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LEGAL ISSUES RELATING TO CONVERGENCE OF IMAGING, POSITIONING AND SPATIAL DATABASES

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ABSTRACT

There is a new scenario developing with the advances happening in the imaging, positioning and GIS domain. The power of "spatial information" is changing the way governance, commerce, development, resource management, environmental protection, security and a citizen's life is impacted - either in a direct or indirect manner.

With the availability of the high resolution images (presently 1m, later even sub-meter resolutions) in the commercial domain, the divide between the "free access" civilian image requirements for supporting developmental activities and the "restricted" defense requirements for national security and image intelligence applications have vanished. With the availability of these images for any part of the globe, the outlook of many nation for dissemination and use of these images have had to adjust to these technological and market driven developments. Further, the high quality data gathered from space with different spatial, spectral and temporal characteristics are also enhancing domain of applications of Geospatial Intelligence and Information, which is produced using GIS technologies. A new dimension is emerging through advent of advanced satellite positioning systems for civilian applications providing interoperability, integrity, reliability and better positioning and location accuracies. Integration of the power of imaging with the precise positioning is fuelling the geo-spatial technologies and applications to reach dimensions and areas hitherto not imagined. The use of these "spatial data" promises greater efficiency in commerce, improvements in the environment, health, and safety, increased convenience for consumers, more citizen participation in governance, and improved public and private decision making in a general manner. What are the policy framework that will become relevant with the integration of these 3 spatial technologies?

Legal regimes for protecting and managing compilations of digital spatial data, however, are underdeveloped and unclear. Ownership of digital spatial data, protection of privacy, access rights to spatial data compiled and held by governments, and information liability are still developing in the context of spatial data. However, they also pose several legal challenges relating to national security and integrity and access to data. This convergence is also driving establishment in different countries of National Spatial Data Infrastructures, which interlink and integrate various spatial databases managed by different agencies and generate information that can be accessed by the users in the government and private sector including general public and NGOs. This paper discusses several poloicy and legal issues in these areas – specifically in the context of technology management, spatial databases, applications etc and brings to fore the need for an international consensus on the policy regimes.

1. INTRODUCTION

With the information revolution way on, by means of which huge masses of information now flow widely around the world, there is a growing acceptance of transparency, which has led to relaxation of long-held political restrictions on the gathering and dissemination of information.

One of the important information sets that is emerging to play a dominant role in Informatics is Spatial data – data that pertains to a geographic location or has a "reference coordinate" connotation. What does the Spatial data constitute? Images from satellites and aircrafts; maps derived from the images and from other ground surveys; data from GPS and Positioning systems; data from specialized instrumentation surveys (many new instruments are in use today – Airborne Laser Terrain Mapping instrument; Ground Profiling Radars etc) are some of the major constituents of the spatial datasets in any community. Spatial data have had substantial impact on government and business throughout the world. Increasingly, spatial data constitute the core of the information management systems of both private companies and public agencies. The spatial data and processing capabilities supplied by the technology also constitute a significant component of the emerging Global Spatial Data Infrastructure (GSDI).

One of the major technological elements that has changed the information scenario is the availability of high-resolution satellite imagery in the commercial domain. Although satellites have been observing the Earth for nearly forty years, those that could provide highly detailed imagery were operated by secret military/intelligence programs. US made satellite imagery available for sale beginning in 1972, followed by the French SPOT system and the Indian IRS systems and many other systems. But all these imagery showed broad panoramas, not fine detail. While the Indian IRS opened the civilian domain of highres images (highres here is meant anything better than 5 m resolution) with 5.8m resolution in 1995 and the present Cartosat-1 with 2.5m resolution, today IKONOS, Digital Globe and Orbview provides images at 1m (and better) resolution and there are planned missions that would reach the range of 30cm resolution from satellite platforms shortly. Public availability of timely high-resolution imagery represents a notable break with the past. With the availability of the 1m data (later maybe even sub-meter resolutions) in the commercial domain, the divide between the "free access" civilian image requirements for supporting developmental activities and the "restricted" defense requirements for national security and image intelligence applications has vanished (Rao et al, 2002).

These images considerably enhance the scope of applications for developmental activities and open up vistas for a number of newer applications – specifically for spatial databases for urban infrastructure, cadastral and rural mapping, geo-engineering, micro-watershed development, disaster management support, business geographics, retailing and marketing etc. Quite significantly satellite imagery has become a crucial component of an ongoing shift towards greater transparency. The relevant question, therefore, is whether this era of transparency has adequately equipped itself to meet the current and perceived future challenges in terms of appropriate legal and policy frame works at international level. How are they influenced by events of September 11, 2001, which resulted in mounting concerns on security, in particular, in various states across the globe?

With the availability of these images for any part of the globe, the outlook of any nation for dissemination and use of these images will have to adjust to these technological and market-driven developments. We have moved from an era in which only a handful of governments had access to high-resolution imagery to one in which every government and businesses, nongovernmental organizations, and public groups will have such access. The new transparency could offer enormous benefits for nations and peoples around the world and yet governments throughout the world are woefully unprepared for the coming era of global transparency.

The other major technology that has changed the scenario is the Geographic Information System (GIS) – which allows for handling maps in the digital domain and allows powerful integration of various maps datasets to create newer visualization of information and simulation of patterns that enhance knowledge. Thus, GIS have come to handle Geographic Information (GI) and these include images, maps, positioning data etc. Increasingly, GIS constitute the core of the information management systems of nations and their entities. The data and processing capabilities offered by the technology also constitute a significant component of the emerging national information infrastructure in many nations. The use of spatial data promises greater efficiency in commerce, improvements in the environment, health, and safety, increased convenience for consumers, more citizen participation in governance, and improved public and private decision making generally (Taylor, 1998).

The third major technology that is emerging is the precise Positioning and Navigation datasets through satellites that use radio ranging to fix precision position of object. The precision of position is so high and so easy to obtain using a device that the dataset is a major GI input for a variety of aviation navigation and personalized navigation systems. Coupled with terrestrial or satellite communications systems, these technologies are being used in automobile navigation and information systems, fleet management systems, asset tracking systems and other consumer and commercial applications. Location-enabled cell phones are coming soon, and location technologies, wireless devices and the Internet are converging to become one of the hottest commercial technology sectors. There are many different markets for location technologies at various levels, including OEMs, system integrators, value-added resellers, etc., each with its own unique risks and business models. End users range from consumers to municipalities to international shipping fleets. Fortunately, this technology does not present insurmountable legal obstacles that will prevent its further development and widespread commercial application. It does, however, give rise to certain legal issues and, in some cases, certain legal risks unique to the technology.

