HIGH LEVEL FORUM ON GLOBAL GEOSPATIAL MANAGEMENT INFORMATION

WORKING PAPER NO. 5

First Forum
Seoul, Republic of Korea, 24-26 October 2011

Policy Formulation and Institutional Arrangements*

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PC-IDEA Paper for the

High Level Forum on Global Geospatial Information Management

on

Challenges in Geospatial Policy Formulation and Institutional Arrangements

Introduction

Nowadays the increasing attention that decision makers are giving to the territorial (or geospatial, location-based) information is a reality. It has been realized that the use of geospatial information is crucial in order to properly face the current challenges related to, e.g., government planning, sustainable development, environmental monitoring, natural resources protection, land use, utility services, etc. Taking into consideration the territory improves the suitability of the public policies to address social, economic, and development issues.

From the technological point of view, the fast development of geospatial technologies such as satellite imagery, digital aerial photography, Global Navigation Satellite Systems (GNSS) and geographic information systems (GIS) has been contributing to a broader use of location-based information. These tools facilitate data collection and advanced data analysis, and allow for a flexible and integrated approach to information sharing and dissemination based on a spatial framework.

In this scenario, a forum for coordination and dialogue among nations, and between nations and relevant international organizations, to propose work-plans and guidelines with a view to promoting common principles, policies, methods, mechanisms and standards for the proper management of geospatial data and services was missing. However, in July 2011 a very important opportunity was created, when the United Nations Economic and Social Council (ECOSOC) established the United Nations Committee of Experts on Global Geospatial Information Management (UNCE-GGIM) (ECOSOC resolution 2011/24) as the official UN consultative mechanism on GGIM.

Among the topics to be dealt with by UNCE-GGIM, it can be identified those related to the challenges in geospatial policy formulation and institutional arrangements. With this respect, nations of the world are invited to reflect on the need of establishing/updating institutional arrangements and geospatial policies to spread the proper use of geospatial technologies, data and services.

This paper aims at discussing the above topics taking into account the existing situation in the Americas, based on the activities carried out by the Permanent Committee for Geospatial Data Infrastructure of the Americas (PC-IDEA), including results of a questionnaire recently applied to the member countries of the Committee.

I. Relevant issues in Geospatial Policy Formulation

Before any discussion on this issue, some clarification on the scope of the term "geospatial policy" is needed. It may cover policies at the intra-agency, local, national, regional or global levels. Figure 1 shows the relationship between all levels of policies, using the Spatial Data Infrastructures (SDI) as an example.

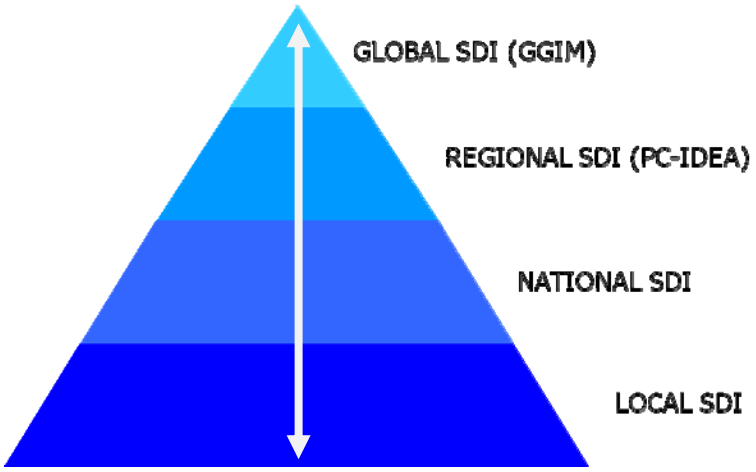

Figure 1: Relationship between various levels of geospatial policies

Geospatial policies may also include strategic, tactical or operational aspects. They can contemplate policies on data/metadata, institutional arrangements, and standards frameworks as well.

Considering the current context at the global level, under the existence of the UNCE-GGIM, a top-down approach can be seen as an efficient procedure, where general recommendations are established through UNCE-GGIM at the global level, creating a geospatial framework to be adhered to by governments of member countries. These policies should cover issues at high, i.e. strategic level, with the main objective of promoting the availability of geospatial data, metadata, and services at global level.

One of the most demanded geospatial policies at global (and other) level is related to open data (and, consequently, metadata). It is not possible to envisage a scenario of data sharing without the willingness of making a set of reference and thematic data (Figure 2) freely available, at least at a medium/small scale (e.g., smaller or equal to 1:25,000). As an example of reference data, it can be listed: geodetic data, topographic mapping (with all its layers – transportation, hydrography, elevation, administrative boundaries, etc.) and imagery. Regarding thematic data, the following ones can be mentioned: vegetation, geology, geomorphology, pedology, land use/land cover, disasters and risks management (flooding areas, for example), socio-demographic statistical data, etc. Therefore, a clear message should be sent to the UN member states fostering them to share, at global level, the aforementioned data.

