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Report of the Regional Committee of United Nations
Global Geospatial Information Management for Asia and the Pacific

Report of the Working Group 3

Place-based Information Management for Economic Growth *

* Prepared by Ms. Jie Jiang, Chair, Sr Hasan bin Jamil, Mr. Simon Costello, Mr. Ahmad Fauzi bin Nordin, Vice-Chairmen

Regional Committee of United Nations Global Geospatial Information Management for Asia and the Pacific

(UN-GGIM-AP)

Working Group 3

Place-based Information Management for Economic Growth

Status Report 2012-2015

for the

20th United Nations Regional Cartographic Conference for Asia and the Pacific (UNRCC-AP)

Jeju, Republic of Korea
6-9 October 2015

Chair
Ms. Jie Jiang, China, jjie@nsdi.gov.cn

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1. TERMS OF REFERENCE FOR WORKING GROUP3

1.1 Purpose

The 19th UNRCC-AP adopted nine resolutions, a number of which charged the UN-GGIM-AP with undertaking further activities on geodetic framework, data sharing and disaster management, and place based information management for economic growth.

The fundamental goal of the UN-GGIM-AP WG3 is to achieve the recommendations in the Resolution adopted by the 19th UNRCC-AP.

The purpose of the UN-GGIM-AP WG 3 is：

(1) To promote the common understanding and advancement of place-based information, by:

(a) investigating the status of development of place-based information management in Asia & Pacific Region; and

(b) defining common requirements for place-based information management related to the economic growth and society development.

(2) To promote the fast acquisition and update of place-based data by intensifying the development and experimental usage of interoperable geospatial data in pilot studies on the local, regional and national level.

(3) To encourage developing Web/cloud-based platform covering the Asia & Pacific Region for the management, processing, visualization and analysis of place-based data;

(4) To initiate dedicated efforts on promoting the application of place-based information in e-Government and public services.

(5) To promote capacity building by developing joint action programs for the educational and training facilities on place-based data handling, delivering, and application.

1.2 Timeline

The work began 2012 and continued through 2015.

1.3 Membership of the Working Group

Chair:

Jie Jiang

National Geomatics Center of China

Vice-Chairs:

Ahmad Fauzi bin Nordin (2012-2014)
Department of Survey and Mapping, Malaysia

Sr Hasan bin Jamil (2014-2015)
Department of Survey and Mapping, Malaysia

Simon Costello
Geoscience Australia, Australia

1.4 Responsibilities

The Chair of the UN-GGIM-AP WG3 will:

(1) Develop more specific terms of reference based on each project,

(2) Implement and complete work plans,

(3) Report regularly on working group activities at the UN-GGIM-AP Executive Board Meetings, Plenary meetings, UNRCC-AP meetings,

(4) Provide expert advice, on request, to agencies and organizations,

(5) Lead discussions at relevant meetings,

(6) Draft resolutions.

Vice Chairs of the UN-GGIM-AP WG3 will:

(1) Carry out the Chair's duties in his or her absence,

(2) Provide support and assistance to the Chair in carrying out his or her responsibilities,

(3) Taking on specific responsibilities from the Chair

1.5 Mode of Operation

UN-GGIM-AP WG3 will conduct their activities through organizing seminar, symposium, tutorial/training under the administration and plan of UN-GGIM-AP.

2. RESOLUTIONS ADOPTED AT THE 19th UNRCC-AP (corresponds to WG3)

2.1 Acquisition and maintenance of place-based information

The Conference,

Noting the increasing importance of place-based information for many aspects of economic growth and societal development,

Also noting the increasing role of interoperable distributed databases created and maintained by different nations and regions to support web-based processing and query,

Recognizing the necessity of up-to-date and properly integrated geospatial information for time-critical applications, such as e-government and emergency management and disaster management,

Also recognizing the benefits of sharing and common use of authoritative geospatial information,

Further recognizing the importance of enhancing national efforts, including investments, in the acquisition and maintenance of geospatial information and its dissemination,

Recommends that Member States improve the acquisition and maintenance of geospatial information by:

(a) Promoting the use of various sensors, imagery and volunteered geographic information for more rapid acquisition and update of authoritative geospatial information;

(b) Piloting and evaluating the usage of fundamental, multiple-use geospatial information for local, national and regional applications.

2.2 Smart services for the delivery of geospatial information

The Conference,

Noting that the increased usage of geospatial information over the web has continuously changed the way Governments function and transact information and services,

Also noting the trend of using the web/cloud to provide smart services for managing, processing and service platforms for geospatial information, Recognizing the potential for web/cloud services for both the timely processing, delivery and application of static and dynamic geospatial information,

Also recognizing that the international standards organizations, such as the International Organization for Standardization and the Open Geospatial Consortium are developing standards for the delivery and sharing of geospatial information, *Recommends* that national geospatial information authorities utilize and share knowledge on web/cloud-based platforms and other smart services for dynamic management, processing, visualization, analysis and delivery of geospatial information.

2.3 Capability to deliver and use geospatial information

The Conference,

Noting the progress made in the development of fundamental geospatial information in the Asia and Pacific region,

Also noting the variability in the maturity of geospatial information usage within the Asia and Pacific region,

Further noting that national geospatial information authorities and professionals need to continuously update and share their knowledge on geospatial information,

Recognizing the increased demand for geospatial information in supporting government functions and community well-being,

Recommends that Member State national geospatial information authorities and professionals extend their capabilities to deliver and use geospatial information by developing joint action programmes for education, training and capability development on the acquisition, management, delivery and application of geospatial information.

3. WORK PLAN OF WG3

No	Activities/Steps	Date
1	Investigating the status of development of place-based information management in Asia & Pacific Region. Define common requirements for place-based information management related to the economic growth and society development.	Dec.2012-2014
2	pilot studies on the fast acquisition and update of place-based data, construction interoperable distributed databases, and the experimental usage for e-government	2013 In some of the countries
3	Experiment on developing Web/cloud-based platform for management, processing, visualization and analysis of place-based data, and for provide location-based	2013 Joint-efforts of some of the

	services to e-Government and public services. This event should be cooperate with WG 1 based on the geodetic system and navigation system in AP region	countries
4	Training courses on place-based data, platform and application.	2013, 2014
5	International Symposium on Geospatial Databases and Location-based Services (joint event with ISPRS TC IV)	May 14-16, 2014 Suzhou, China
6	Reports of the progresses	2013-2015

4. ACTIONS TAKEN BY WG3 SINCE LAST PLENARY MEETING

4.1 Investigation on the status of development of place-based information management

See status of the world in Annex “A”, and status of AP region in Annex “B”.

4.2 Pilot studies on the fast acquisition and update of place-based data, construction interoperable distributed databases, and the experimental usage for e-government

See case study in Australia in Annex “C”.

See case study in Malaysia in Annex “D”

See report by UN-GGIM National Institutional Arrangements Task Group 3 in Annex “E”

4.3 Experiment on developing Web/cloud-based platform for management, processing, visualization and analysis of place-based data, and for provide location-based services to e-Government and public services..

See case study in China and Australia in Annex “F”.

4.4 Capability to deliver and use geospatial information

Organized the ISPRS TC IV Symposium on “Geospatial Databases and Location-based Services”, and hosted the Seminar for Developing Countries on the Global Web-based Geoinformation Services. See detailed information in Annex “G”

5. FURTHER WORKPLAN

Regional sustainable development must aim at a high level of taking into account the diversity of situations in the various regions of the UNGGIM-AP members. The balanced developed, interoperable and sharable Geo-spatial information in the region is essential for the regional sustainable development.

With the studies of WG 3 we found that many NSDIs have been established in the member countries. But a number of problems exist regarding the availability, quality, uniformity, accessibility and sharing of spatial information. So we think it is necessary to promote the common understanding of establishing a regional SDI by using unified data standards, and to share or interoperate the SDI for location-based services.

In coming three year, we would like to focus on the following activities:

No	Activities/Steps
1	Investigation and evaluations the development, access, management, update and sharing of NSDI among the member countries.
2	Promote the generally accepted data specifications, metadata catalogues, and service interfaces, and interoperation of the SDIs among different member countries.
3	Pilot on developing interoperable Regional SDI by some of the member countries by using the unified specifications and the predefined rules;
4	Training courses on regional SDI, portal/platform and application. Workshops, seminars co-organized with other International organizations

Annex "A"

The Status of Topographic Mapping in the World
a UNGGIM - ISPRS Project 2012 - 2015

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* Institute of Photogrammetry and GeoInformation, Leibniz University Hannover, Germany ** Eastview Geospatial, Minneapolis, MN, USA

Abstract

In December 2011 UNGGIM initiated a cooperative project with ISPRS to resume the former UN Secretariat studies on the status of topographic mapping in the world conducted between 1968 and 1986. After the design of a questionnaire with 27 questions, the UNGGIM Secretariat sent the questionnaires to the UN member states. 113 replies were received from the 193 member states and other regions the 51 non-member countries and territories. Regarding the global data coverage and age the UN questionnaire survey was supplemented by data from the Eastview database. For each of the 27 questions an interactive viewer was programmed permitting the analysis of the results. The authoritative data coverage at the various scale ranges has greatly increased between 1986 and 2012. Now a 30% 1:25 000 map data coverage and a 75% 1:50 000 map data coverage has been completed. Nevertheless there is still an updating problem as date for some countries are 10 to 30 years old. Private Industry with Google, Microsoft and Navigation system providers have undertaken huge efforts to supplement authoritative mapping. For critical areas on the globe MGCP committed to military mapping at 1:50 000. ISPRS has decided to make such surveys a sustainable issue by establishing a working group, which also will enlarge its scope toward global land cover mapping.

1. Origins of the Project

In 1986 the Department of Technical Cooperation for Development of the United Nations Secretariat has completed the last survey on the „Status of World Topographic and Cadastral Mapping". The results of the survey were published by the United Nations, New York 1990 in World Cartography, Vol. XIX. The text was submitted by the UN Secretariat as document E/CONF 78/BP7 in 1986 prepared by A.J. Brandenberger and S.K. Ghosh of the Faculty of Forestry and Geodesy at Laval University, Quebec, Canada. It referred to previous surveys submitted by the Department of Technical Cooperation for Development of the United Nations

Secretariat in 1968 published in World Cartography XIV and in 1974 and 1980 published in World Cartography XVII.

The paper published in World Cartography XIX in 1990 summarized the progress made in topographic mapping across the globe between 1968 and 1980 in 4 scale categories:

range I;	scales between 1:1000 and 1: 31 680
range II;	scales between 1:40 000 and 1:75 000
range III;	scales between 1:100 000 and 1:126 720
range IV;	scales between 1:140 000 and 1:253 440

These ranges represent the more recently standardized scales:

range I;	scale 1:25 000
range II;	scale 1:50 000
range III;	scale 1:100 000
range IV;	scale 1:250 000

While scale in the age of digital cartography has changed the meaning, the scale ranges nevertheless maintain their significance with respect to the resolution of mappable details.

The 1986 survey covered the following number of countries or territories:

Africa	53 countries	4 territories
North America	24 countries	13 territories
South America	12 countries	3 territories
Europe	39 countries	4 territories
Asia	40 countries	3 territories
USSR	1 country	0 territories
Oceania	11 countries	17 territories

Antarctica was not included in the survey.