Policy and legal regimes for managing the varieties of spatial data, their usage and access and their commercial potential, however, are underdeveloped and unclear. Ownership of digital spatial data, protection of privacy, access rights to spatial data compiled and held by governments, and information liability are still developing in the context of images and GIS. Moreover, it is spatial data products and services, as opposed to other forms of electronic data, that agencies at a variety of levels are attempting to sell, thus prompting legislative and other efforts by owners to restrict access to spatial information in digital form. In short, because of the great value of GIS, its potential for altering government's relationships with citizens, and its potential for intrusiveness, concerns over the

handling of digital spatial data will be substantial factors in society's reconciliation of competing social, economic, and political interests in electronic data generally.

Thus, in this paper, we touch upon policy and legal issues concerning images and GI information.

2. EVOLUTION OF INTERNATIONAL LEGAL FRAMEWORK AND TRENDS

With the advent of satellite remotes sensing, the UN led the way for an informed debate on the use of satellite images by way of a basic legal framework established by the United Nations for conduct of outer space activities. A landmark development was the adoption of a resolution by the General Assembly of the United Nations in 1986, on Principles Relating to Remote Sensing of the Earth from Space (http://www.oosa.unvienna.org/SpaceLaw/rs.html). In general, UN resolutions are recommendatory in nature, and not legally binding as are international agreements. In many cases though, UN resolutions incorporate already adopted Principles from prior treaty law or international customary international law and, if so, to that extent such Principles remain binding (Gabrynowicz, 1993). These principles essentially recognized that imaging from space required no prior consent of sensed country. At the same time, it was also stipulated that remote sensing activities from space shall not be conducted in a manner detrimental to the legitimate rights and interests of the sensed states. The resolution also established the guiding principle of non-discriminatory access by the sensed state for data concerning its territory. While reiterating the goal of promoting international cooperation in the conduct of remote sensing activities, the resolution emphasized that remote sensing activities should be conducted with due regard to the needs of developing states. These principles, although adopted in the form of a non enforceable resolution, enjoyed a wide consensus, guiding and providing a basis for several international agreements between the providers of remote sensing data and the recipients.

However, since the time of adoption of UN resolution and the above initiatives, significant changes have occurred in the field. These include: (i) improvements in technologies that enabled satellites to provide data with much better spatial, spectral and temporal characteristics, (ii) entry of many more state players who owned and operated remote sensing satellite systems and (iii) evolution of commercial systems providing high resolution data. From legal perspectives, the last of above three trends assumes great significance. A significant trigger for evolution of commercial systems for high resolution data came in the new atmosphere of post-cold war era through the new legal and policy measures adopted in the USA such as the Land Remote Sensing Act of 1992 and the Presidential Decision Directive (PDD) of 1994, which provided framework for licensing private remote sensing satellite systems and which loosened restrictions on the sale of imageries to foreign entities. Similarly, the Canadian Government has issued a policy document on images and so has India (there may be other nations also that have similar policies). The recent Presidential Decision Directive of 2003, which superseded the 1994 PDD, further lays down the US Policies in Commercial Remote Sensing (Murthi, 2004).

As against this, the map information, which had more historical origins, did not go through an international debate and remained in the purview of individual nations. Many governments had a stronghold on map censorship, concealment and information

falsification for military and economic amelioration. Harley defines two main categories of government censorship manifested in maps - secrecy and silence. While secrecy, or concealment, was an obvious military necessity, silence was generally used to hasten societal and political agendas (Harley, 1988). With the incessant European state of warfare, the secrecy of maps was vital to military strategy. While some military maps were intentionally falsified to leak "misinformation" to the opposition, many were accurate representations of territory that would prove detrimental if confiscated by enemy hands. Even maps drafted for civilian purposes were kept under tight military control. Not only was map concealment of military importance, but essential to that of commerce and the origination of capitalism in world society. Today, mapmaking is inundated with precision measurement technology. The spectrum of today's precision technology encompasses the use of advanced mathematics, surveying techniques, and computers; with computers culminating the boldest technological advancements in the industry. On the other hand is the issue of the use of map information and images for commercial or competitive benefits – which brings many important decisions to play based on the availability of good GI and images. Thus, the growth of business and commerce also is a major factor in the way map information is available and accessible. This has also changed the demands and legalities for mapmakers.

The policy regimes for GI and map information have always been a national perspective and there have hardly, even now, been debates at international level to come to an international understanding on map information. What is needed is a pragmatic Policy consideration – which can emerge from international debate and an inclusive process for all nations. The policy must deal with the protection of private or intellectual property rights and the conditions of fair use of spatial data by others. It must also deal with governments' interests, and the public's rights, in information collected by government—interests and rights that arise from creating, storing, accessing, and disseminating information (Longhorn, 2002).

3. SOME CORE ISSUES THAT NEED TO BE UNDERSTOOD

Before we go on, we would like to draw some parallels – just to bring issues into perspective and define as to why issues of policy and legal aspects are becoming important today. The illustrations below are merely for the purpose of establishing "prima-facie" that there are issues that cannot be ignored and that we must look at the images and GI in the right perspective.

First, imagine that a person was photographed, without his knowledge, by a low-quality imaging system where he was seen in a group and his individual details were not seen. As against this, imagine that the same person is photographed, again without his knowledge, but this time using a very high quality and sophisticated imaging system enabled by advancement of technology. By all probability, in the former case the individual would not be too worried about his being photographed (as the image so generated had no graphic details of the individual and in fact was of a group, of which he was seen as one of them). However, in the latter case, the individual would be immensely worried. However, presently, he could easily get legal protection (under national or international law), provided he proved of being imaged and the harm done.

Something akin to this is what is happening in the remote sensing image arena. Earlier, with the resolution of the imaging systems are being coarse, the

UN Principles provided sufficient "protection" for nations being imaged – though they were not too worried because of the broad resolutions and coarse information. However, with the availability of high resolution images, the nation's worries have started (just like the individual mentioned above) – as they feel that information of their territories is being imaged for which they have no control.

The parallelism does not end here. Let us continue with our analogy. If the detailed photograph of the individual is then commercially sold and made use of by different groups to endorse product (commercial use) or create gossip (infringement of privacy) or harass the person (individual security issue) and so on, then the individual is further extremely worried. His worry is that information about him (which he considers personal) is now available, without his knowledge, to one and all – thus contrasting the fundamental aspects of good society.

Thus, when nations see that high resolution detailed images of their nations are being acquired and sold, without their having any control, and that the information is used in advantage of certain specific groups and sometimes without the involvement of the related nation (which they consider national interest) and even against the nation (which they consider against national security), the nations are also extremely worried.