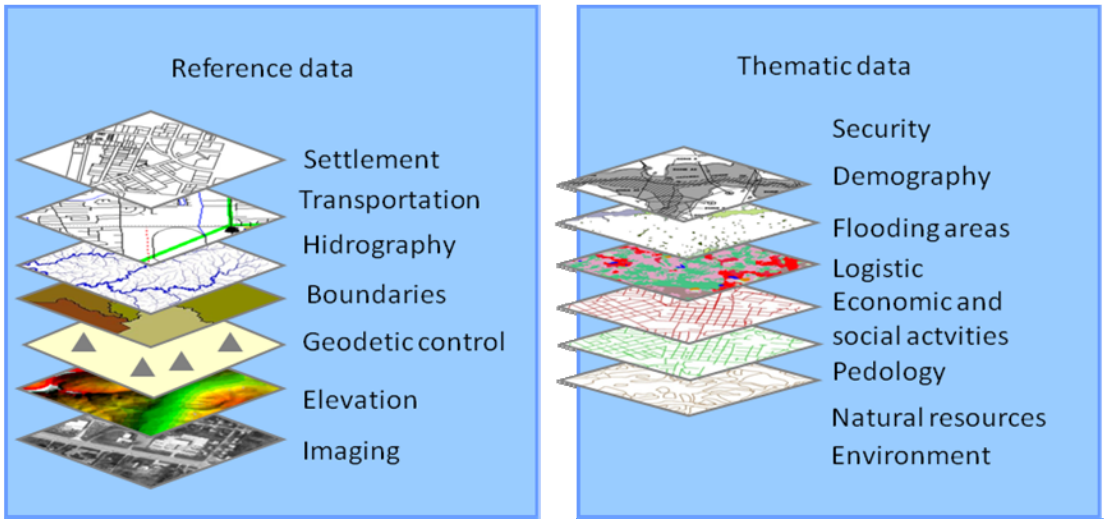

Figure 2: Examples of reference and thematic data to be openly shared by countries

In terms of data policies, it must also be mentioned the strong necessity of making data adherent to international standards, in order to facilitate the access to and sharing of it. With this respect, the Open Geospatial Consortium (OGC) and International Organization for Standardization (ISO) standards are important references for adoption.

Institutional aspects also need to be addressed at global (and, again, other) level. Most countries have established legal mapping frameworks, in some cases a long time ago, quite before the geotechnologies boom. These legal frameworks generally established institutional responsibilities, especially in terms of the production of national geodetic and topographic mapping information, and, in some cases, also included thematic information. Mandates for the development of standards and specifications may be part of that legal framework as well. Those countries which have not updated these legal instruments after the emergence of the new digital geotechnologies urgently need to do so in order to make the framework compatible with the current best practices. With this respect, UNCE-GGIM has again a role to be played, issuing recommendations and directions towards the modernization of this framework.

II. Relevant issues in Institutional Arrangements

Under the current context of massive demand for geospatial data, it is necessary to review the institutional arrangements to support the challenges regarding the timely production, dissemination and sharing of geospatial data. Much of the reflection related to this aspect has been carried out in the scope of the establishment of the National Spatial Data Infrastructures (NSDI). Whether there is a legal framework supporting the establishment of a NSDI (like in Brazil – www.inde.gov.br) or not (like in Canada – www.geoconnections.org), its intrinsic nature (based on collaborative efforts to build it) requires the proper assignment of responsibilities to institutions involved. Actually the same principle needs to be followed in the entire national geospatial sector, including the production (of all types of data – reference, thematic and of

added-value) sector. With this respect, due to the current relevance of the geospatial data and information for policy making, the establishment of a National Authority on this field is seen as extremely necessary. As an example, Japan can be mentioned, as the former Geographical Survey Institute became Geospatial Information Authority of Japan in April 2010 (www.gsi.go.jp), which made explicit the authoritative role played by this Institution. Of course countries have their own particularities, culture, and institutional frameworks, but similarly to Japan´s move, each country may reorganize, if needed, their government structure, in order to have an official National Geospatial Information Authority (NGIA) to:

- Coordinate the acquisition and production of geospatial data and information, according to priorities established by the government policies and programs;
- Coordinate the establishment of the National Spatial Data Infrastructure;
- Coordinate the establishment of standards and specifications to support the production, dissemination, sharing and access of geospatial data and information;
- Propose mechanisms for certifying geospatial information made available to the public as official, authoritative data;
- Play the role of the National Authority in geographic names;
- Propose corrective measures for the handling of information which is not adherent to the adopted standards and specifications;
- Report directly to the cabinet of the highest Government authority (President, Prime Minister, or equivalent);
- Coordinate the development of a National Geospatial Information Plan (NGIP) to produce, maintain, disseminate and share geospatial data and metadata, including the specification of the necessary human, technological and budgetary resources;
- Promote the availability of a complete coverage of the entire country territory by certified georreferenced orthorectified medium-to-high resolution imagery mosaic, updated at least once every two years, in order to provide the necessary view of the territory and its continuous changes. The access to this imagery should be given to all government institutions and society, at all levels and no charge, ideally through the NSDI, and, as long as confidentiality and security requirements are not violated, to other countries as well;
- Manage budgetary resources to implement the NGIP;
- Identify in all existing government programs those actions which depend on the production and/or availability of geospatial information, in order to guarantee the allocation of the corresponding necessary resources;
- Promote the necessary capacity building and training, at all levels, to government institutions which are potential users of geospatial information, in order to increase the general knowledge of the non-specialized users on geospatial information and technologies.

