Geo-spatial policy to consider all aspects of spatial products and activities. One regulatory authority to oversee all aspects of Geo-spatial data, institutions, policies and laws would help in removing uncertainties in interpretation of regulations. This policy must be framed after public debate and guidelines framed with a view to enabling compliance.
- 2 As of now, industry approaches several agencies for survey permissions and map clearances. A single window for survey permissions and map clearances is required. One Geo-spatial portal with a comprehensive checklist of all laws, policies, regulations, documents, processes and timelines would go a long way to simplify engagements with regulators.
- 3 S&M often form a part of other large projects. Time taken to complete them has critical impact on the rollout of the overall project. Development projects get stalled because of the delay in providing survey results on time. So regulators must be time bound in giving approvals and to clear applications.
- 4 Over a period of half a century, some regulations have become archaic. The topography of restricted areas in India is seen on Web maps offered from overseas data centres via the Internet. So the restriction on export of maps, paper or digital, serve no purpose. The OSM maps, cleared by MOD for public distribution in India, should be available for export also.
- 5 Some policies may not withstand legal and constitutional scrutiny and have become superfluous. The RTI Act 2005, sections 4(1), (2) & (3), mandates all public authorities for proper documentation of data and

- provide its easy access to every citizen of the country. But the NDSAP-2012 promotes sharing data between government organizations only. The public should get access to maps, created by public funds.
- 6 The NRSC is the sole distributor of satellite images in India. The RSDP protects its commercial interests, and this can be viewed as discriminatory in law. This practice negatively affects Indian industry and must be discontinued. Satellite images and data from foreign sensors can be sourced at lower prices, in shorter delivery time from overseas.
 - 7 Mobile Smartphones, 3D videography, ubiquitous GPS enabled devices, HR satellite images downloads from the Internet, are today's realities. Crowd sourcing data rapidly and inexpensively, using diverse platforms, is here to stay. Regulators must adopt internal process automation to quickly validate Industry's pre-publication data using digital processes. This will reduce transaction cycle times for S&M companies.
 - 8 The NMP should make it possible to distribute the certified international boundaries of India in digital form by the regulator from the SOI portal and Map Sales Offices, without the requirement for further approvals by the publisher. The international boundary files of India should be offered at different scales, approved by the regulator and acceptable by law.

THE FUTURE

The impact of technology on this industry has been significant in recent times. So, besides reviewing the policies, other related measures should be taken to foster growth in the industry.

1. There is a shortage of trained S&M professionals today. It is anticipated that this will lead to serious bottlenecks in undertaking the massive amount of work that will arise as a result of new government projects, like, Digital India. Building human resources takes time and thus training of skilled persons requires immediate attention. The Ministry of Science and

Technology should take a lead in this matter, especially since it involves technical education specific to S&M.

2. Certification of capabilities of professionals like surveyors, auditors, digital cartographers, technical document writers, software programmers, instructors, GIS technologists etc. is now imperative to build capacity in the S&M industry. Certified professionals will ensure quality mapping for different verticals, like the power sector, highways, forestry etc.
3. S&M practice now works within an electronic environment. Survey technologies include handy digital instruments, with embedded GPS and mobile post processing facility. To successfully utilize these in getting best results, standards documents are required. The time has come for *the nodal mapping agency, SOI, to produce documentation of the minimum acceptable standards in field survey, map preparation, data interoperability and distribution.* This will enable SOI to involve industry in producing large scale topographic and other maps.

CONCLUSION

The policies, described above, indicate that some cannot be applied effectively and others are subject to ambiguous interpretation. The certainty of law is missing in them, and so it should be balanced by implementation guidelines that are clear and transparent. This is a very legitimate demand from Industry, as there are several examples of inconsistencies, such as, cases where 3D video images are sometimes permitted to be captured and at other times not. These results in leaving an impression those policies are applied in a discriminatory manner.

The MOD and MHA are usually identified as those who restrict sharing of maps with the public. Their concerns regarding security of Indians and India are unquestionable. However, all S&M activities cannot be equated to security risk and to the exclusion of all other purposes, like, development, tourism and travel, convenience, information storage, location services, and many more. Reviewing regulations that hinder Industry from functioning efficiently should be high on the priority of policy makers.

The S&M Industry responds not only to technological changes like instrumentation, communication and data processing, but also to people's expectations. Thus it becomes important for those framing policy and laws to have close linkages with industry players, researchers and S&M institutions to appreciate these drivers of business. These linkages will also establish platforms to communicate and exchange ideas and views leading to effective policy framing.

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