As we go on, with modern techniques of photo and image processing, it is possible to morph/suture/compose/merge photographs and create distorted image from the original photograph and use the same to "threaten or black-mail" the individual (the threat perception). This is what individuals and good citizen's be afraid of. On similar lines, nations would be worried whether the images of their nation could be "processed" and create trouble for them from outside their soils.

Let us go on with our analogy. Suppose there are extremely advanced techniques and methods (exclusively available with a select group) to extract multitude of information about the individual (who was photographed) from the photograph itself and generate a very comprehensive biological and financial database of the individual. If this information/database of various parameters, is then integrated with some other external information available with the select group, and is utilized for the benefit of the individual then it is ok. However, if the information is commercially or otherwise exploited which may not be in the benefit of the individual (in fact even detrimental to him), this would lead to serious repercussion from the individual and society.

This is where the concept of GIS comes in where information on a event, nation, resource, business, etc. is organised in a multi-layered database and is used for a variety of "good applications" of society then it is a positive trend but if the information is exploited against the interest of the local society, nation then the society has serious objections. Multitude of issues come up to the fore and the need for protection from such "abuse or misuse" of the database becomes very relevant.

Thus, one will see how issues of privacy, national interest, threat perceptions, commercial benefits, societal good, etc become relevant – not just in the context of the examples mentioned above but very much so for images, GIS databases and other elements. Of course, technological changes and developments – especially the ability to image great details, the digital processing technology, the internet technology (allowing easy dissemination of information) etc are

also major "drivers" that are calling for changes in the environment and culture for the creation and use of Images and GI.

We believe that, as we paint this scenario to illustrate the perspectives, the realities are there for us to see – even as we cannot wish away these perspectives. It requires that we understand them and create a regime that provides comfort for one and all (just as the individual want to feel safe and comforted but is always on guard, nations too may like to feel safe and comforted from such technologies and possible damages).

Let us see how these can be addressed.

4. IMAGES AND GI AS A SOCIETAL GOOD

One definition of 'a public good' comes from economics. A private good is one that solely benefits the person who has possession of it while the benefits of a public good are shared (Stallkamp, 2001). Examples cited are defense as a public good and a consumable such as a chocolate bar as a private good. Characteristics of 'a public good' thus are that there is non-rival consumption and that the cost does not depend on the number of users (Love, 1994). This implies that 'a public good' is something that is valued but would not normally be supplied by a market economy. Thus government by default must be the supplier.

Under these definitions, spatial data that a government has generated is a public good to the extent that it is non-rival in consumption. The possession of a satellite image or a GIS layer of an area in no way decreases another person's ability to have the same image or map. In fact, with the wide use of the dissemination of data through a medium such as the internet, it has been increasingly easy for several users to have access to data at the same time. However, if access is restricted, the data can also have market value. For example, data might be of considerable value to a company such as Cargill if it had exclusive access to spatial data and images giving them the condition of the wheat crop in a rich agricultural area. In addition, there are resources and costs involved with transforming the data into information. Should the government be involved in transforming data into information? If so, how does this change the compensation picture?

Love, in Pricing Government Information (Love, 1994), asks the question "Are information goods in general public goods?". His answer is "sometimes yes, sometimes no, and sometimes partly yes and partly no." In order to better answer the question of availability to government information, Love introduces the concept of 'merit good'. A merit good is one "for which consumption should be encouraged, based upon non-market value judgments by society." Education is cited as an example of a merit good. Much government information, Love says, also fits this example. Thus the information should be made available not solely on economic judgments but also using social criteria. Although Love does not elaborate on what the basis for these social criteria would be, he does put the question into the proper realm for questions of law and policy exist not just in the economic sphere but are really questions of values.

One criterion for determining societal value is the utilitarian concept of "the greatest good for the greatest number." Although the concept is easy to understand in general terms, the application of the utilitarian principle to specific cases can be problematic. One value in the US is that of an open society where the greatest good can be achieved with an informed electorate. This implies ready access to data with

that access ensured through government subsidy if necessary. The electorate can only be informed however if it can afford access to information. Another value in the US is that of the market economy. The greatest good is achieved by allowing the market to distribute scarce resources.

Welfare and Good also have an impact on GI product market perception. The arguments are made considerably more complex by the fact that the information in GIS is a non-excludable public good (eg one which exhibits non-rivalrous consumption) produced jointly with a private good in a competitive market. Land survey maps are private goods in their use in land transactions: one person's plan cannot be used in another's land transaction. On the other hand the GI in the plan is a public good. Since each new unit of information can be provided at no additional cost to all purchasers (and assuming that more information is better), then the demand for the information will depend not only on the per unit price, as is true for private goods, but also on the quantity of information produced (Siebarrese and McLaughlin, 2001)

While the change in welfare per work resulting from complete protection is ambiguous, there is an unambiguous increase in welfare due to the creation of new works. Therefore, if there is a significant increase in the number of plans of survey produced, then a net increase in welfare is more likely, as the welfare increase from the additional works is more likely to dominate the ambiguous effect on welfare per plan (Burns and Walsh, 1981).

5. LEGAL AND POLICY PERSPECTIVES FOR IMAGES

Since the mid-1995s there had been significant changes in the policy and technological environment affecting remote sensing activities around the globe. Most important among these were the following:

- Emergence of commercial remote sensing systems in the late 1990's providing high resolution remote sensing data globally as a sequel to several policy measures in the US.

- Spread of internet which facilitated global access to digital remote sensing data, triggering a new era of transparency and making some aspects of regulations on flow of remote sensing data and information obsolescent.

In 1992 the US Congress enacted the Land Remote Sensing Act repealing the earlier Land Remote Sensing Commercialization Act of 1984. Landsat was returned to government control. The act observed that development and the provision of commercial value added services should remain exclusively a function of private sector. This act partially relaxed the non-discriminatory distribution policy for private sector operators, who were no longer obliged to make their raw data available to all users on a non-discriminatory basis, but they might be required to make such data available to the Government for archiving with a view to eventual public availability (Hall, 2001). The Act further required that all domestic, privately owned remote sensing systems be licensed. In the new atmosphere of the post cold war era, several private companies in US applied for licenses to operate remote sensing satellites. The Presidential Decision Directive in 1994 further loosened the restrictions on the sale of imageries to foreign entities, and about a dozen companies in the US received licenses for operating commercial remote sensing systems.

The high resolution commercial imagery sale, started in 1986 by the French SPOT-1 satellite capable of providing images of 10 meter resolution, saw

steady advances through Canada's Radarsat (2 meter images) in 1995, the Indian IRS-1C satellite (5.8 meter images) in 1996 and Space Imaging's Ikonos satellite (1 meter resolution in 1999. The trend is continuing with more satellites such as Orbview, Earth Watch, EROS (Israel), Cartosat-1 (India) and several others which are already providing operational services. Augmenting the products of these spacecraft are the high resolution imageries which were declassified from the archives of the US satellites of 1960's and 1970's. Similar declassified high resolution pictures of Russian satellites were also commercially made available in the public domain.