The acquisition and production of geospatial data and information is usually carried out by many institutions in each country, at several levels (e.g., from the central, state/provincial and local governments). Therefore, in order to optimize resources allocation, it is crucial to have all related

initiatives properly coordinated among all actors. For this, the proposed National Authority should have a leading role in coordinating these efforts. Furthermore, superposition of responsibilities between institutions at the same or different government levels need to be eliminated, which can bring again the necessity of reorganizing the government administrative structures.

Additionally, considering the geospatial nature of more than 70% of the information used for decision making in the public sector worldwide, it is urgent to promote a closer relationship between government institutions of all levels, to have producers and users sitting together to discuss the priorities of geospatial information production. In special, taking into account the applicability of statistical data to the establishment of socio-economic public policies, a close proximity between the NGIA and the National Statistics Office (NSO) is seen as very beneficial. This could lead to, for instance, an active participation of NSOs in the NSDI initiative in each country, paving the way to make geospatial statistical data broadly accessible and correlated to other geospatial information layers. As a result, one may expect an integration of geospatial/geographic institutes and statistical offices in some countries of the world, following the track left by Brazil and Mexico.

III. Current Situation in countries of the Americas

For the Permanent Committee for Geospatial Data Infrastructure of the Americas (PC-IDEA), policy formulation and implementation of institutional arrangements represent key challenges to be faced in response to the knowledge of the current status of SDI development in the region.

Based on seven resolutions issued by the 9th United Nations Regional Cartographic Conference for the Americas (UNRCC-A), held in August 2009 in New York, PC-IDEA established a Working Group on Planning (GTplan) during the 5th Executive Board meeting held in May 2010 in New York. This working group is composed by representatives of Brazil, Canada, Chile, Colombia, Cuba, Guatemala and Mexico, under the leadership of Chile and co-leadership of Canada. The first GTplan meeting was held at the Brazilian Institute of Geography and Statistics (IBGE), in Rio de Janeiro, in December 2010, with the support of the UN Statistics Division. During this meeting, a working plan was established covering seven themes, each one under the responsibility of a country representative:

1. Institutional capacity building (Colombia);
2. Standards and technical specifications (Mexico);
3. Best practices and guidelines for the development of SDI (Canada);
4. Innovations in National Mapping Organizations (Brazil);
5. Knowledge gathering on topics relevant to SDI for the region (observatory on SDI) (Guatemala);
6. Assessment of the status of SDI development in the Americas (Cuba);
7. Technological means for discussions related to SDI (Chile).

In order to obtain a baseline to support the activities on themes 1, 2, 3, 4 and 6, a questionnaire – comprised by 76 questions in total - was designed by GTplan and applied to PC-IDEA member

countries this year. 20 out of the 24 members (Figure 3) replied to the questionnaire (responses from Cuba, Dominican Republic, Guyana and USA were missing).

This section covers some results of the questionnaire, to give an overview of the situation in the Americas regarding geospatial policy formulation and institutional arrangements[1].

Figure 3: PC-IDEA member countries

The results shown in Figure 4 are related to relevant SDI issues. From this figure it is possible to see that the existence of legal frameworks, SDI policies and the availability of data and services is a reality in a significant portion of the countries. However, the following issues represent a challenge in the formulation/expansion of policies and implementation of institutional arrangements in the region: the definition of models for the assessment of return on investment for SDI and its components; the monitoring of economic and social impacts due to an adequate management of geospatial information, especially considering the use of this information by decision makers; and mechanisms that give visibility to SDI services that are used.

Another aspect to consider in the formulation of policies is related to SDI documentation and dissemination of good practices. This is essential to optimize the development of SDI in all of its components. Figure 5 shows the level of documentation of good practices and success stories in the region. It can be seen that most of the surveyed countries do not develop this type of documentation, which poses a challenge and sets a priority line of work to strengthen/create policies related to these matters.

[1] For a detailed analysis of the questionnaire results, the reader is invited to review the corresponding report to be released by GTplan by the end of this year.