Source of the data obtained by the surveys were completed questionnaires, sent by the UN Secretariat to the UN member countries, plus additional surveys made directly by Laval University for UN member countries not having answered the questionnaires, for non-UN member countries and for territories under foreign administration. The result of the survey was for each region and for the different scale ranges:

	range I	range II	range III	range IV
Africa	2.3%	29.7%	20.6%	86.8%
North America	41.3%	68.2%	8.0%	92.8%
South America	9.7%	29.0%	44.2%	50.4%
Europe	92.5%	93.8%	81.3%	95.7%
Asia	16.0%	62.7%	65.4%	92.0%
USSR	>5%	>60%	100%	100%
Oceania	13.3%	15.6%	36.1%	99.8%

The areas covered by the survey were:

	range I	range II	range III	range IV
Africa	75.8%	100%	100%	100%
North America	90.7%	100%	100%	99.5%
South America	100%	100%	100%	100%
Europe	98.0%	90.2%	97.25%	96.7%
Asia	87.8%	90.9%	87.6%	90.2%
USSR	100%	100%	100%	100%
Oceania	94.1%	94.5%	94.3%	99.9%

World summary:

	range I	range II	range III	range IV

area of survey 1986	90.1%	97.4%	97.0%	97.75%
1986 map coverage	17.9%	49.3%	46.4%	87.5%
1980 map coverage	13.3%	42.2%	42.2%	80.0%
1974 map coverage	11.6%	35.0%	40.5%	80.5%
1968 map coverage	7.7%	23.4%	38.2%	81.0%

Since the last survey in 1986 considerable progress has been made in data coverage:

	range I	range II	range III	range IV
2012 map coverage	33,5%	81.4%	67.5%	98.4%

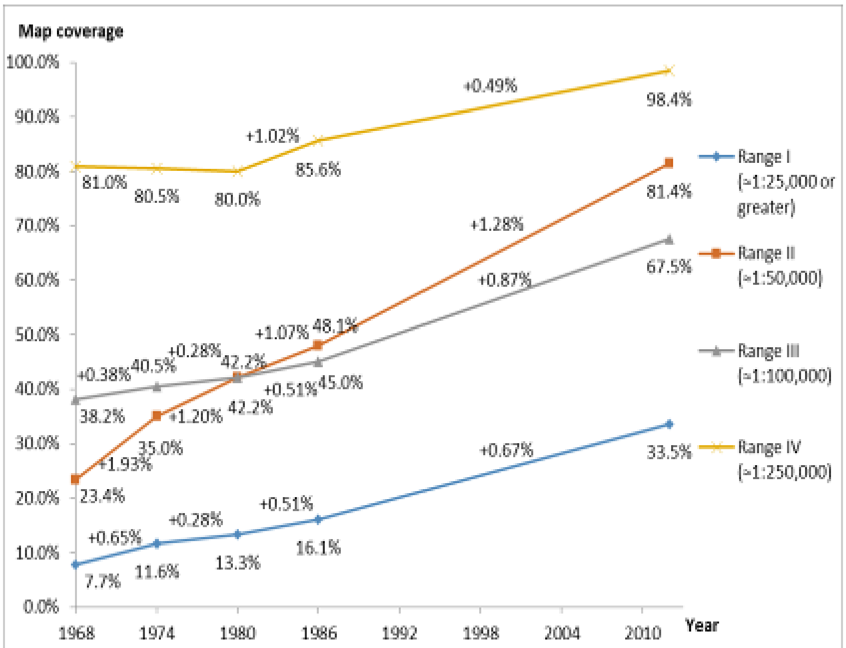


Chart 1: Percentages of total world area covered in each scale category, 1968-1974-1980-1986-2012

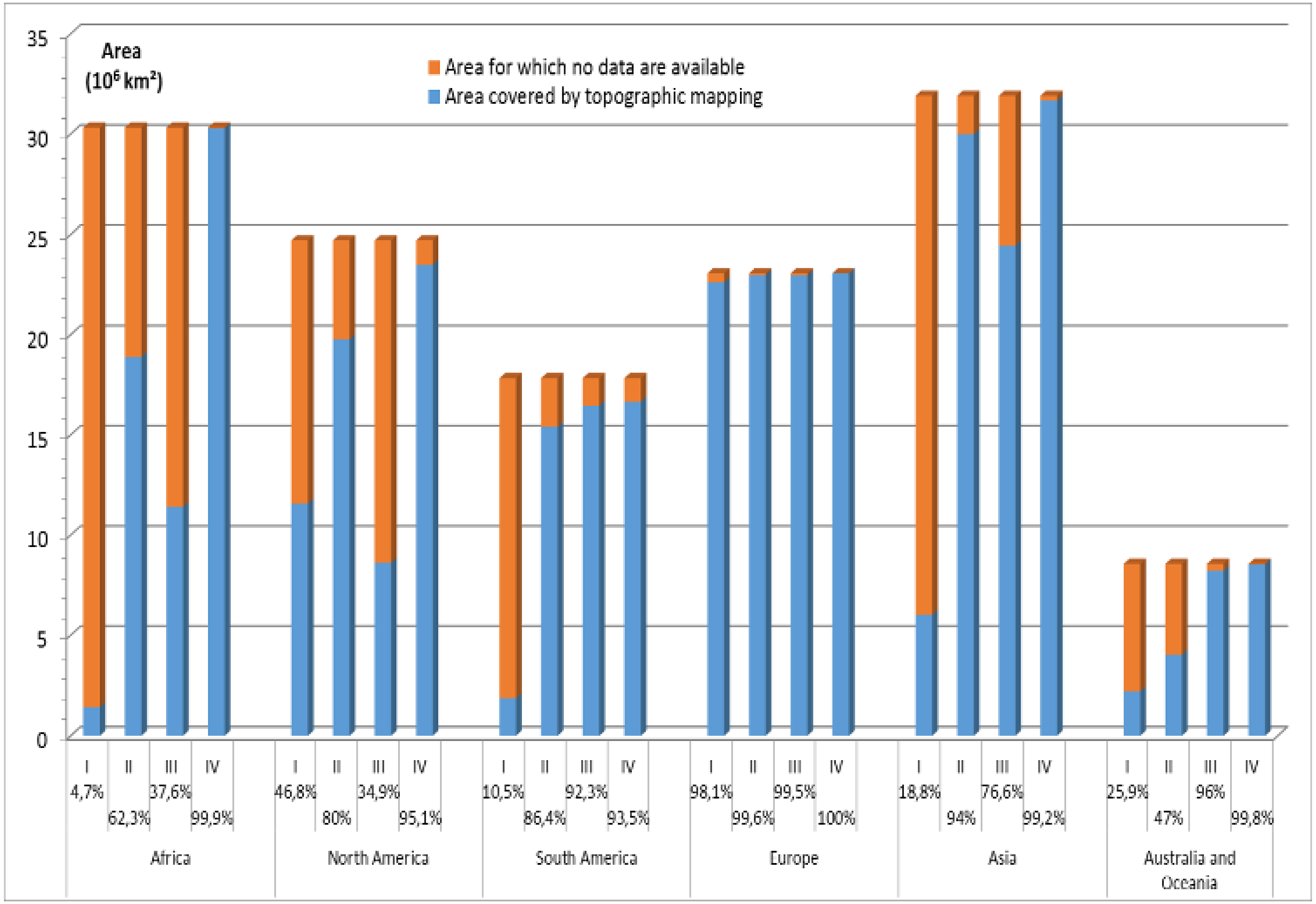


Chart 2: Area covered by topographic mapping on four scale ranges, by geographical region, 2012

While the surveys presented in 1986 did not concentrate on map revision on a global basis, they nevertheless derived an update rate for the four scale ranges:

	range I	range II	range III	range IV
update rate 1986	3.2%	1.8%	2.7%	3.6%

This points to the fact, that in 1986 the maps at the scale relevant to national planning operations 1:50 000 were hopelessly out of date.

	range I	range II	range III	range IV
update rate 2012				

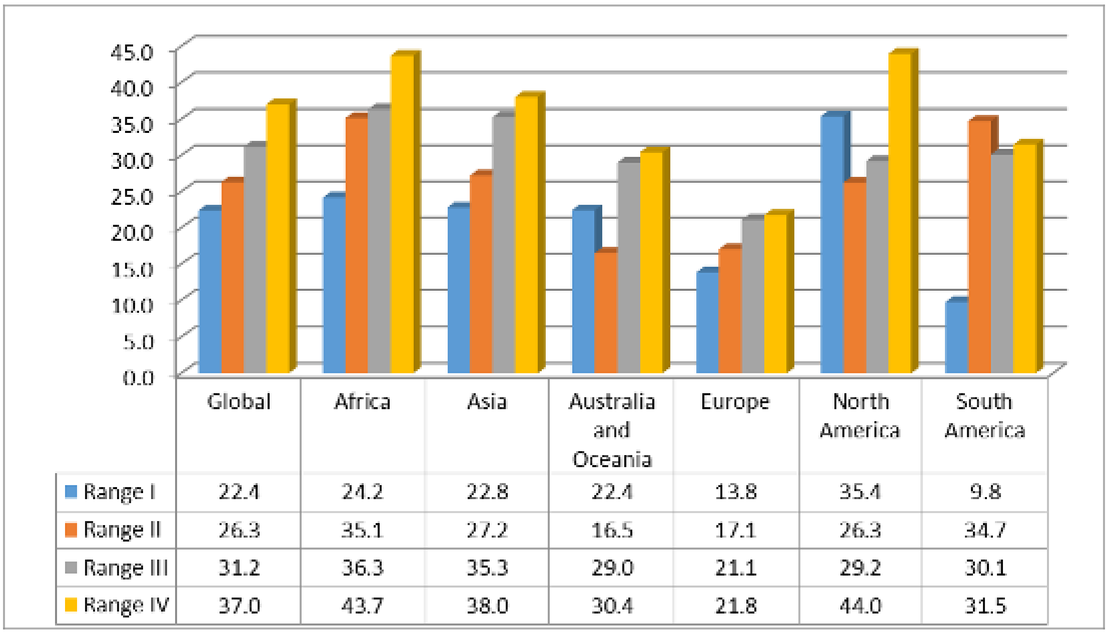


Chart 3: Average map age in years counting from 2012

Other aspects of the surveys conducted in 1980 were directed toward the existence of geodetic networks and their density. In 1980 there existed 3.67 M horizontal and 3.16M vertical control monuments on the globe, but again their density varied from 2.66 km^2 per horizontal control monument and 3.61km^2 per vertical control monument in Europe to 232km^2 in Africa with an average of 42.5km^2 per horizontal control monument to 46.4km^2 per vertical control monument.

Today the GNSS technology makes control point densities irrelevant, except for the case, when old map data need to be referenced to a global datum.

In 1980 the national mapping agencies possessed 12 120 theodolites, 5790 precise leveling instruments and 1914 EDM devices, 162 airplanes for aerial photography, 267 aerial survey cameras and 3120 photogrammetric stereo plotting instruments.

Disregarded in that survey are instruments owned by companies mapping for governments under contract.

Again, the availability of geodetic instrumentation is not of essence to judge progress any more.

The attempts of 1980 to determine the existing manpower of the national mapping agencies for each region were based on few countries only (e.g. Algeria and Nigeria for Africa, the USGS in the USA, the Surveys and Mapping Branch in Canada, the IGN France in Europe). These data were used to extrapolate the requirements in other countries with the attempt to develop a budget of global expenditures, yielding a global sum of US$ 868 million, at that time 0.010% of the gross national product, while the global surveying and mapping activities at that time were estimated to be between 8 to 9 billion US$ per year. A program for increasing the expenditures to 0.02% of the GNP was recommended in the report to meet the need for lacking mapping coverage and lacking map updates.

The financing of geospatial information is a very complex issue. To track progress these tasks should now be transferred to another UNGGIM Working Group

The rather inaccurate and inconclusive results of 1986 may have discouraged the UN Secretariat in continuing the past surveys due to lack of a budget for this purpose.

2. The UNGGIM-ISPRS Project

The United Nations Regional Cartographic Conferences (UNRCC) for the Americas and for Asia and the Pacific nevertheless continued to recommend to the Secretariat to continue the studies on the global status of mapping. One of these resolutions of the UNRRCC for the Americas in 2009 gave the mandate to the Secretariat for a new survey.

This happened at the time, when UNGGIM (United Nations Global Geospatial Information Management) was created as a new structure.

ISPRS approached the director of UNGGIM in 2011 to start a joint project on the survey of the status of topographic geospatial information,

- because the issue is of global interest
- because new technologies, such as GNSS (GPS, GLONASS), digital aerial mapping, high resolution satellites for mapping, digital photogrammetry and GIS have taken over as new mapping methodologies
- because large private organizations such as the navigation industry (Here, Tomtom),
  Google Earth and Microsoft Bingmaps have entered the mapping effort, which was previously the domain of the national mapping agencies.

The project was approved in December 2011 by Dr. Paul Cheung, director of

UNGGIM at that time, who nominated Dr. Amor Laaribi as UNGGIM contact, and by Chen Jun, President of ISPRS, who nominated Prof. Gottfried Konecny of Leibniz University Hannover as ISPRS contact.