Present policies of dissemination and access for data make it extremely difficult for satellite operators to specify who the ultimate users of the data are and for what purpose they will use it. As much as the data could be used for several vital contributions to society, they can also be used for not so benevolent uses such as support to terrorism, espionage by industrial competitors, intelligence on disadvantaged regions/populations and so on. There were also a couple of instances of images being misinterpreted in media.

5.1. HIGHRES IMAGES – "CONFLICTING" COMMERCIAL AND NATIONAL CONSIDERATIONS

The Principle IV of the Resolution adopted by the UN stipulated, inter-alia that remote sensing activities "shall be conducted on the basis of respect for the principle of full and permanent sovereignty of all states and peoples over their own wealth and natural resources, with due regard to the rights and interests, in accordance with international law, of other states and entities under their jurisdiction. Such activities shall not be conducted in a manner detrimental to the legitimate rights and interests of the sensed state".

Availability of improved quality of remote sensing data, particularly at a level of 1 meter resolution or better, has also raised growing concerns in various states on legitimate and proper use of data. The ready availability of 1 meter resolution images in the market place and the promise of new data of similar or higher resolution with better spectral characteristics including hyper spectral data and even all weather radar data of improved quality are leading to an era of growing transparency. Apart from contributing to several beneficial uses, these images of one-meter resolution quality can also detect vehicles and identify aircraft. Tanks can be distinguished from trucks and road and bridge conditions can be seen. In view of the potential of these for military use, the governments are concerned about the widespread dissemination of such data in the public domain (Dehqazida, 2000).

The events of September 11, 2001 created new awareness across the globe on the critical needs for effective measures to ensure security. Of particular relevance to the remote sensing is the information that can be derived on certain vital installations of infrastructures that have bearing on national security, public health and safety, economy and public morale. This will mean meeting a twin set of requirements - firstly to generate information which will assist governments in the task of their protection and secondly taking necessary safeguards to ensure that such information is used exclusively for legitimate purposes. These concerns share a view that sensed states do not have any jurisdiction over commercial entities from other states that carry out imaging over their territories and sell imageries to any one who pays. In light of this, they consider that the spirit of UN Principles and their own legitimate rights

and interests are compromised (i) if they have no definite means to know whether their territory is imaged by commercial operators and (ii) if they have no access to the data of their territories on a non-discriminatory basis soon after they are imaged. Since satellite operators have no obligation to know and control the ultimate end use or to identify the end user, there are issues for the governments of sensed states as to how they could protect security of their vital installations from the acts of terrorism or prevent misuse of information on resources which are under their sovereign control (Rao et al, 2001).

Since the data availability from commercial systems providing high resolution data will be mainly driven by the market considerations, the affordability for accessing such data will be another major issue for a large number of states, particularly for developing states. The policies adopted by the commercial operators also show that the sensed states do not have priority for acquisition of data over their territories if they are unable to pay the high premium, which the other customers in any part of the world are ready to pay, even if those customers make such request later than the sensed state.

It is noteworthy that certain measures are taken in the US to impose conditions on its licensees such as the so called "shutter control" obligations (which can be imposed during specific periods when national security or foreign policy interests of the US are determined to be compromised) and for provision of access to the US government of downlink formats and data. Further the US government has also stipulated that licensees should make available to the government of any country un-enhanced data concerning the territory under the jurisdiction of such government as soon as such data are available and on reasonable cost terms and conditions, subject to all other conditions of its licenses. However, such measures are not universally applicable and since more commercial players are bound to enter into market from different countries into this business, there will be increasing conflict of interests and diversity of regulatory measures.

Such trends of regulation of remote sensing data are apparent in many nations. International law entitles of all States to freely acquire satellite imagery without the consent of the sensed States. Subject to the applicable principles of international law, a sensing State is entitled to determine the distribution or denial of satellite imagery. The 1986 UN Resolution recognizes the right of the sensed State to have access, on a non-discriminatory basis, to satellite imagery of its own territory. However, contrary to the provision of this Resolution, several States have started making such access subject to their national security concerns, foreign policy interests or international obligations (Jakhu, 2003).

5.2. RIGHT OF SOVEREIGNITY

The Principle IV of the Resolution adopted by the UN stipulated, inter-alia that remote sensing activities "shall be conducted on the basis of respect for the principle of full and permanent sovereignty of all states and peoples over their own wealth and natural resources, with due regard to the rights and interests, in accordance with international law, of other states and entities under their jurisdiction. Such activities shall not be conducted in a manner detrimental to the legitimate rights and interests of the sensed state". The advent of commercial systems, with capabilities for worldwide dissemination of high quality remote sensing imageries, which can provide a great deal of details of the land surface and oceans has been posing according to some challenge to concerns of states.

5.3. RIGHT OF SENSED STATE

As data availability will be purely driven by market considerations, the affordability for accessing such data will be another major issue for a large number of states. As there are concerns about governments losing some degree of control over information about their territory, there could be tensions, particularly when a state considers that entities abroad have exploited information about its territory, even as it had no fair and affordable access to the same – due to commercially driven policies. There are real threats to the Rights to privacy – due to possibilities of industrial espionage, and potential use of imagery by anti-social groups. Commercial corporations from one country could gather information on exploitable natural resources in another country without the knowledge of its government and could possibly gain strategic advantage in negotiations.

5.4. ISSUE OF GLOBAL TRANSPARENCY

There are, however, significant benefits of transparency created by the availability of high quality images including their use by NGO's, media, environmental groups and governments. These benefits cannot fully fructify unless international community develops means to harmonise the policies and legal measures. National regulations to restrict physical flow of information products in the age of Internet are ultimately not going to be very productive. Hence there is a need for evolving acceptable legal norms for the operations of commercial operators – taking into account the basic needs of civil societies' rights for information and the legitimate concerns of the governments to maintain the rule of law in the territories under their jurisdiction.

5.5. "SHUTTER CONTROL" – TURNING OFF THE FLOW

The unimpeded observations and distribution of data gathered from space, particularly in the high resolution range, through commercial channels have thus raised policy questions on the rights of the sensed state for access to data and also its ability to safeguard the right of privacy. Concerns are also expressed on proper use of images to meet national security needs and ensuring friendly relations among nations. The United States has responded to this situation by "Shutter Control" policy – which allows the US government to limit collection or distribution of data by the US commercial satellites during specific periods when national security or foreign policy interests could be compromised. This policy balances the goals between promoting commercial interests of industry on the one hand and meeting national security and foreign policy interests of the US on the other hand. The US government imposes on its licenses certain conditions to protect interests of sensed states and also to secure its interests for national security or foreign policy angle. The licensees in US are obliged to make available to the government of any country (including the US) un-enhanced data concerning the territory under the jurisdiction of such government as soon as such data are available and on reasonable cost terms and conditions subject to all other conditions of the license. The US government has also stipulated that its licensees shall use a down link format that allows US government access and use of data during the periods when national security and international obligations may be compromised. Further, the licensees are required to maintain all satellite tasking operations for the previous year and shall make this available to the US government, as requested. Thus the US government has ensured a fair degree of control over the operations of its licensees besides

access to the information gathered by them.