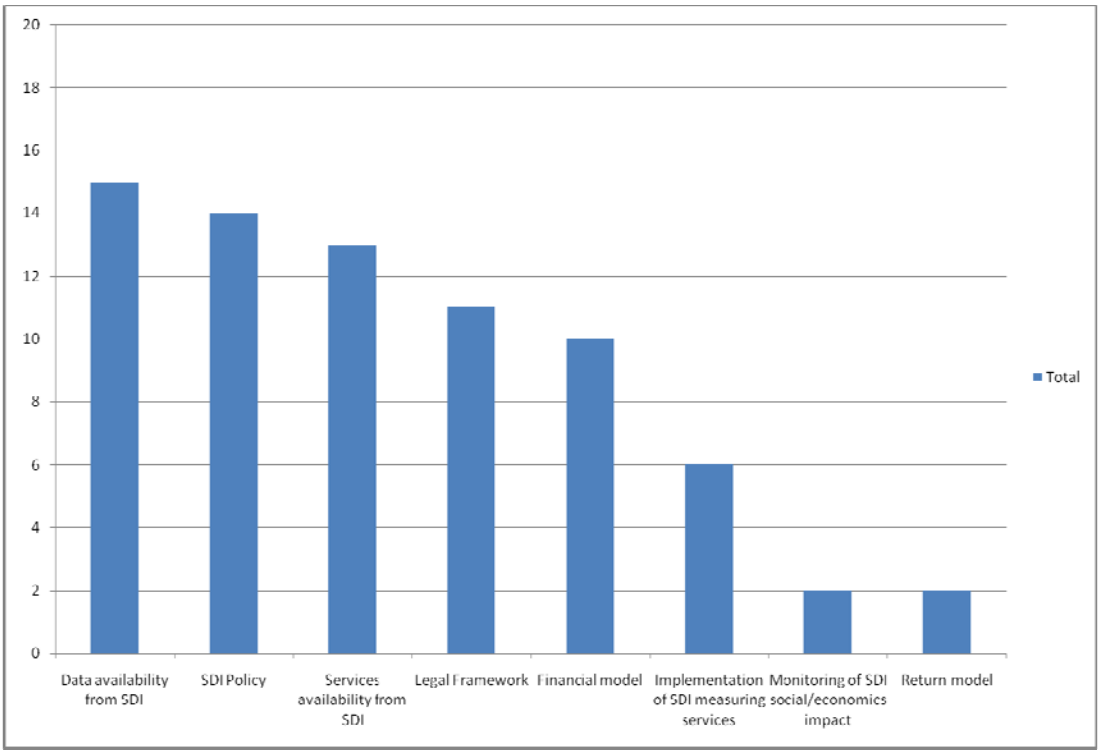

Figure 4: Number of countries in the Americas fulfilling SDI relevant issues

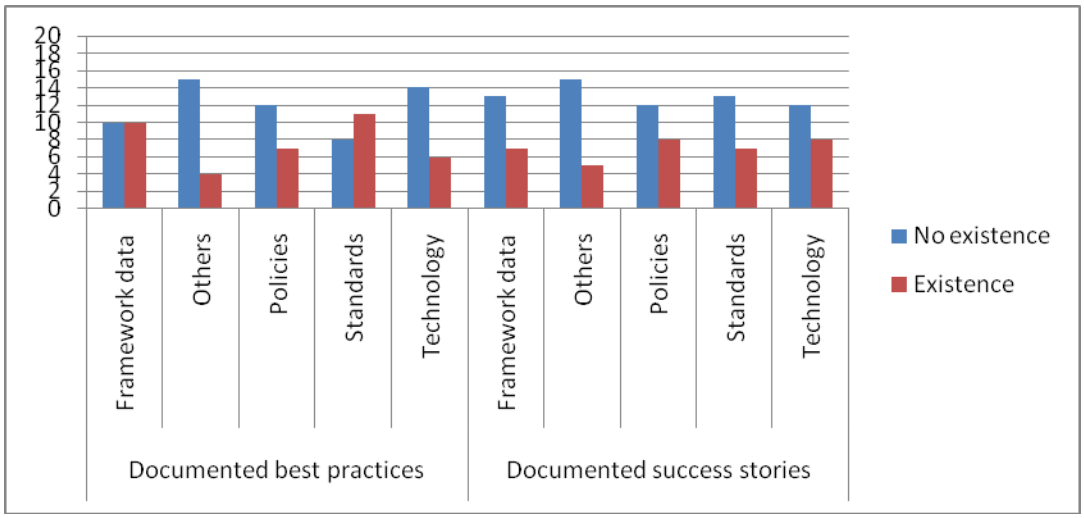

Figure 5: Existence of documented best practices and success stories in SDI topics

In terms of standards and technical specifications, the number of countries which generate geospatial information standards in different subjects are shown in Figure 6. It can be concluded from this figure that most of standardized topics correspond to reference data[2], meaning that most of the countries have a standardized basis on which they represent the themes of various sectors. On the other hand, thematic information has significantly lower levels of

[2] See Figure 2 for reference and thematic data

standardization, which results mainly in interoperability problems and difficulties for exchanging this kind of information. Therefore, in terms of institutional arrangements, the Americas' countries have the challenge of modeling thematic data and documenting technical specifications by means of an agreed work between producers and users, so that thematic information may be used more extensively. With this respect, the proposed NGIA may play an important role coordinating these efforts, involving the corresponding public institutions, so that they incorporate these tasks into their responsibilities.