In January 2012 a questionnaire to the UN member states was designed, mutually discussed, translated to French, Russian and Spanish and mailed to the contacts of the UNGGIM Secretariat in the UN member states. Ms. Vilma Frani of the UNGGIM Secretariat sent the replies to Leibniz University Hannover, where they were placed in a database designed by Uwe Breitkopf for further analysis.

3. The Questionnaire

The jointly designed questionnaire consists of five parts including 27 Questions:

- PART A: Background Information
- PART B: National Topographic Mapping Coverage
- PART C: National Imagery Acquisition
- PART D: National Surveying and Cadastral Coverage
- PART E: Organization

See Appendix I for the original Questionnaire.

Until March 13, 2015 altogether 113 responses have been received from 193 UN member states. In addition, there are 51 non-UN member countries and territories, which are also covered by map data. These map data for 244 UN member states and regions were generated in UN member states, but these have in general no direct responsibility for mapping these territories.
Figure 1 shows the 113 UN Member States, which have answered the UNGGIM-ISPRS questionnaire.

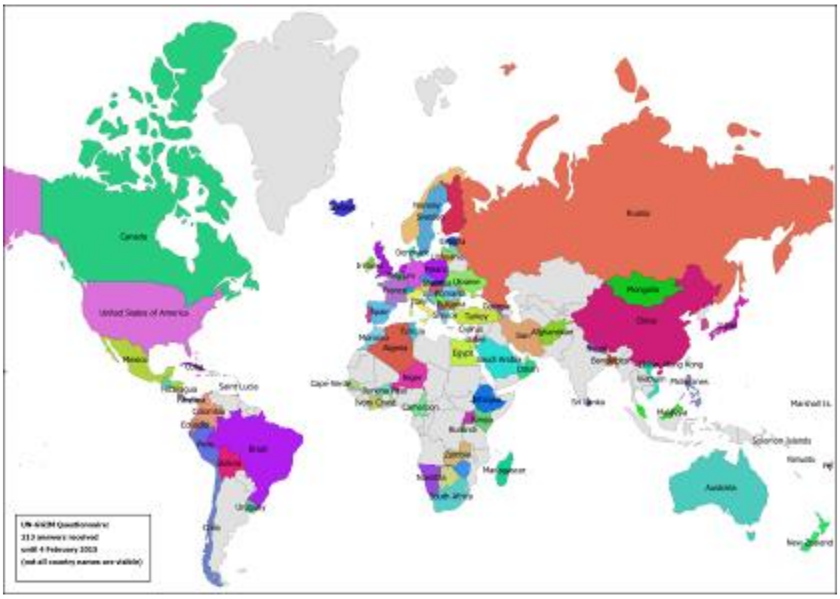


Figure 1: 113 countries have replied the Questionnaire until February 2015

4. Content of the database

While not all of the 27 questions need to be answered globally, this is, however, important for questions 1 and 2, since they characterize the global data coverage at the different scale ranges and their age of the data. To assess the global status the Eastview database is a fundamental component to answer these questions. Dr. Kent Lee, CEO of Eastview has kindly agreed to make the missing data available from their database.

Regarding question 1 Figure 2 to Figure 5 show the global coverage in the scale ranges
1: 25 000 or greater, 1: 50 000, 1: 100 000 and 1: 250 000.

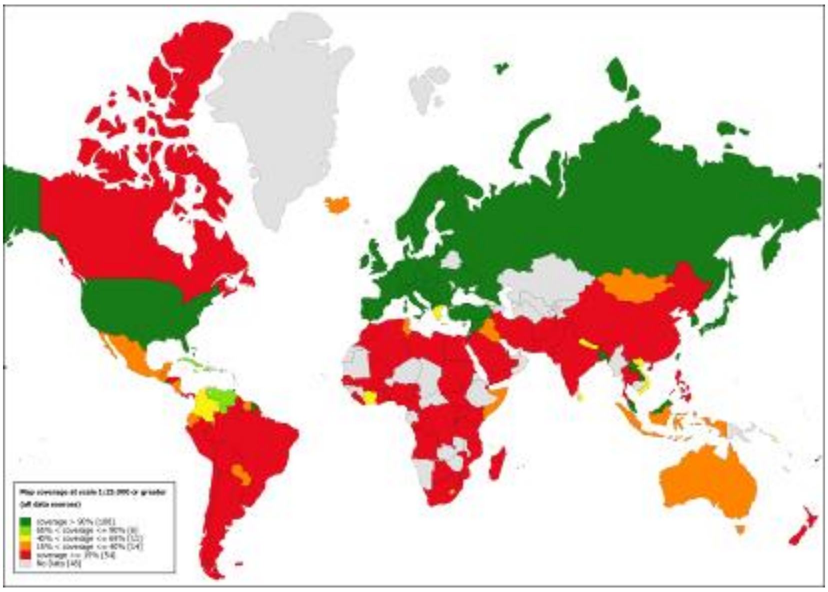


Figure 2: Map coverage at scale 1:25 000 or greater

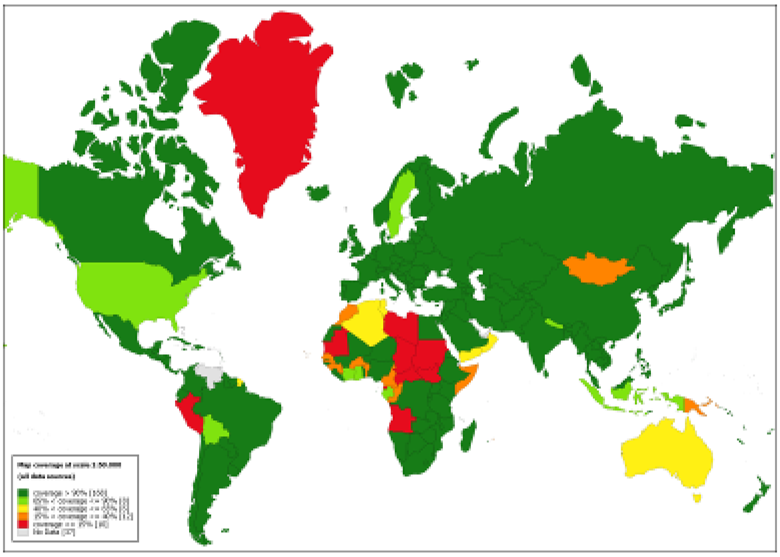


Figure 3: Map coverage at scale 1:50 000

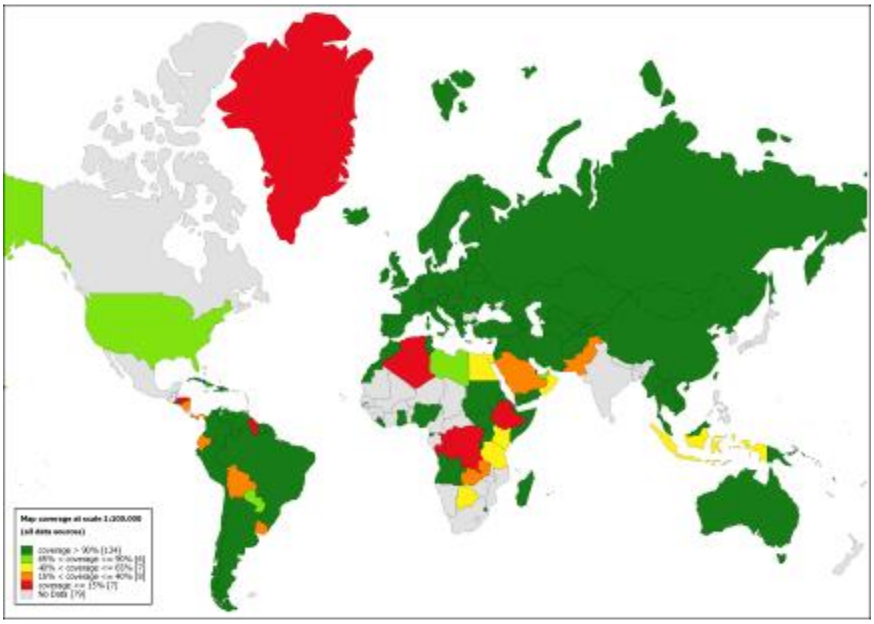


Figure 4: Map coverage at scale 1:100 000

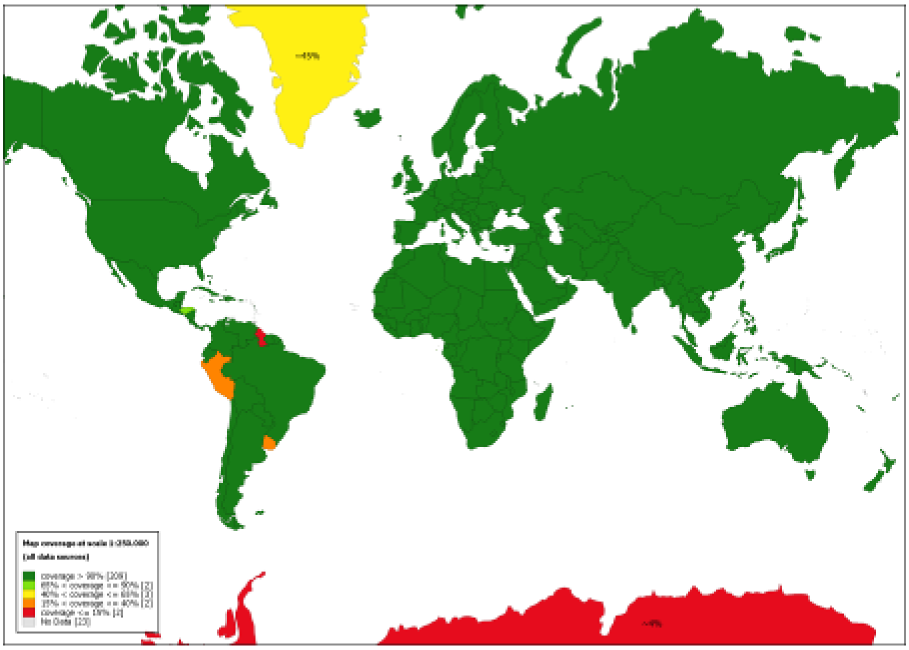


Figure 5: Map coverage at scale 1:250 000

Chart 4 and Fig. 6 to Fig. 9 give the source of the meta data information for Figure 2 to Figure 5. This answers question 1