While these measures may satisfy some governments, they have no universal appeal because of lack of multilateral framework in their application. Vagaries of unilateral policies could also affect realisation of full commercial potential. Thus the remedies which exist currently are not satisfactory. The policies adopted by the US are applicable to its licensees only. What would happen when there are more players from other countries? Each country may follow its own regulations and there could be conflicts of interests, to the detriment of healthy development of commercial sector. More over common global needs such as monitoring and protecting global environment, tracking illicit activities; promoting public health and responding to natural disasters can be satisfied only with a broader international understanding and consensus. Pending development of such common norms, states could develop means to live with the new era. They would negotiate with satellite operator's conditions to satisfy their concerns, as they provide access to their markets. Some countries could also try to camouflage the sensitive targets or take recourse to counter measures, (which in extreme cases would constitute a hostile step, triggering confrontation).

5.6. IMAGES vs INFORMATION: RIGHT ON VALUE-ADDITION

Access to images versus access to information is yet another area of debate – opening up the issue of right to value-add on images to generate "information" – yet another dimension of value and related to a nation's sovereignty. What if somebody buys all images of a country and value-adds to generate variety of social, cultural, physical and resources information of the country and makes it available – either in conjunction or separately from the images. Would this provide other "advantages" – security-wise, commercially etc over the nation. Would images and information become potent tools of "armament"?

6. LEGAL ISSUES OF POSITIONING AND NAVIGATION

For obvious reasons, the legal issues in the Positioning and Navigation depend on numerous factors, including the precise commercial applications, business operations and markets involved. With proper evaluation, planning and action, steps to reduce legal risks can be taken in a timely manner. A very good assessment of the GPS legal issues is provided by (Daniel R. Sovocool (2000)) – and some of these are discussed here.

For manufacturers, system integrators, vendors and service providers, users these issues include:

- **Product Liability Issues**: Any agency offering a Positioning or Navigation product or service that utilizes satellite navigation or location technology must protect itself against product liability risks. There are at least three types of risks: (1) the risk of liability for product misuse, (2) the risk of liability for product failures or inaccurate location or navigation information, and (3) the risk associated with inaccurate descriptions of the capabilities and limitations of the product. In terms of liability arising from these risks, agencies must bear in mind that consumer expectations regarding GPS can be unrealistic. There is an awareness of these risks but clarity needs to emerge on how to reduce their exposure. Services can suffer from "shadowing" caused by any artifact that interferes with the line of sight between the receiver and the satellites to which it is initialized. There are other risks as well; for example, until text-to-voice

technologies evolve, "driver distraction" is likely, and providers of mayday devices and services need to be especially mindful of the potential liability that may arise if the product or service fails in a crisis situation. The best way now to avoid liability under consumer protection laws, manufacturers and systems integrators must be careful to accurately describe the capabilities of the product or service in light of limitations of signal accuracy, integrity and availability.

- **Issues Regarding Partnerships**: The general trend in positioning and navigation is to "integrate" capabilities to offer innovative services. These often involve developing sophisticated, cross-industry contractual relationships between auto component manufacturers, electronics component manufacturers and content providers, among others. This calls for coordination of multiple agencies and unless there are strong legal interfaces, disputes can arise as to who is responsible for a "liability".

- **Issues Related to Signal Accuracy, Integrity and Availability**: The main liability issue is the extent to which parties who suffer losses caused by signal failures, or inaccurate or degraded signals, will look to them for compensation. It is a mistake to assume that parties who suffer losses caused by signal problems will not look for relief to the companies that provided the device, even if the technology performs perfectly. Any company involved in this area, whether as a manufacturer, system integrator, vendor or service provider, must take steps to minimize the likelihood of being sued for failures or inaccurate navigation or location information. Contractual risk allocation measures, such as indemnity provisions, warranty disclaimers, damage exclusions and arbitration clauses, should be carefully considered.

- **Regulatory Issues**: The GPS/satellite area raises myriad regulatory issues. Protecting the spectrum has been a major regulatory issue. While there are few export restrictions imposed on civilian GPS receivers, other countries impose special taxes or restrictions on GPS equipment in addition to the usual import tariffs required of other types of electronic equipment. In the aviation area, the use of GPS devices for en route operations and instrument approaches is highly regulated by entities such as the Federal Aviation Administration and the International Civil Aviation Organization. In the maritime area, the International Maritime Organization now requires specific satellite-based navigation and emergency equipment on international passenger and cargo ships. In some cases, industry groups are seeking statutory immunity from tort liability, such as in the emergency response area. These need to be addressed.

- **Intellectual Property Issues**: Location technologies can present intellectual property issues for the company, ranging from obtaining and enforcing patent protection, to developing licensing agreements, to protecting the company's intellectual property through nondisclosure agreements and other restrictions.

- **Privacy Issues**: Privacy will be an issue for certain users of location technologies. In the consumer context, user consent and/or technologies that separate user identity from the call location will eliminate most privacy issues. In the

commercial context, the privacy issues are more significant because, among other things, of the well-developed body of law regulating workplace privacy. Ultimately, proper evaluation of these privacy issues depends on several factors, including the specific application (e.g. fleet vehicles, specific employees, etc.), the business relationships involved (e.g. independent contractors, union employees, non-union employees, etc.), the limitations imposed on the tracking (e.g. work hours only or 24 hours per day), and the jurisdictions and laws involved.

The foregoing is only a partial list of the more obvious legal issues that exist in this area, and that may affect the technology and services. There needs to be an international debate amongst governments, technology providers, service providers and users.

7. LEGAL AND SOCIETAL ISSUES FOR GI

Geographic Information form part of the spatial data infrastructure that is emerging in the transition to an information society. Along with the positive effects of GIS, the negative impacts of the technology and databases need to be considered, weighed against the positive, and divulged, eliminated, minimized, or accommodated. What is the likely distribution of social benefits and costs of GIS databases in respect to poor versus wealthy persons, urban versus rural communities, large versus small businesses, and developed versus developing countries? Will use of GIS widen or narrow socio-economic gaps between different segments of the population? How will different societal attitudes toward the proper role of government in handling personal data affect society's ability to benefit from wide scale sharing of geographic information? Can or should the technology be instituted in such a manner that will promote equity in the distribution of its benefits and costs?