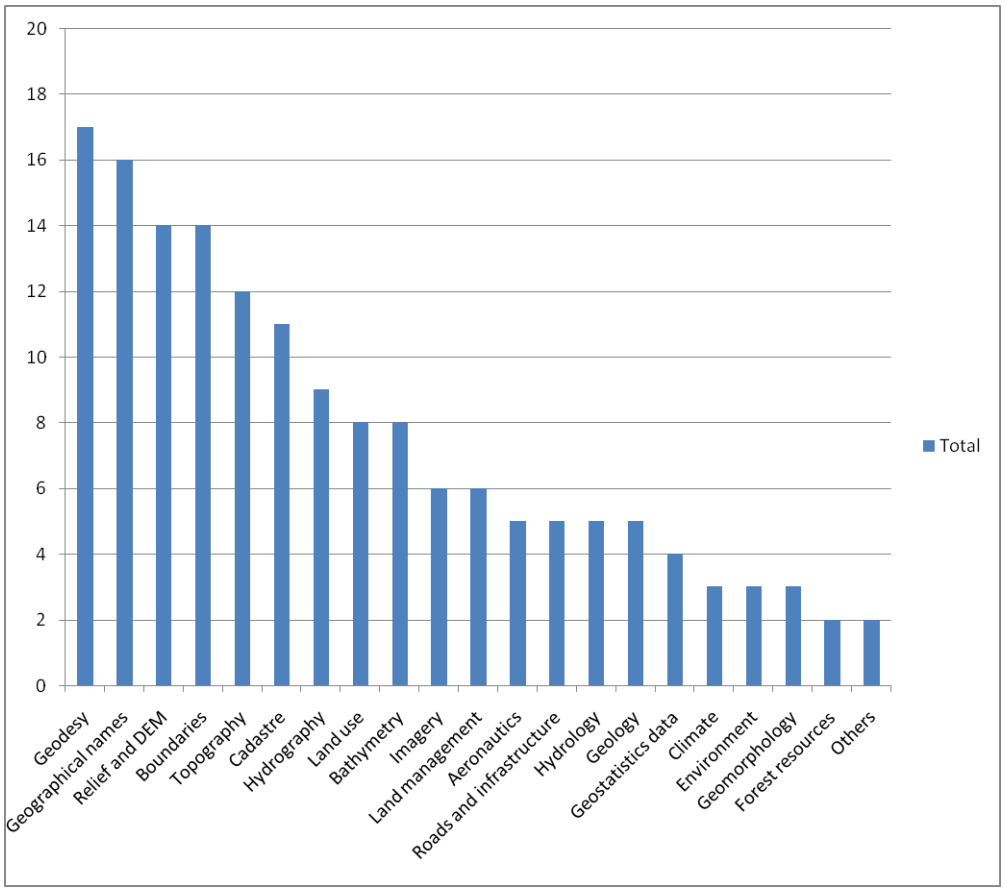

Figure 6: Number of countries that produce geospatial information standards in different topics

The PC-IDEA questionnaire also provides relevant information on the requirements of the countries of the region in terms of capacity building and education, posing as a challenge to incorporate these issues into geospatial policies and institutional arrangements. In this context, Figure 7 shows the results of the questionnaire regarding the topics of interest of the different target groups considered in the survey. It can be seen that capacity building priorities for decision makers are related to the topics of Spatial Data Infrastructures, Geographic Information Policies, Standards for Geospatial Information (GI) and Best Practices. For users of geospatial information, topics of interest are closer to technology, whereas producer priorities are in SDI issues, Geographic Databases and GIS.

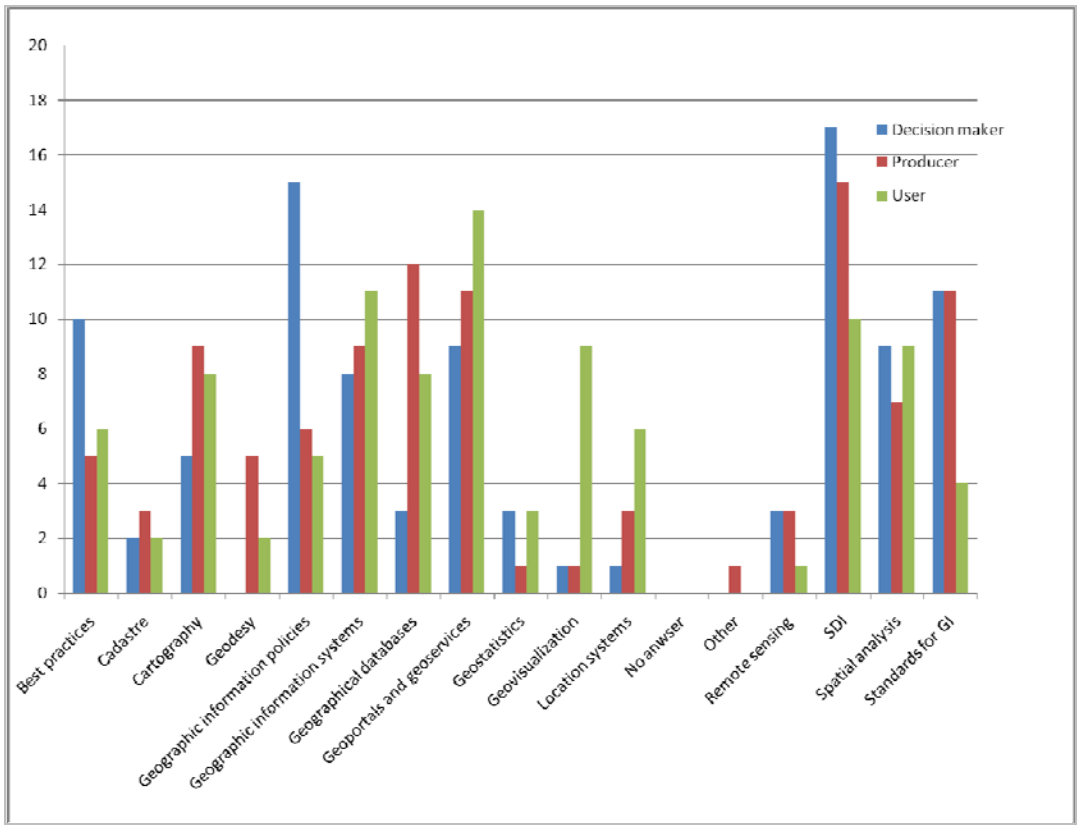

Figure 7: Number of countries of the Americas pointing out capacity building priorities for decision makers, producers and users of geospatial information

The situation of National Mapping Organizations (NMOs) is also part of the contents that were consulted with the member countries of PC-IDEA. The particular interest was focused on innovations carried out in these organizations in terms of production, business models, privacy policies, etc.