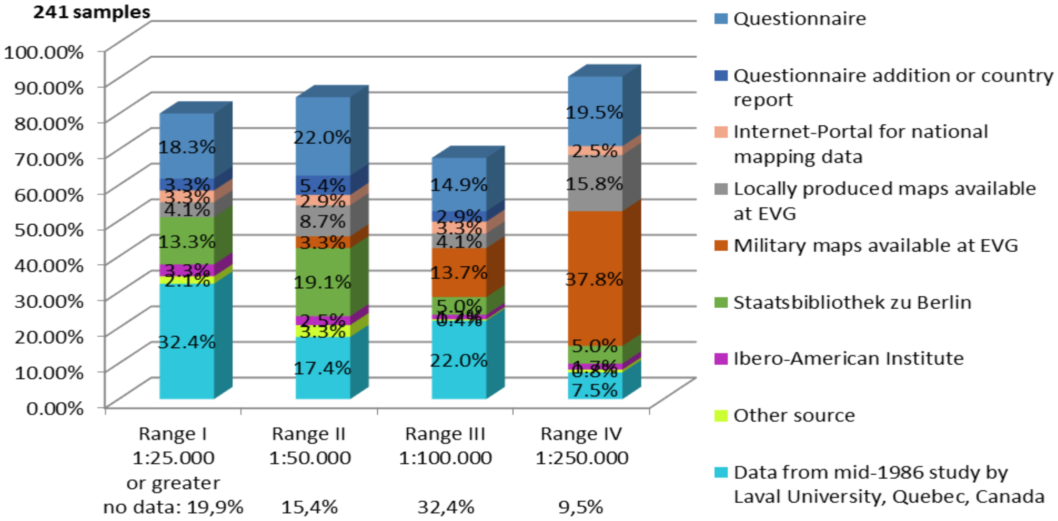


Chart 4: Data source for coverage per scale category

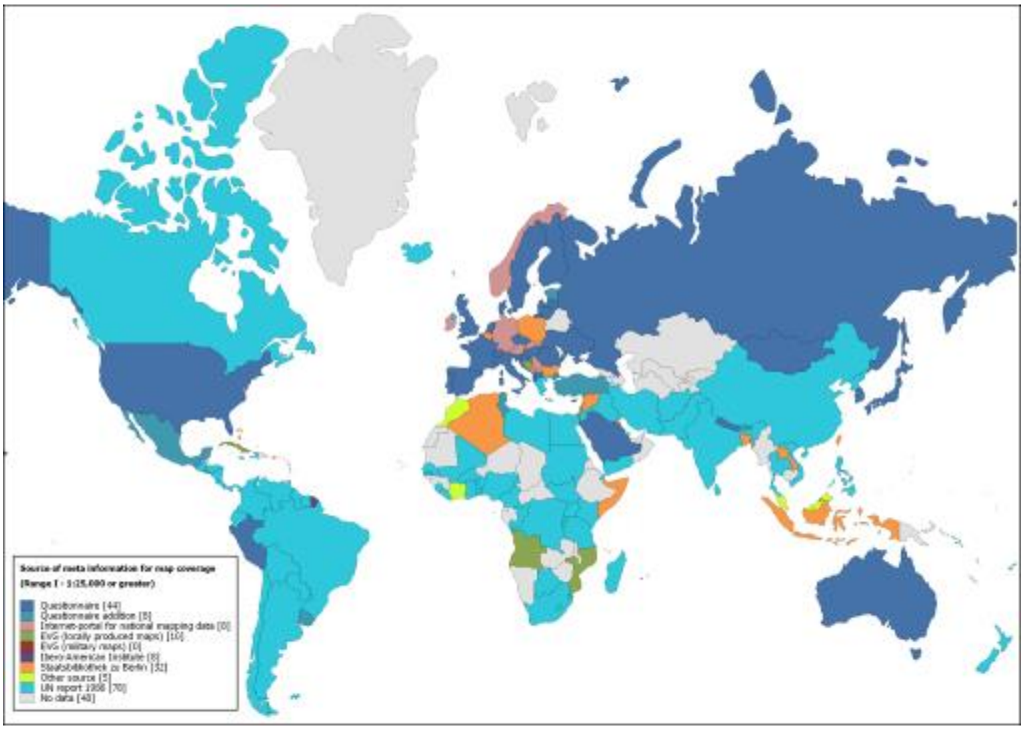


Figure 6: Source of meta information for map coverage in range I - 1:25,000

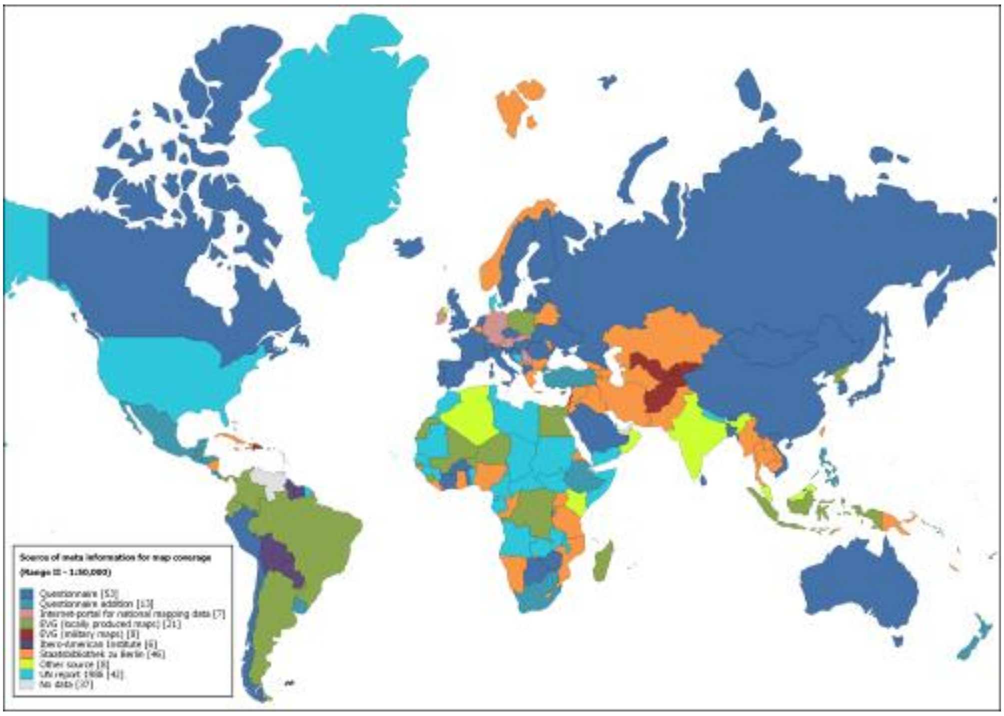


Figure 7: Source of meta information for map coverage in range II - 1:50,000

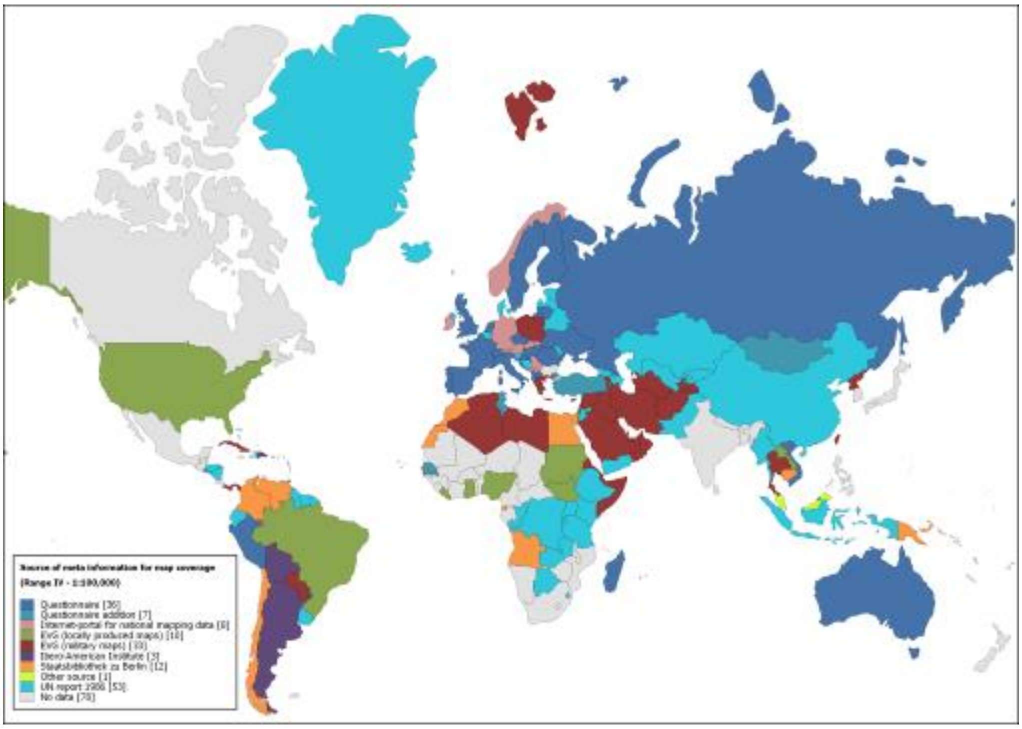


Figure 8: Source of meta information for map coverage in range III - 1:100,000

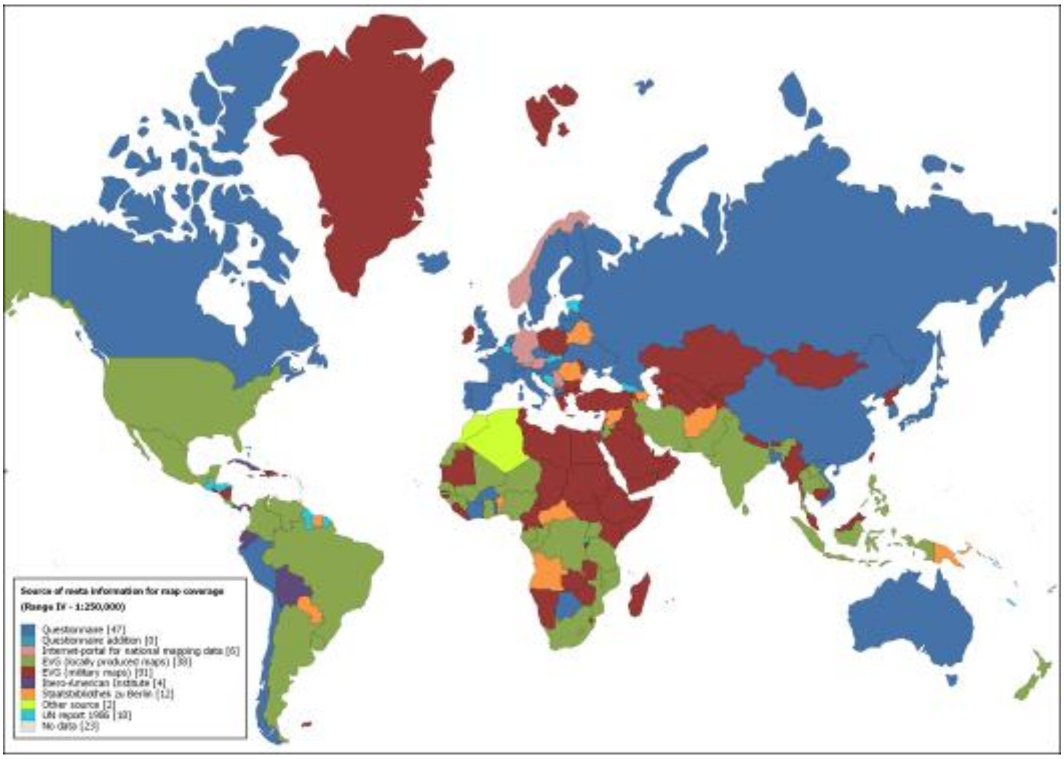


Figure 9: Source of meta information for map coverage in range IV - 1:250,000

Figure 10 to Figure 13 shows the equivalent data to Figure 2 to Figure 5 for the year 1986, depicting the huge progress made through technology from 1986 to 2012. Also Figure 14 highlights the change in map coverage between 1986 and 2012.