Legal issues differ based on what type of GIS product or service is being considered. GIS tools, data sets, Application Program Interfaces embedded functions need to be treated under existing and proposed software protection legislation. Specialized GIS applications such as land registry, land use, utilities, environmental monitoring may contain personal data or data with far reaching financial, health or safety consequences. Any misuse or commercial loss due to poorly constructed or managed systems will have legal ramifications to the vendors and users. The GIS containing personal data such as marketing research, Census data, public authority data etc., will be governed under the data privacy or data protection legislations. Also, GIS in critical systems such as flood control and civil protection, require high data accuracy, and this has implications for protection of life or property. Inaccuracies could invite liability or prosecution of data providers and software interface developers. Further the new possibilities for incorporating Virtual Reality (VR) functions to GIS products can give rise to problems of ownership of data, software elements, and search engines and so on. Hence basic problem is one of different actors who become involved in creating product or service. There are also other issues such as using GIS as the "value added" element to permit legal resale of otherwise "not for resale" datasets drawn from the public domain. In summary the various legal issues that could apply to GIS products and services could cover many of the following legal aspects: (i) IPR / Copyright and neighboring rights, (ii)Data Protection, (iii) Confidentiality/ data privacy, (iv) Competition Law, (v) Licensing, (vi) Consumer protection /

fitness for purpose, (vii) Product and services liability, (viii) Censorship and other information content related issues, (ix) Health and safety legislation, and (x) Patent law – especially as GIS systems become more complex (Onsrud, 1995)

Foregoing legal issues are becoming very significant elements in the development and use of GIS technology. Different actors who are involved in the production and use of GIS products and services are to be educated and supported in these legal aspects depending on the nature of their involvement. As these products or services are globalised, data could come from one legal jurisdiction and could then be transformed into a product or service and sold in an area of different legal jurisdiction. Rights and liabilities of the collector of the data, sellers, other intermediaries and users become hazy to determine and these need further consideration.

7.1. THE ROLE OF GOVERNMENTS AND PRIVATE SECTOR

The future growth of GI and its range of applications is not simply determined by the advent of new technology: such technology enables but does not dictate destiny. In practice, the expansion of use of GI for operational tasks - as opposed to one-off research experiments - is bound up with the national political culture, the legal framework, the organisation of the state's bodies, international obligations and history. One reason for this is that the availability and supply of spatial data - a key determinant of GI expansion - is largely determined by these factors. Even today, in many nations Government is typically the ultimate source of most 'core' or commonly used spatial data. Though there are notable exceptions, the government trend world-wide seems to be towards charging more for use of these data at the time when copying of it becomes cheaper. Some attribute these price rises to ideologically inspired actions of government. Indeed, virtually any sale of government data seems to be anathema to three classes of people - individuals who believe that everything the state holds should be freely available to its citizens, vendors who recognize that its price influences the sales of their software and those who, unconcerned with the operating efficiency of government and its cost to the taxpayer, continue to see the state simply as the provider of subsidised services and goods. The wide variation in the competencies of different levels of government is also reflected in the nature of the data collected and the rules which are applied. Superimposed upon these within-nation state variations in regard to data and some moves towards 'subsidiarity', there are increasing numbers of international rules, agreements or pressures to act in a harmonised way. Typically, then, all countries have a 'cocktail' of laws, policies, conventions and precedents which determine the availability and price of spatial data. (Rhind, 1999)

7.2. GI AS A COMMODITY

Is GIS becoming a tradable commodity? It appears so as GIS data seems to have value for at least some of the populace. It is now possible to supply GIS to those who are willing and able to pay for it and exclude its use by those who do not wish to pay for it. Its provenance is now provable and laws must exist which permit the protection of Intellectual Property Rights. It is often said that the market for spatial data is an immature one. It is however clear that the market is not operating perfectly so far as GIS is

concerned at present. The requirements for an efficient market such as perfect awareness on the part of the purchasers are not met. Moreover, the presence of market distortions due to subsidies, legal constraints public perceptions, etc. and the existence of substantial externalities further renders the existing markets sub-optimal. One example of the externalities is readily summarized - duplication of massively expensive operations like the creation or up-dating of detailed national spatial data sets seems inherently wasteful. Putting a value on such externalities is difficult, especially since the costs are visited on those at the end of supply chains and are often discovered long after the data have led to mistaken conclusions.

7.3. GI ACCESS RIGHTS

There is a growing tendency by governments in different nations to move away from treating publicly-held information as a public good - to alter the status quo of current open records policies and to move towards commercially selling spatial data products and services. Yet, little empirical evidence is available with respect to the possible advantages and disadvantages of differing approaches. Current evidence that supports the competing public policy, legal and efficiency stances is largely anecdotal.

Comparisons might be made in the U.S. at the local government level among free access approaches, marginal cost recovery approaches with no restrictions on the subsequent use of data, marginal cost recovery approaches with subsequent restrictions, and approaches pursuing greater than marginal cost recovery. Similarly, at the international level, one might compare the effect of U.S. freedom of information laws on the uses of federally-produced geographic information with (for instance) the effect of the cost recovery approaches of the Ordnance Survey of Great Britain on the uses of similar geographic information.

Another issue involves the current move towards creating a national infrastructure that will allow citizens more readily to acquire and use geographic information. Most within the GIS community assume that any infrastructure used for accessing and transferring spatial data will be part of this overall information infrastructure. The eventual networked system is envisioned as supporting data transfers and transactions not only for the education and research sectors, but also for private citizens, government, and commercial interests. Many envision the national network as creating an electronic marketplace where, for instance, potential sellers of geographic data sets will be able to find buyers and vice versa, and where the many thousands of users of the Network will create a wide-ranging demand for geographic data. Investigating alternatives for addressing the political, legal, and technical constraints in establishing an electronic publishing capability for spatial data (or an electronic library capability for spatial data) could provide valuable insights for wider electronic publishing and library endeavors. Many studies have draw lessons from a comparative analysis of the history and jurisprudence surrounding public access to the legal and medical databases and conclude that no generic information policy covering all government data realms is likely to emerge or be successful. Many even suggest that sorting out sensible policies relative to spatial data may be more complex than for legal or medical data as the national security issues are also involved.

7.4. GI: ISSUE OF INFRINGEMENT OF PRIVACY

Linking information about individuals with where they live and work is a highly sensitive issue with the general public. Prior to the development of present-day computer capabilities, it was impractical for government and private industry to maintain such information, but technically and economically the building and networking of detailed databases on all members of a community, their property, and their habits is now a practical reality. As the ability of portable computers to store and query large spatial databases expands, privacy concerns become more pronounced.