Figure 8 shows the results regarding the number of NMOs of the Americas versus each type of geospatial information (GI) produced by them; and the number of NMOs which started to produce each type of GI during the last 2 years. For example, 8 NMOs produce information related to risks, with 6 of them starting to produce this type of information during the last two years.

From Figure 8 it can be seen that the focus is on the production of topographic mapping and geodetic information, as expected. However, an increasing responsibility on the generation of data for cadastre and risks management can be seen. This confirms a tendency of the NMOs in expanding their set of activities, working in larger scales (for cadastre) and in support to governments regarding risks and disasters management.

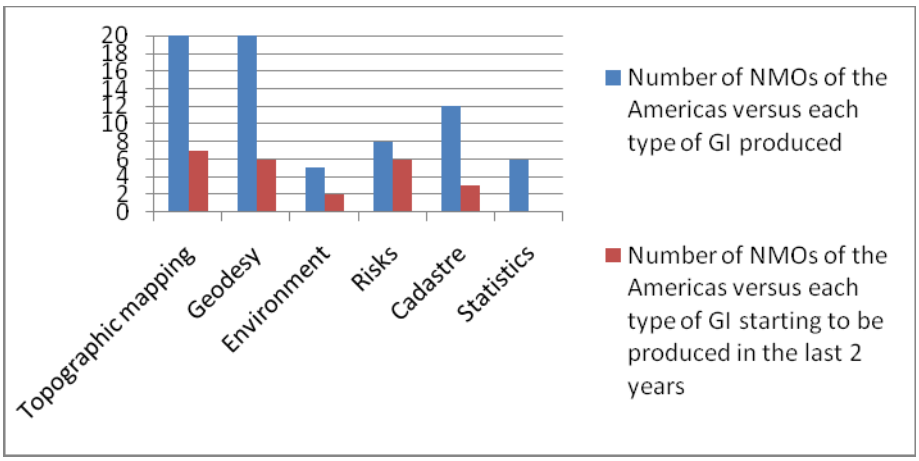

Figure 8: Number of NMOs of the Americas versus each type of geospatial information (GI) produced by them; and the number of NMOs which started to produce each type of GI during the last 2 years

In Figure 9 the number of NMOs of the Americas that use each type of data collection technology can be seen, which confirms the wide use of GPS satellite positioning and orbital imagery in the region. This latter result indicates the benefits that the availability of an updated high resolution imagery mosaic of the country can bring to it. In terms of Personal Digital Assistants (PDA), the countries have just started to use this type of devices for automating data collection.

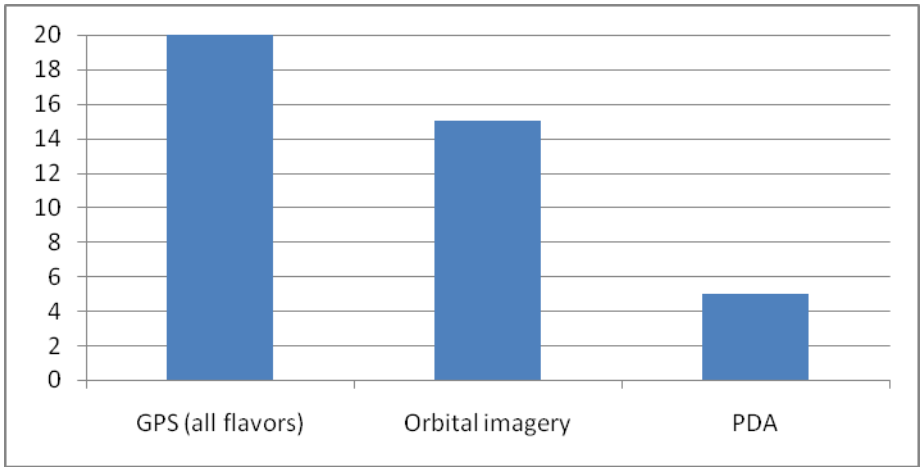

Figure 9: Number of NMOs of the Americas that use each type of data collection technology

Figure 10 shows the situation of NMOs in the Americas in terms of geospatial information distribution free of charge, and the number of those which started doing it in the last two years. Comparing with Figure 8, it can be seen that in general no more than 50% of the institutions release data free of charge (except for environmental and statistical data), with most of this happening recently (during the last two years). Besides, data at larger scale (cadastre) are usually

sold by institutions. This clearly shows that there is a later tendency towards releasing more data freely, but an open data policy would still be very challenging in the region.

With regard to data release policies, Figure 11 lists the number of NMOs of the Americas that present some sort of restriction on the release of each type of geospatial information, and how many of them do it due to confidentiality reasons. It can be seen that most of the restrictions are related to confidentiality constraints. Comparing to Figure 8, the conclusion is that in general more than 50% of the NMOs do not follow any type of restriction to release data (except for statistical data, as expected), which is an important requirement for data sharing.