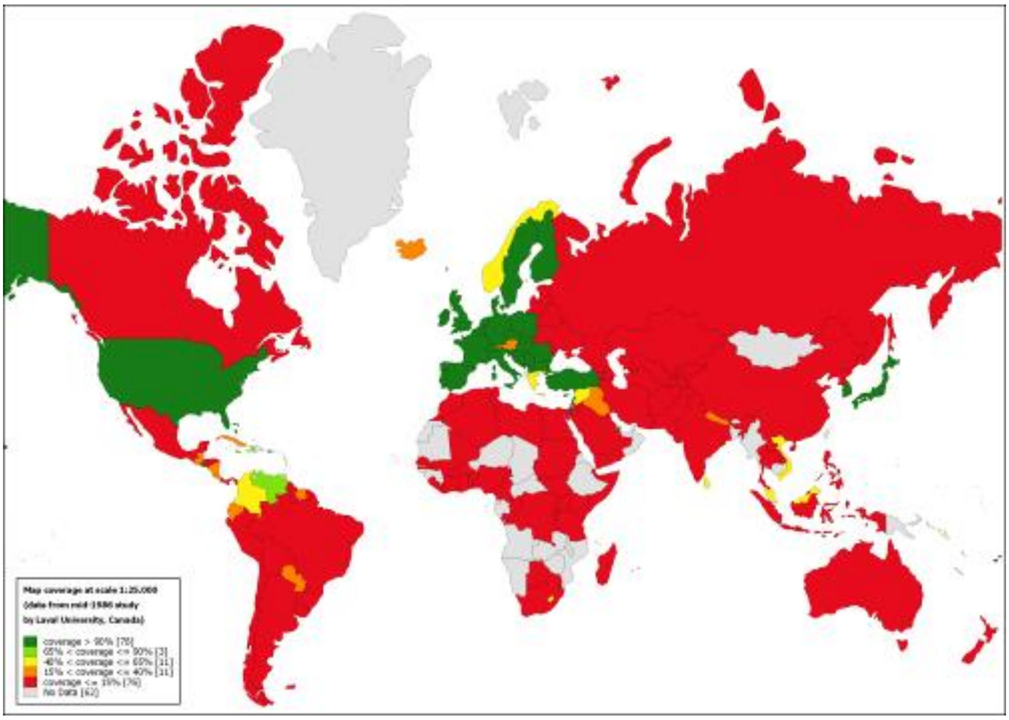


Figure 10: Map coverage 1986 at scale 1:25 000 or greater

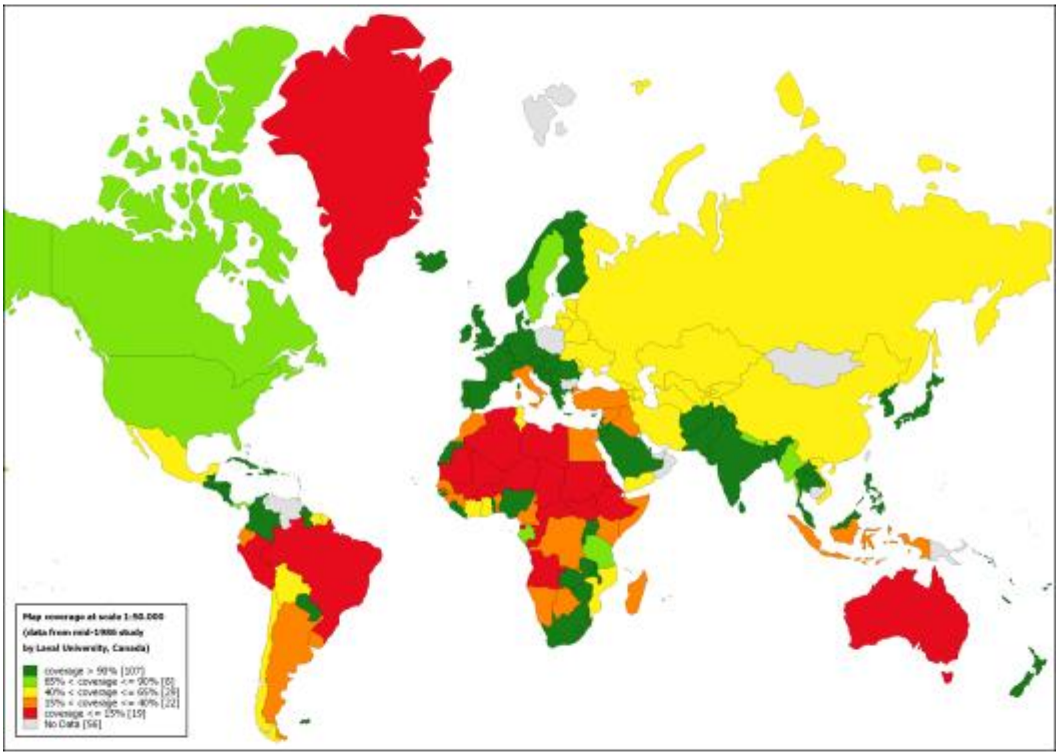


Figure 11: Map coverage 1986 at scale 1:50 000

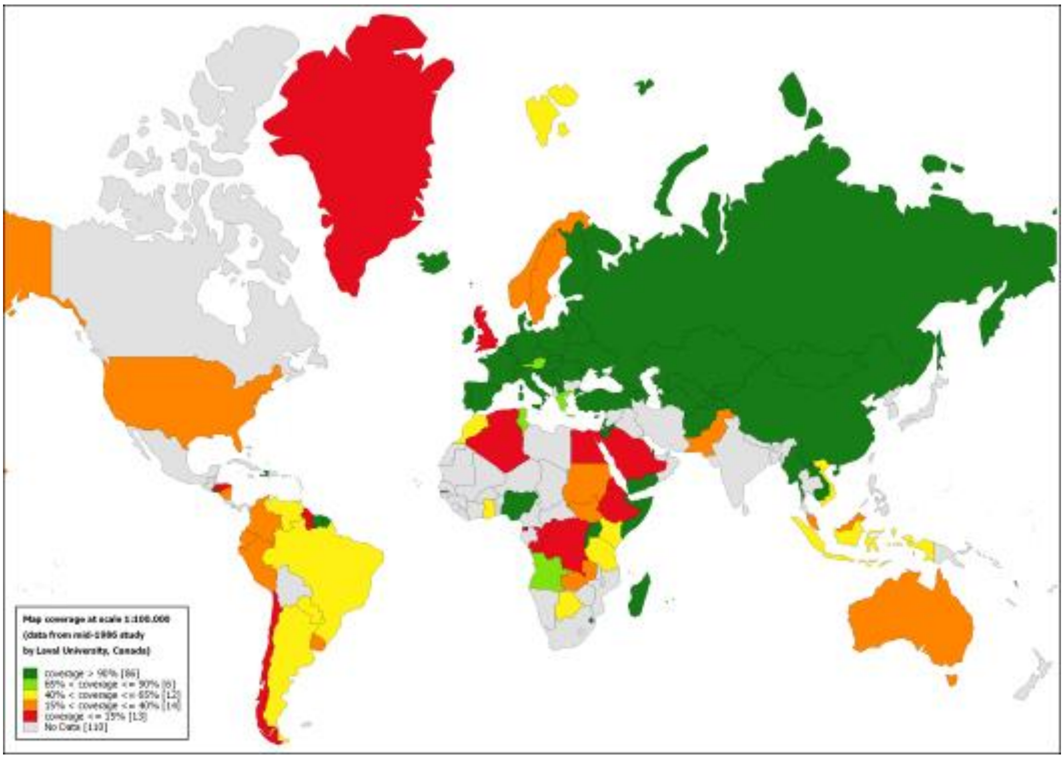


Figure 12: Map coverage 1986 at scale 1:100 000

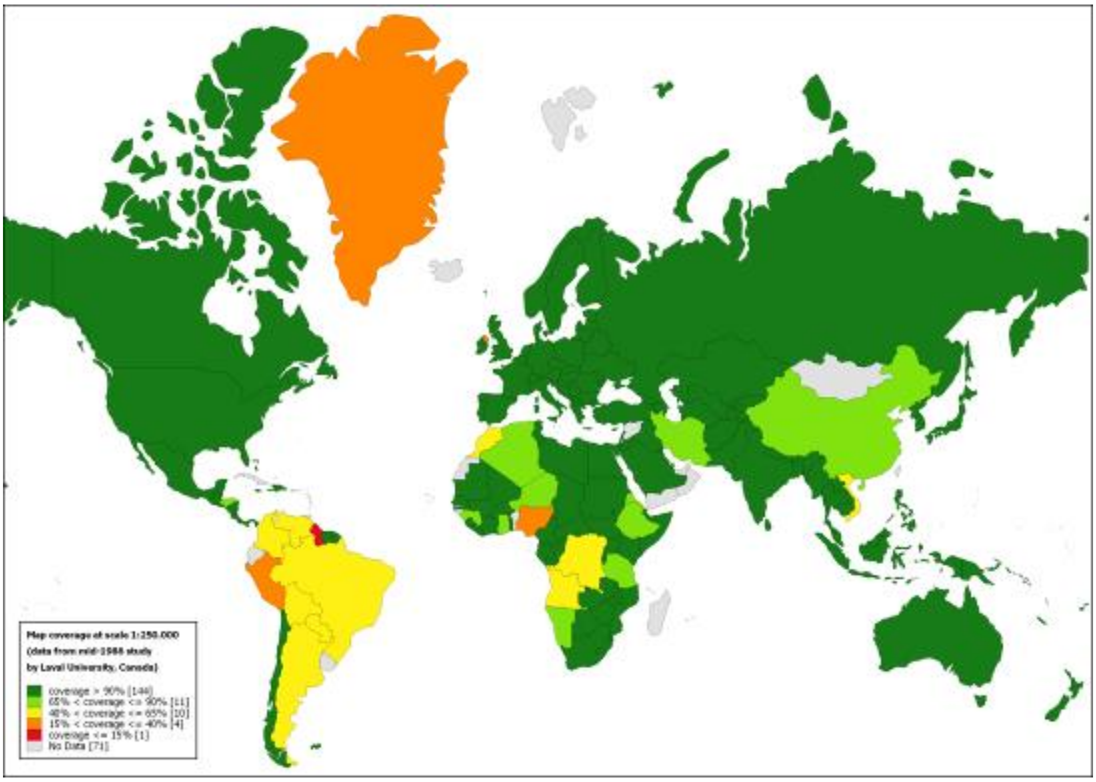


Figure 13: Map coverage 1986 at scale 1:250 000

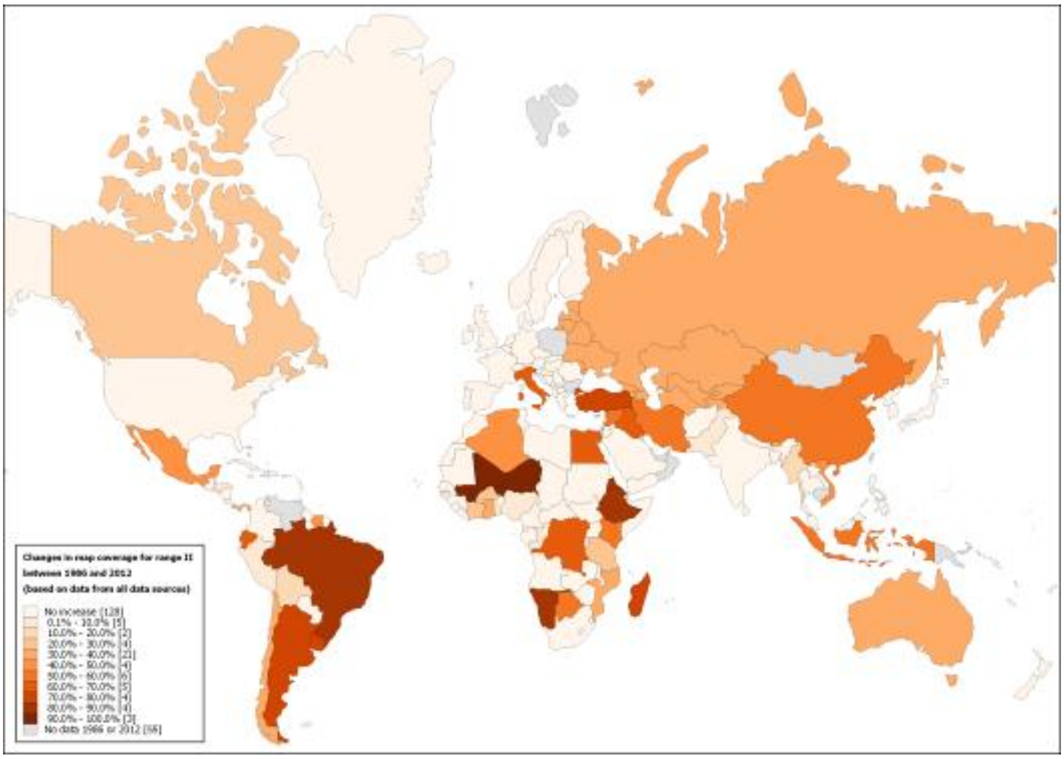


Figure 14: Change in map coverage between 1986 and 2012 for range II - 1:50,000

This answers question 2 at least in part.

The other 25 questions characterize the general global infrastructure for provision of map data. Figure 15 to Figure 39 give answers to most of the questions 3 to 27.