Laws that compartmentalize data on individuals have been in place in the U.S. for some time. However, the laws impose few restrictions on the private sector's "mixing and matching" the same databases that government is prohibited from manipulating. As a result, businesses are often able to compile substantial information about individuals. For instance, businesses are interested in building profiles on individual households in their market areas. Governments engaged in selling spatial data sets to the private sector have found that cadastral data (i.e. the household-level data that tie ownership information to the location and physical attributes of the land) are in more demand than any other layer of information. Having this parcel ownership and household-level information allows businesses to conveniently aggregate information through computer cross-matching. When local jurisdictions fail to have cadastral data available or readily accessible in digital form, businesses have found their own survey methods to generate 'simulated" spatial datasets they use and market. We have entered a new social and technological era in which conflicts involving privacy no longer affect individuals singly but affect everyone in the community. The degree to which aggregation of personal data through cross-matching of GIS files with other files should be allowed is not clear.

The practice of "profiling" customers raises the issue of where the line should appropriately lie between a "permissible exchange of facts to pursue a commercial goal" and an "impermissible intrusion" on personal privacy.

7.5. GI: COPYRIGHTS & IPR

Copyright protection for spatial databases raises a series of emerging, unresolved theoretical questions. Although maps have been with us for ages, a theoretical foundation based on solid policy objectives explaining what aspects of maps warrant protection is lacking. Representation of geographic data in digital form, with its own uncertain status in property law, adds to the theoretical complexity. Resolving rights in spatial databases implicates the theoretical shortcomings of copyright law both as applied to geographic representations and to computer representations (Holland, 2001).

Copyright compensates creators of original expression as an incentive for them to continue to bring forth knowledge and information that others in the community may exploit for social or commercial gain. To this end, copyright protects expression, but not the underlying ideas, which can and should be used without compensation to the creator. Even though a spatial database might cost hundreds of thousands of dollars to compile, its claim to copyright protection is typically far weaker than that of, for instance, a novel. One reason is that spatial data are largely factual in nature and "facts" are not subject to copyright. Facts, algorithms, physical truths, and ideas exist for everyone's use. It is difficult to argue that the outline of a building, the bounds

of a land parcel, or a line of constant elevation on a map (a contour line) are expressions of originality. Any other person or sensor attempting to represent these physical facts would have little choice but to do so in much the same way. To represent the features by other than points, lines, polygons, or image bits would make the representation non-standard, greatly decrease the value to others, and make the data useless or cumbersome for computer processing. Experts even suggest that protection of maps in digital form ultimately will require either amendment of the Copyright Act or a federal sui generis database protection statute.

Even if a copyright claimant argues the existence of originality in the selection, coordination, or arrangement of a data compilation, the typical GIS user is primarily interested in the data themselves and not in the original aspects of the data compilation. Database ownership interests are further complicated in GIS environments because much of the data in them are copied from existing paper maps - some of which are in the public domain but many others of which involve potential preexisting copyright.
However, if indeed the spatial data are largely factual and political biases are absent in their selection or arrangement, the dilemma arises that the data are then also unlikely to be copyrightable. As a result, many government database builders, along with the private sector, are resorting to contract and licensing instruments to impose limits on the use of the digital data they supply. These practices raise the issue of whether and how these legal devices might be applied to facilitate participation of data proprietors and users in a networked electronic marketplace, and whether alternative devices may be available for protecting government interests in spatial databases.

The unresolved legal and public policy issues regarding the application of copyright and other work product protection devices to spatial databases present a host of potential problem areas for research activity by the academic community.

Longhorn (Longhorn, 2001) argues that the lesson for producers of GIS products and services, especially those without prior experience of publishing either software or information products, is to beware, question the business plan, look for the potential negative effects on the future success of your product which might be caused by legal problems. He suggests not focusing all efforts simply on technical virtuosity and market research.

7.6. GI: LIABILITY

Liability is a subject of much interest in the GIS community. The value of any database lies in its use. When an action or decision is taken based upon the information and analysis in a GIS, the liability exposure of those involved with the development of GIS software and databases, or with provision of information based upon analysis in a GIS, can be important. The only certainty is that, under current legal principles, liability can never be eliminated, merely minimized. Those who have been hired specifically to provide spatial data for a database or those who are offering data for sale to others are responsible for some level of competence in the performance of the service or for some level of fitness in the product offered.

Is liability exposure or the perception of liability exposure a significant impediment to the willingness of businesses and others to share geographic information or offer it for sale? Liability exposure may have a substantial impact on whether businesses and others will be willing to

share GIS data and whether they will be willing to offer GIS data for sale in a networked electronic marketplace. Evidence needs to be gathered on whether current liability exposure is an actual threat or primarily a perceived threat. Evidence also needs to be gathered on what legal arrangements are currently best accommodating both liability and business operation concerns. The evidence gathered and any conclusions reached should be helpful in the design of an electronic marketplace for geographic information.

7.7. GI: RIGHT ON VALUE-ADDITION

Access to maps and images versus access to information is yet another area of debate – opening up the issue of right to value-add on spatial data and images to generate more meaningful "information" – yet another dimension of value and related to sovereignty. What if somebody buys all images and spatial data of a country and value-adds to generate variety of social, cultural, physical and resources information of the country and makes it available – either in conjunction or separately from the GIS. Would this provide other "advantages" – security-wise, commercially etc over the nation? Would images and information become potent tools of "armament"?

8. RECENT FGDC GUIDELINE

FGDC has issued a new set of guidelines for provide a method for balancing security risks and the benefits of geospatial data dissemination (FGDC (2005)). US agencies note that many public, private, and non-profit organizations originate and publicly disseminate geospatial data. Dissemination is essential to the missions of many organizations and the majority of these data are appropriate for public release. However, a small portion of these data could pose risks to security and may therefore require safeguarding. Although there is not much publicly available geospatial information that is sensitive (Baker and others, 2004, page 123), managers of geospatial information have safeguarded information using different decision procedures and criteria. The FGDC guidelines provide standard procedures to:

- Identify sensitive information content of geospatial data that pose a risk to security.
- Review decisions about sensitive information content during reassessments of safeguards on geospatial data.

It is interesting to note that the some the guidelines are very exhaustive and are more a process of transparency and "self declaration" for the access of the data. The guidelines propose a step-by-step approach that includes any agency to evaluate what it would do for the geo-spatial data. We reproduce here (at **FIGURE-1**) the decision-tree proposed by FGDC for Providing Appropriate Access to Geospatial Data in Response to Security Concerns.