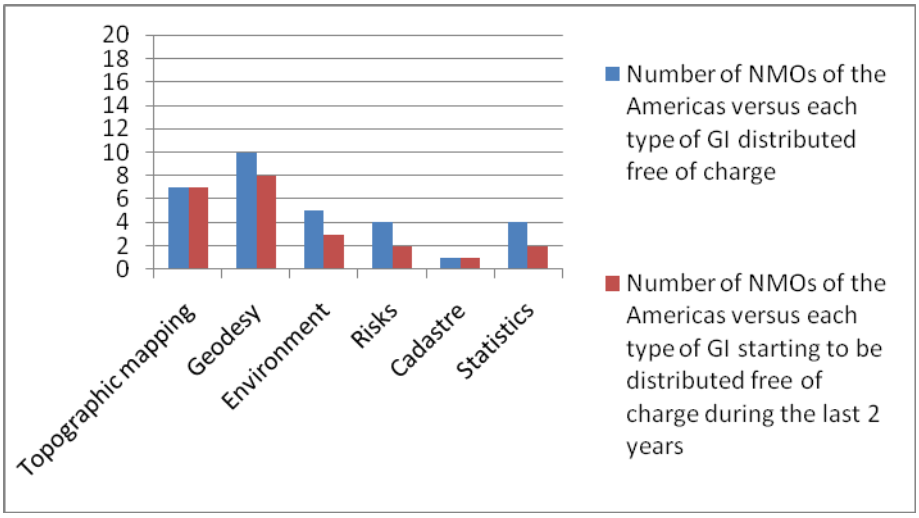

Figure 10: Number of NMOs of the Americas versus each type of GI distributed free of charge; and the number of those which started doing it in the last two years

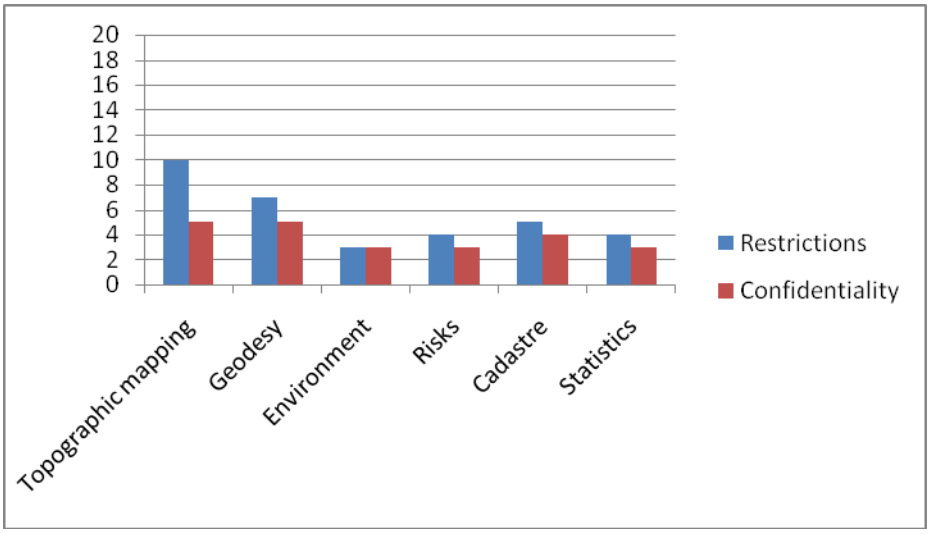

Figure 11: Number of NMOs of the Americas that present some sort of restriction on the release of each type of geospatial information, and how many of them do it due to confidentiality reasons

In terms of adherence to international standards, Figure 12 shows the number of NMOs of the Americas which follow ISO, OGC and W3C standards. It can be seen from the results that most institutions already adopt ISO and OGC standards, which is an important step towards data and systems interoperability.

Concerning data interchange format, Figure 13 shows the number of NMOs of the Americas which adopt the (OGC) GML, the KML and the SHP standards. It can be concluded that the NMOs still have a way ahead towards adopting a common open data interchange format.

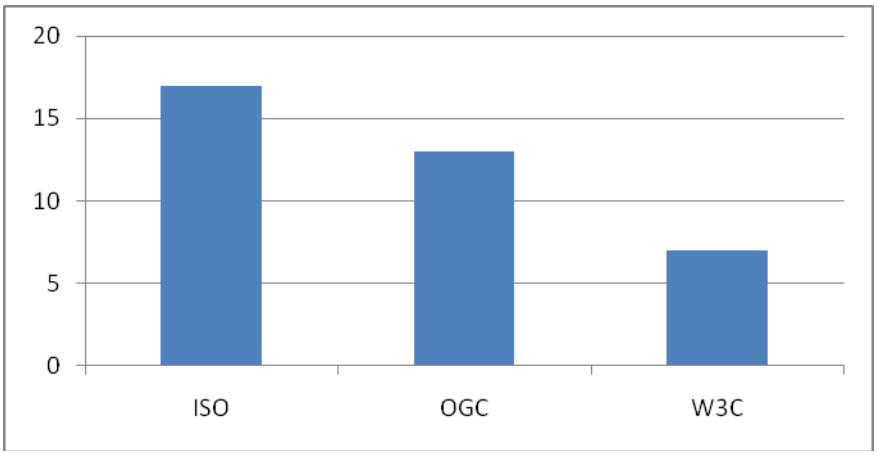

Figure 12: Number of NMOs of the Americas which follow ISO, OGC and W3C standards