Figure 15: Question 3. Restricted access or limited circulation to maps and/or data

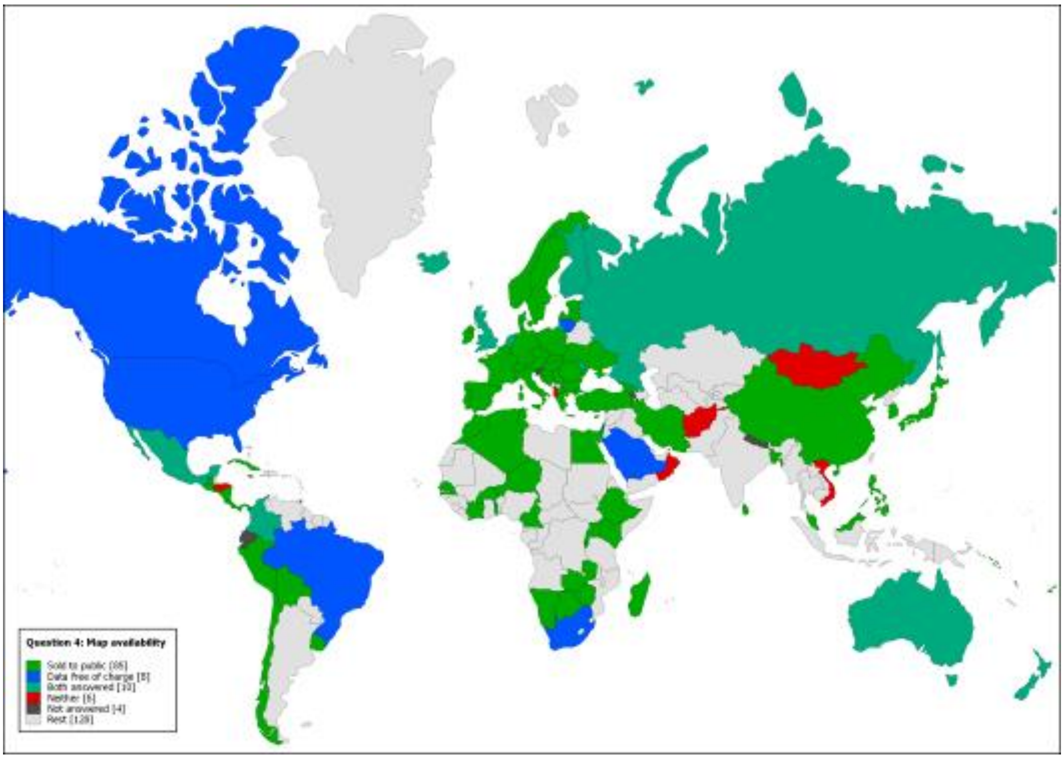


Figure 16: Question 4. Maps and/or digital data sold to the public or data free of charge

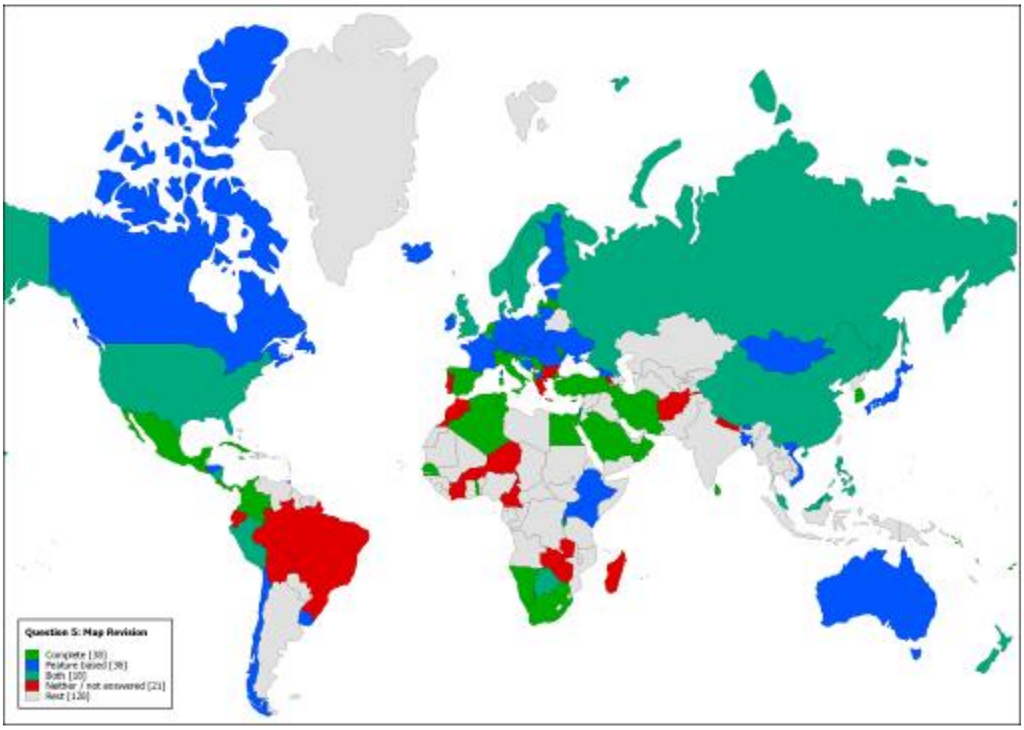


Figure 17: Question 5. Cycle of map and data revision by complete mapping, ie. revision of a national series or mapping of changed features

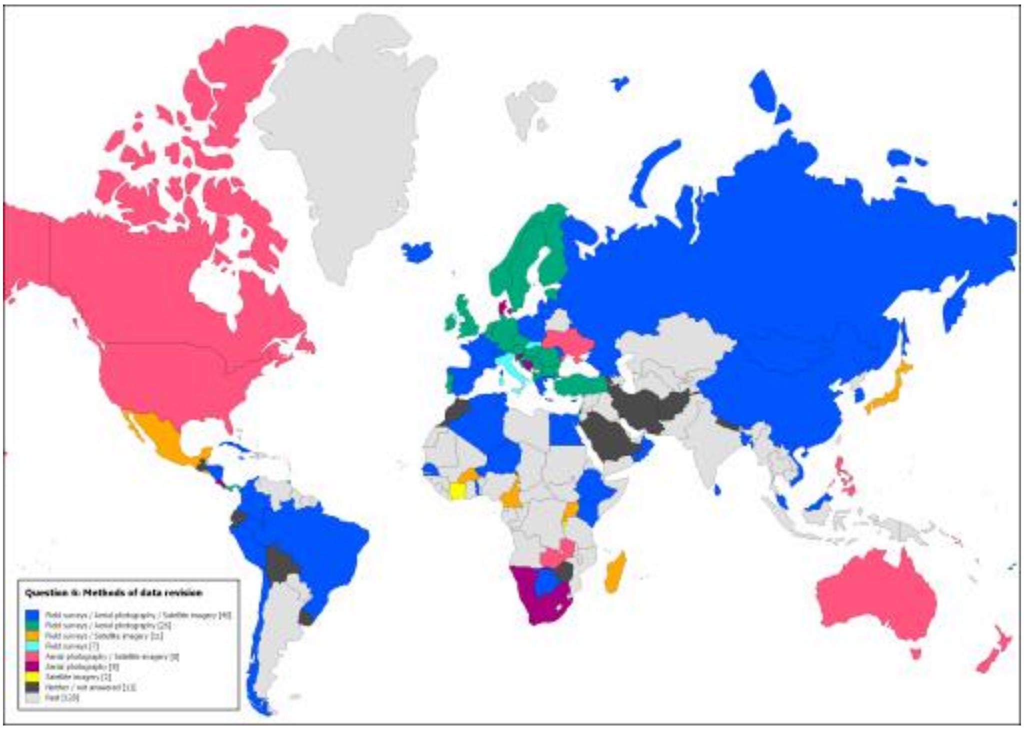


Figure 18: Question 6. Methods of national data revision and map updating

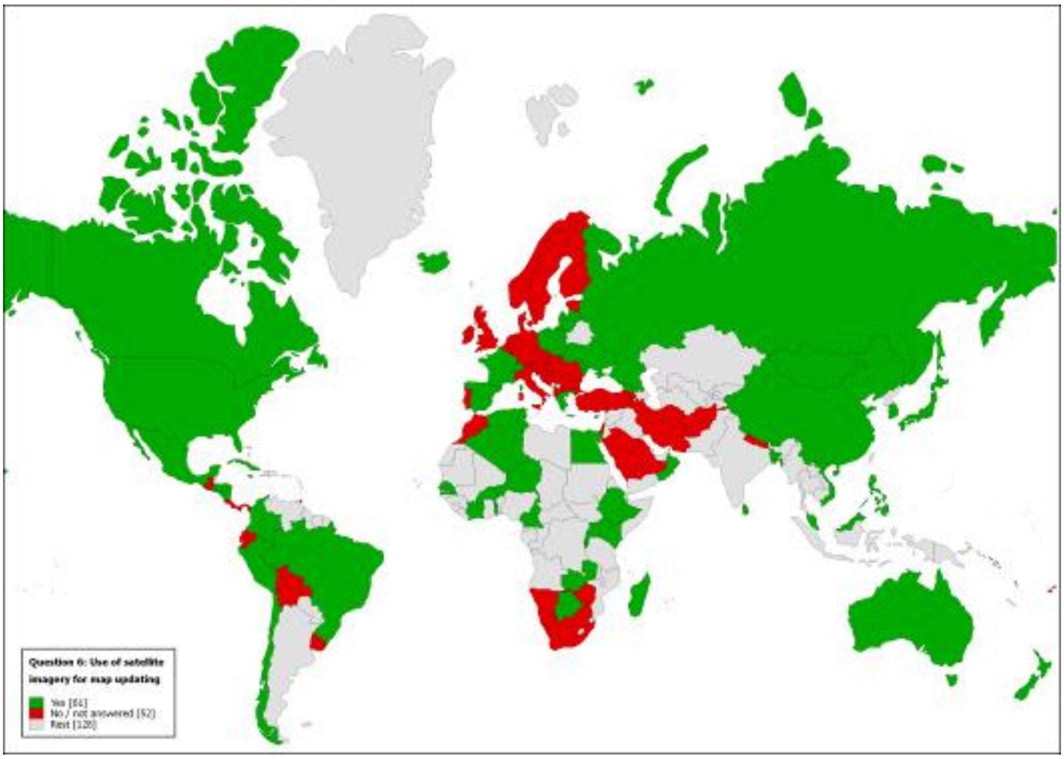


Figure 19: Question 6. Use of satellite imagery for national data revision and map updating

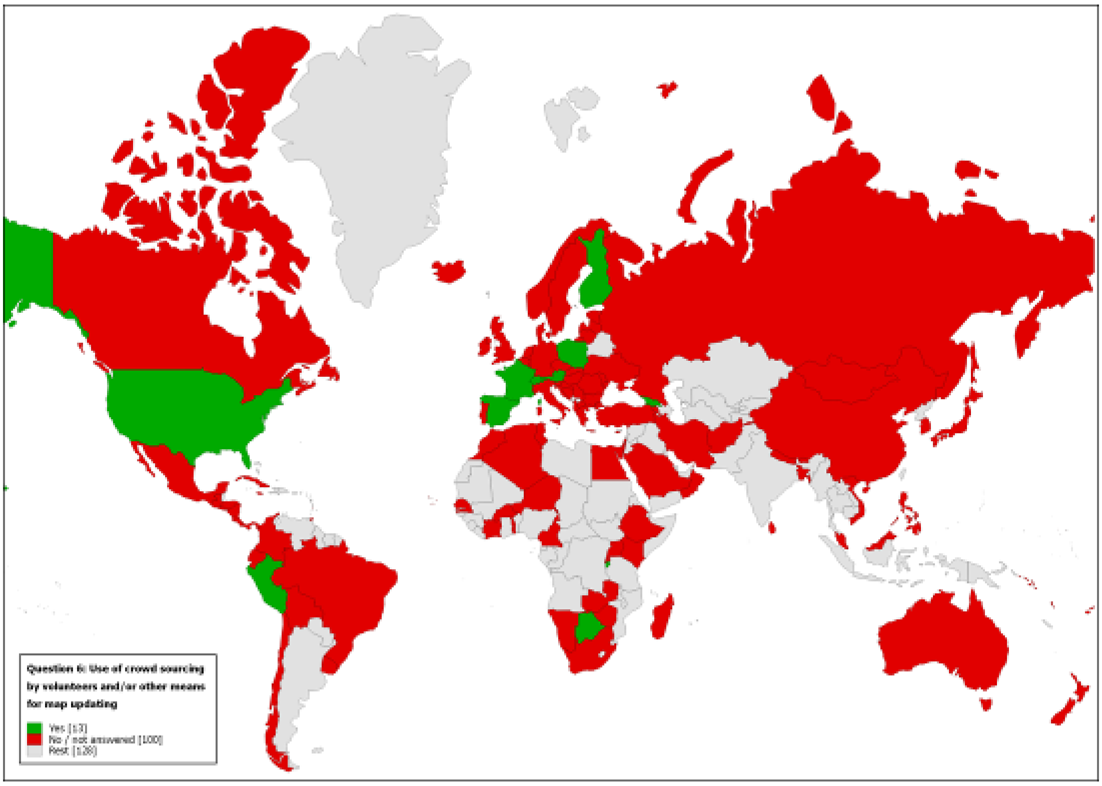


Figure 20: Question 6. Use of crowd sourcing for national data revision and map updating