In a detailed analysis of the recommendations, the authors have found a very peculiar process – which hints at "strict regulating" – not everyone will access every dataset, regulation would determine what one can access and how. Some of the recommendations made in the guideline include assessment of:

- Risk to security: Are the data useful for selecting one or more specific potential targets, and/or for planning and executing an attack on a potential target?
- Uniqueness of information: If the data contain information that pose a security risk, is this sensitive

information difficult to observe and not available from open sources?

- Net benefit of disseminating data: If the sensitive information poses a risk to security and is unique to the geospatial data, do the security costs of disseminating the data outweigh the societal benefits of data dissemination?

And then recommends steps that include:

- Change the data: Change the data to remove or modify the sensitive information and then make the changed data available without further safeguards. Text includes reducing pixel-size, eliminating pixels and reduce sharpness of images, summarizing data, reducing precision of points and so on. THESE WOULD CREATE A DEBATE CERTAINLY.

- Restrict the data: Establish restrictions, commensurate with the assessed risk, on access to, use of, or redistribution of the data. Restrictions could be to license to specific users, specific use only or on re-distribution. THESE ARE ALSO DEBATABLE ISSUES.

The authors are yet analyzing the document and making observations on its implementability and impact but do observe about the comprehensive nature of the document. However, there are many questions un-answered – especially on how a community that has practiced un-impeded access to data will adjust to regulations that may make access denied/difficult and time-consuming. Would it promote a regime of "black-market" or "spurious" data market?

9. RECENT GOOGLE PUBLIC DOMAIN GI PORTAL

Recently, yet another initiative of public access to image sand GIS information has been positioned by Google as part of their Google Earth portal – where high-resolution images and maps of almost all parts of the globe are accessible in the public domain – thus bringing in transparency to GI access but also raising "hot debates" on impinging on security.

Technology allows Google-like and other such initiatives to bring in public access but with the regulations being discussed (like FGDC and others) would such initiatives become extinct or get regulated.

Imagine US laws recommending restriction to some images (say of critical areas) which can be easily accessed on public portals. Would such IT initiatives be liable to regulation and adhere to "national" or "international" laws.

Who would define what should be "restricted" and "regulated" and how – the nation in question, the technology owner, the service provider or an international understanding? This is the crux of the issue.

10. KEY POINTS FOR IMAGE AND GIS POLICY DEFINITIONS

Notwithstanding the FGDC guidelines and the Google Earth initiatives, in summary, we point out some of the critical points that are prime in defining a good policy definition for images and GI – these are some perspectives but one can build upon these and generate a paper that becomes comprehensive for a policy definition exercise. Some of the key issues that need to be considered for defining a good national and international framework for policy on images and GI (Rao et al, 2002)):

- Need to re-look and address the 1986 UN Principles on Remote Sensing and arbitrate a new international regime of understanding for images from satellites. This framework will have to encourage nations to recognize the need for a over-arching understanding for satellite operators (both government and commercial), nations that are imaged and global image user community.

- Recognise that satellite images, including high-resolution images, are essential to support development activities. As has been mentioned earlier, a large number of societal development activities or "societal good" depends critically on the availability of satellite images – disaster management support; land and water management; environmental monitoring; mapping of various themes; for planning and managing urban facilities/infrastructure; rural development; cadastral mapping; national infrastructure development – roads/ highways, telecom, power and many others. Many of these societal issues are trans-national.

- National (security or commercial) interests will have to be fully taken into consideration to ensure that nation's interests are not compromised. Possibilities of necessary steps for non-disclosure and second-order dissemination are already being discussed.

- Recognise that imposing any control on foreign private satellites for "imaging" over any region is truly not possible. With the highres satellites, images of any region would be acquired and made available to any user in any country – especially when commercial considerations and demand will drive data sales. While shutter-control is available to the country licensing the satellite (like, say USA can regulate imaging/dissemination/use of images over its or a specified territory), the "sensed state" will not be able to regulate any control on the commercial satellite for imaging over its territory.

- The "rights" of the sensed state may emerge stronger in the coming days and it may be difficult to ignore/by-pass this aspect in defining the international framework. However, international discussions/consensus needs to be built on the role/privileges of "sensed state" for imaging over its territory. It may be appropriate to move for atleast a consensus that provides comfort to "sensed states" by sharing the information on users who use images of their territories.

Similarly, key Points underlying a GI policy would have to consider:

- Recognize that creating high quality spatial data is very expensive

- Data maintenance can be almost as expensive as de novo data creation. As a result, many data originators will be devoting much effort to this aspect in the coming years.

- Many organisations are capable of creating data on a limited area, project basis. Creating, updating and managing detailed national spatial databases is however a very different and non trivial matter. Those with these skills and track record have a real competitive advantage, especially where Intellectual Property Rights are vested in the holders of the data

- Private sector data sets are typically derived from public sector ones and a good copy-right regime is called for

- It is possible to sustain a solid intellectual and economic case for either complete cost recovery or nil cost recovery; any position in between is essentially pragmatism. Where only a fraction of the populace directly benefits from the existence of spatial data, cost recovery policies provide greater equity through ensuring the user rather than the taxpayer pays costs

- Changing the method of access to spatial data may well facilitate different charging regimes: both through perception and charging metric, on-line access to data fosters and permits much larger numbers of small value transactions.

- Promote standards for documentation, archiving, distribution of information, geographic control, and accuracy of analysis. These standards could be developed in collaborative processes with research and resource management institutions. They need not be mandatory, but should be widely known so that all institutes have a reasonable idea for what is expected of them.

- Liability exposure may have a substantial impact on whether agencies and others will be willing to share GIS data and whether they will be willing to offer GIS data for sale in a networked electronic marketplace.

11. NEED FOR INFORMED DEBATE UNDER MULTILATERAL FRAMEWORK

An effective solution to the predicaments brought about by the technology developments including convergence of various tools and techniques like GIS, GPS and Remote Sensing data, world wide access to databases by the Internet revolution, interfaces with emerging technologies for visualization such as Virtual Reality and multimedia applications coupled with commercial availability of high resolution data give rise to issues that would warrant a harmonized international framework of legal norms under an appropriate multilateral forum such as UN-COPOUS and UN-Regional Cartographic Conference (RCC), Global Spatial Data Infrastructure (GSDI), ISPRS etc addressing various concerns on access to spatial data, its use, rights of privacy, security and sovereignty of states. It is clear that the world is currently facing far more new challenges, which were not anticipated at the time of evolution of the Remote Sensing Principles by the UN and, even later, when the technological developments I GIS have happened. An urgent debate on these issues raised is essential to ensure that the full potential and benefits from the remote sensing images and GIS is available to society.

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FIGURE-1: DECISION-TREE PROPOSED BY FGDC FOR PROVIDING APPROPRIATE ACCESS TO GEOSPATIAL DATA IN RESPONSE TO SECURITY CONCERNS