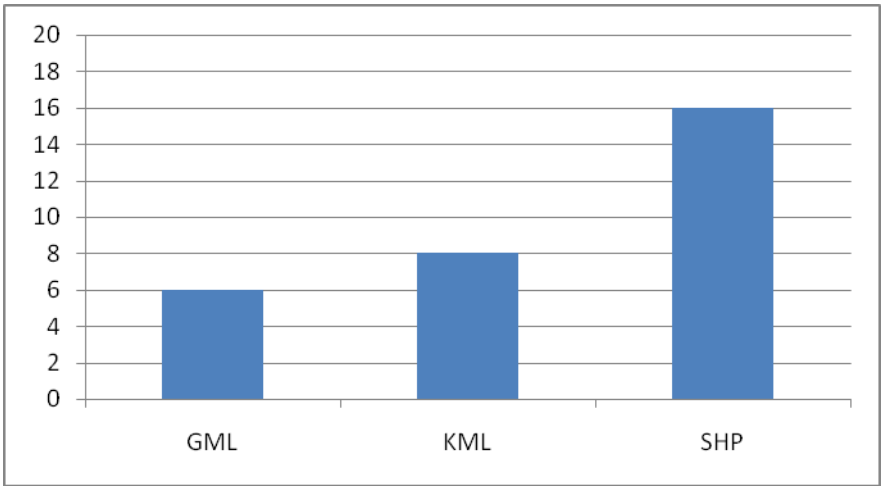

Figure 13: Number of NMOs of the Americas which adopt the GML, KML, and SHP data interchange formats

IV. Conclusions

Nowadays the importance of geospatial information supporting the decision-making process is unquestionable. The establishment of the UNCE-GGIM by ECOSOC last July clearly conveys this message. Among the issues to be addressed by this Committee are the challenges in geospatial policy formulation and institutional arrangements. Based on the experience brought by the activities carried out by PC-IDEA, including the results of a questionnaire responded by 20 countries of the Americas, relevant aspects of these issues have been discussed, leading to the following conclusions:

- Considering the potential correlation between policies established globally, regionally, nationally, and locally, UNCE-GGIM plays a very important role in setting up the general strategic legal framework to member countries. Whatever the specificities of each country, this top-down approach may well help the establishment of a consistent set of rules that, at the end, should expectedly contribute to the proper production, sharing and access of geospatial information among the involved nations;

- One of the most challenging policy issues is related to open data. In the Americas, the PC-IDEA survey has shown that in general less than 50% of the NMOs release geospatial data free of charge, and that most of these started doing it during the last two years. On the other hand, results have also shown that in general less than 50% of NMOs in the Americas have some sort of restriction on the release of geospatial data. Therefore one can assume that open data policy is still a challenging issue in the region, and supposedly this is also true for other regions. Considering that the establishment of a geospatial framework will not be possible without the adoption of an open data policy, it is suggested that at least a set of reference and thematic data, at medium and small scale, be made freely available to national and foreign users. Therefore, a clear message should be sent to the UN member states fostering them to share, at global level, geospatial data. Regarding data production financing - a critical issue in some cases to make open data policy a reality -, UNCE-GGIM should include this topic in its agenda, especially in the case of developing countries;

- Many countries still have out-dated legal frameworks established a long time ago. These countries urgently need to update the corresponding legislation taking into account the new digital geotechnologies in order to make their frameworks compatible with the current best practices. With this respect, UNCE-GGIM has a role to play, issuing recommendations and directions towards the modernization of this framework;

- Due to the unquestionable usefulness of the geospatial framework for sustainable development – being nowadays as important as any other basic infrastructure service –, countries should evaluate the possibility of carrying out an institutional remodeling initiative towards the establishment of a National Geospatial Information Authority (NGIA), with the responsibilities indicated in section II of this paper;

- Given the urgent need for cross correlating all types of geospatial data, in particular those of socio-economic nature (for instance, for environmental studies, risks and disaster management, etc.), a close proximity of NSOs to the proposed NGIAs, contributing to the

active participation of the former in the NSDI initiatives, is seen as very beneficial. In some countries, an integration of geospatial/geographic institutes and statistical offices may be expected;

- The results of the PC-IDEA questionnaire show that the Americas' countries are in good shape regarding the existence of SDI legal frameworks, SDI policies, the availability of data and services, and the development of reference data standards. On the other hand, the low level of monitoring of SDI impact and usefulness to decision makers and society, as well as the lack of documentation and dissemination of good practices and the lower level of thematic data standardization, demonstrate the need for including these topics in the formulation/expansion of policies and implementation of institutional arrangements in the region;

- The demand for capacity building and education in the Americas was also provided by the survey, pointing out the priorities for producers, users and decision makers to be included into geospatial policies and institutional arrangements in the region;

- Adherence to international standards is key to the successful implementation of a global geospatial framework. With this respect, NMOs in the Americas have mostly adopted ISO and OGC standards. However, regarding data interchange formats, the countries of the region still have a way ahead towards adopting a truly open standard in support of data interoperability.

Acknowledgements

This paper was prepared on behalf of PC-IDEA by Luiz Paulo Fortes, with the contribution of Álvaro Monett, Estebán Toha, Paula Mcleod, Moema Augusto, Rafael March, and Valéria Araújo.

We would also like to thank GTplan for preparing the questionnaire, the PC-IDEA Executive-Secretary for applying it and the 20 PC-IDEA member countries which have taken the time and effort to answer it, providing a very rich set of information to support the coming PC-IDEA activities.