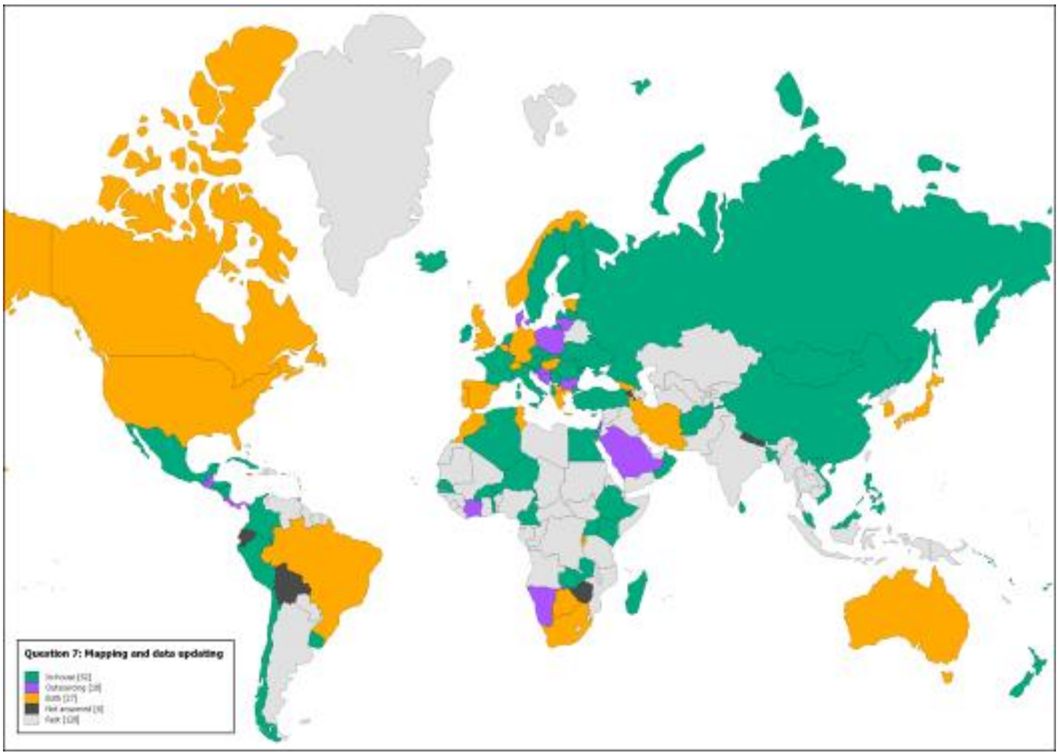


Figure 21: Question 7. Mapping and map updating done in-house or by outsourcing

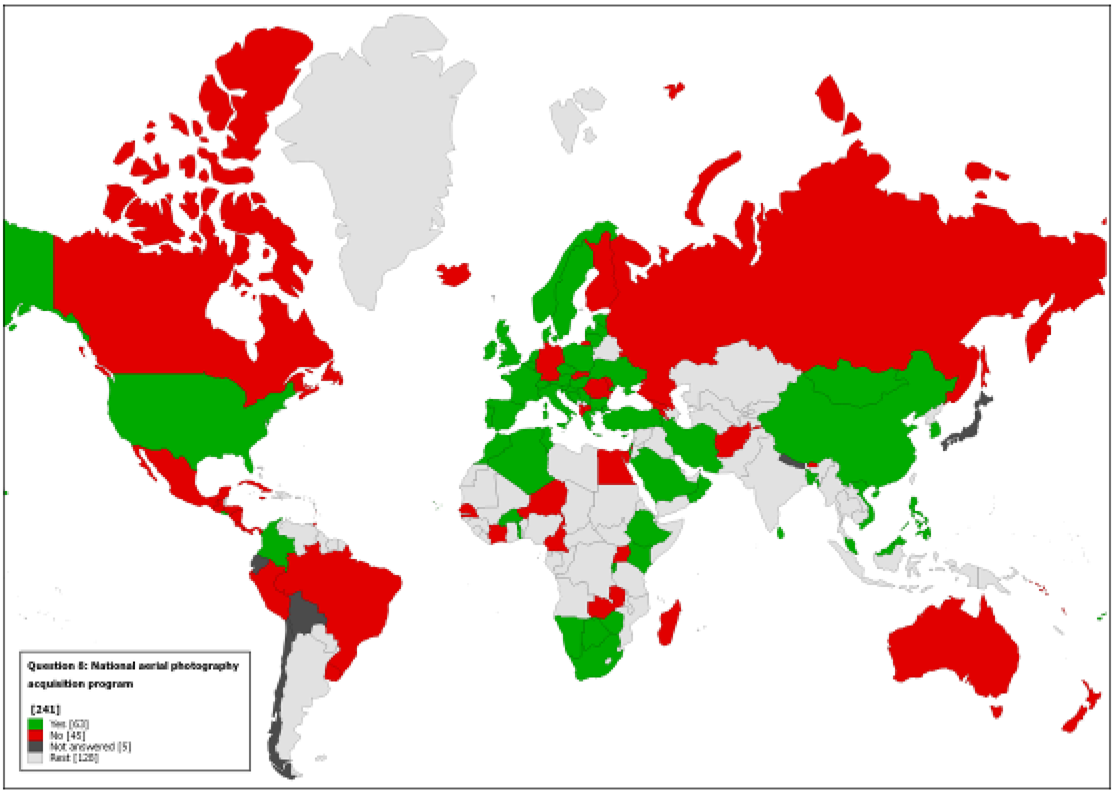


Figure 22: Question 8: National aerial photography acquisition program

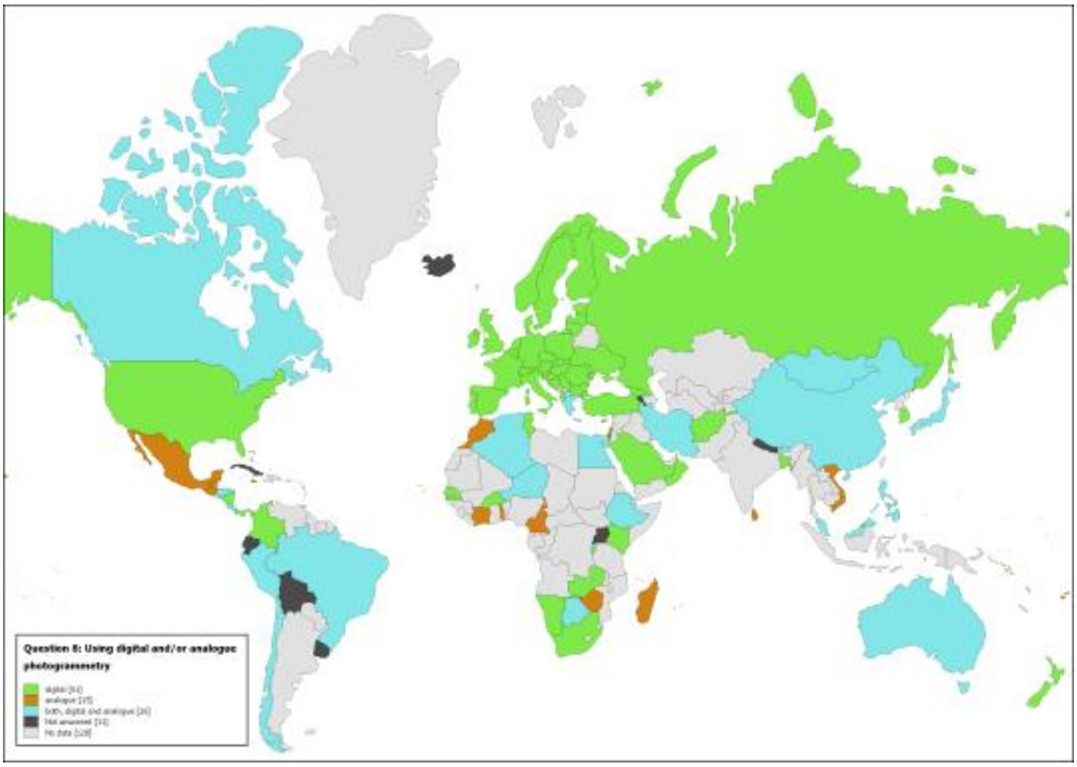


Figure 23: Question 8. Using digital and/or analogue photogrammetry

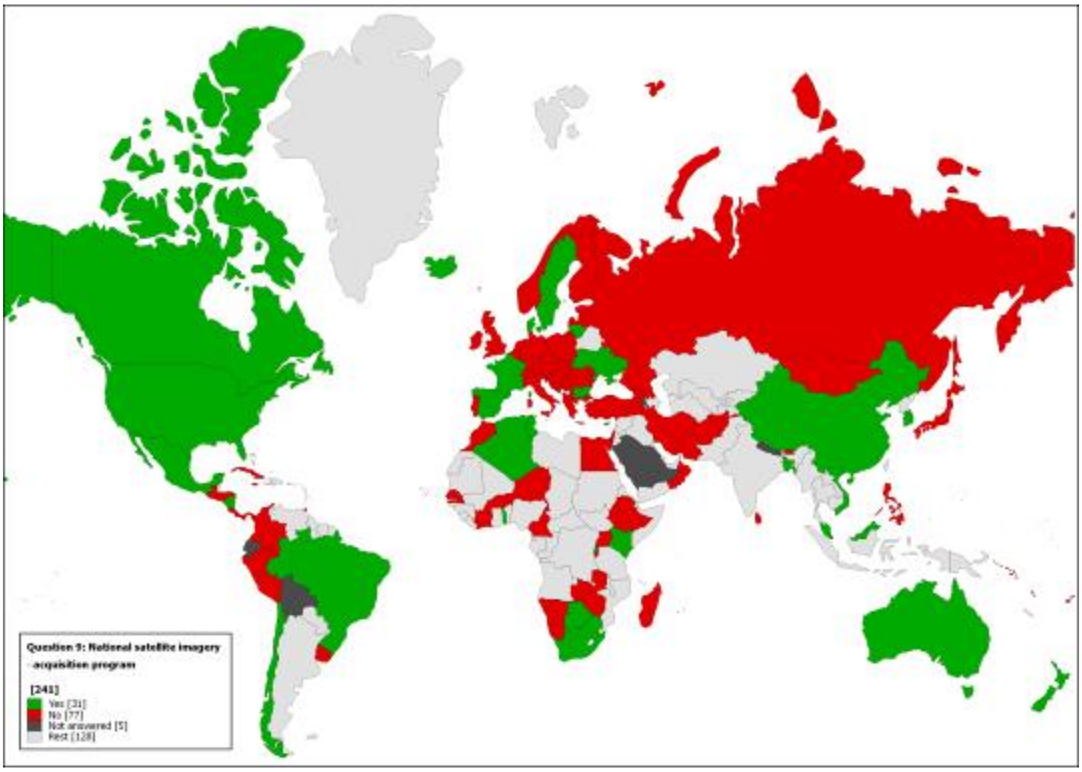


Figure 24: Question 9: National satellite imagery acquisition program

Figure 25: Question 10. Acquiring and/or using other imagery types (such as LiDAR, RADAR, etc.)

Figure 26: Question 12. Production of orthophotos and orthophotomaps

Figure 27: Question 14. Production or intention to produce, 3D urban and rural landscape models and/or product visualization

Figure 28: Question 16. National coverage of cadastral maps and/or data available

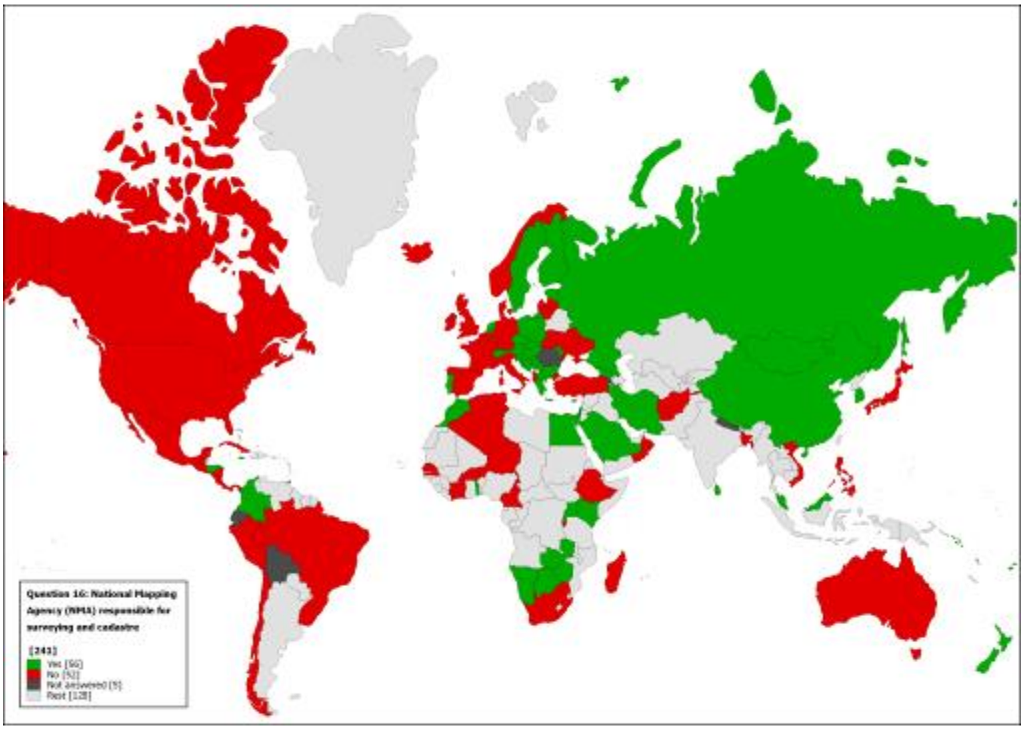


Figure 29: Question 16. National Mapping Agency (NMA) responsible for surveying and/or land titles and cadastre

Figure 30: Question 18. Cadastral maps based on geodetic control

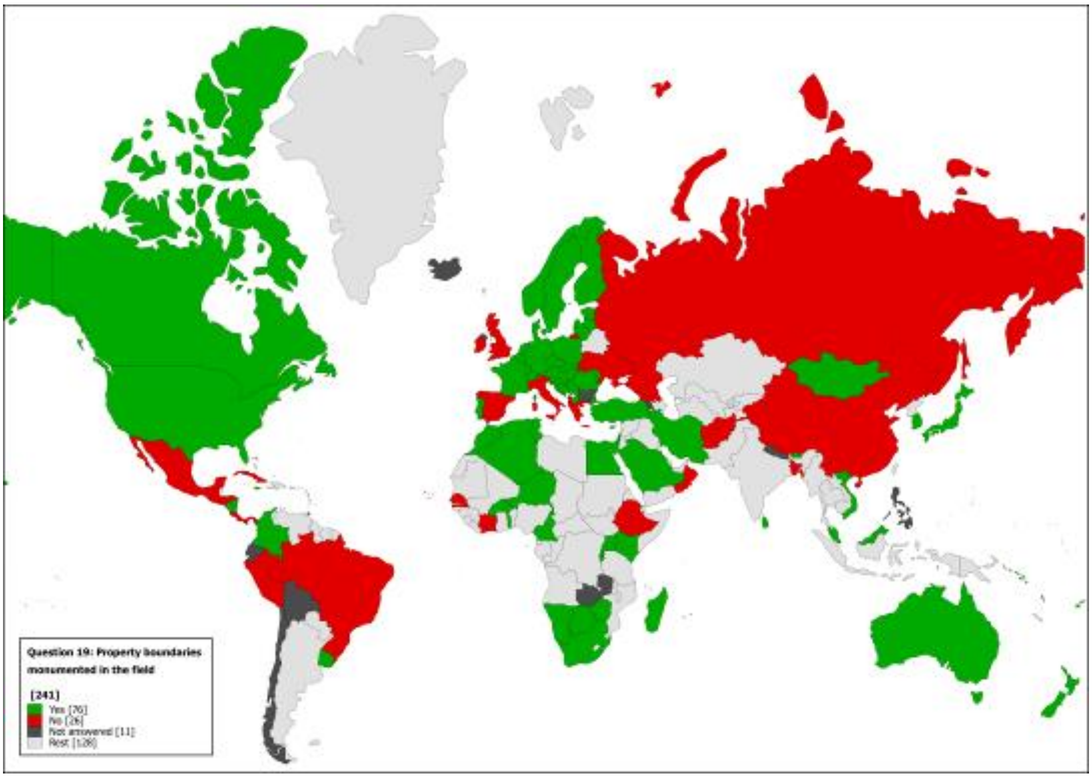


Figure 31: Question 19. Property boundaries monumented in the field

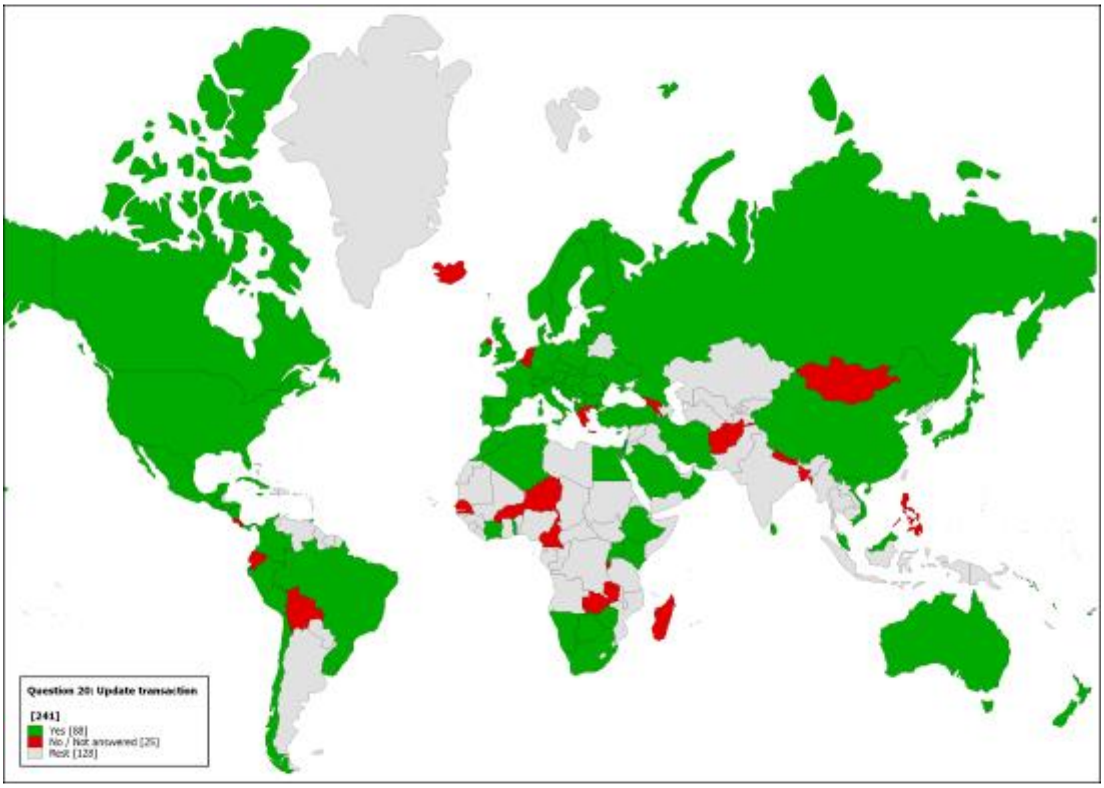


Figure 32: Question 20. Update transaction of property maps and/or data

Figure 33: Question 22. National topographic mapping, imagery acquisition, surveying and cadastral programs funded by your national Government

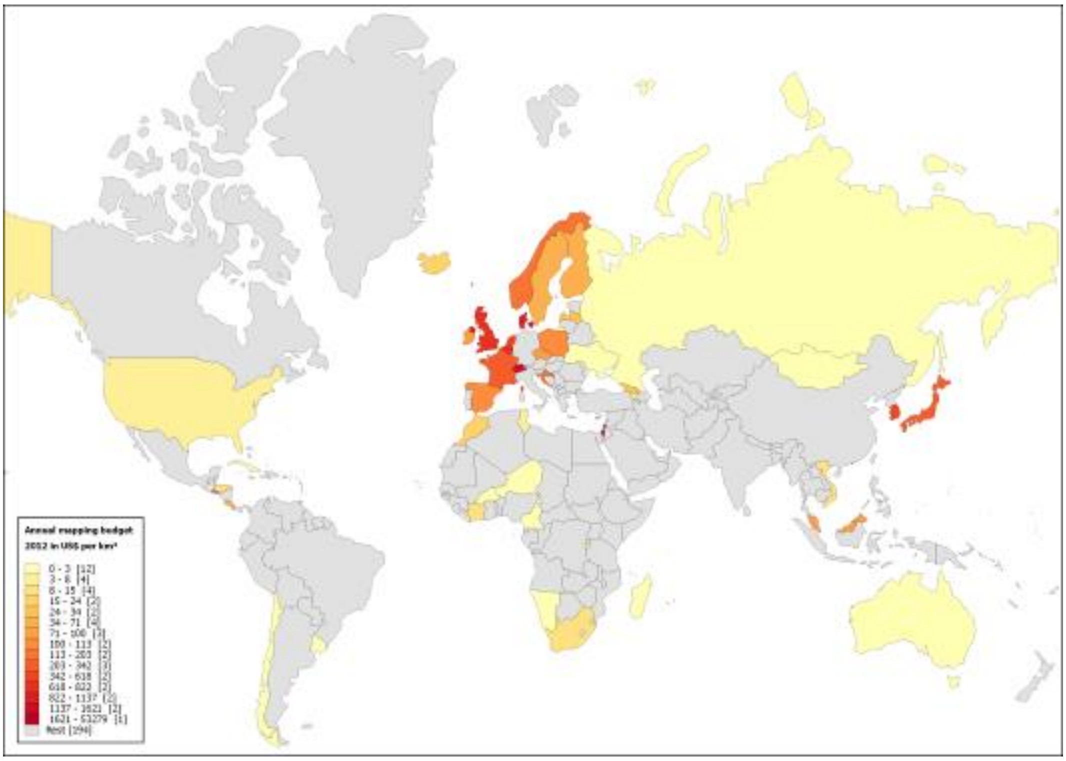


Figure 34: Question 23. Annual mapping budget of the National Mapping Organization converted to million US$ per square kilometer of the country area

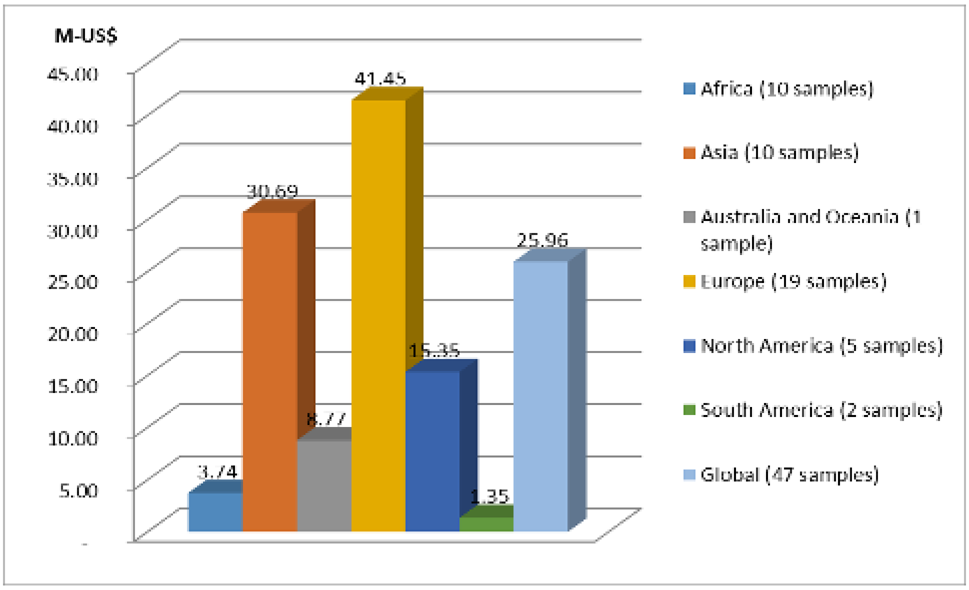


Chart 5: Question 23. Average annual budget 2012 per region converted to million-US$

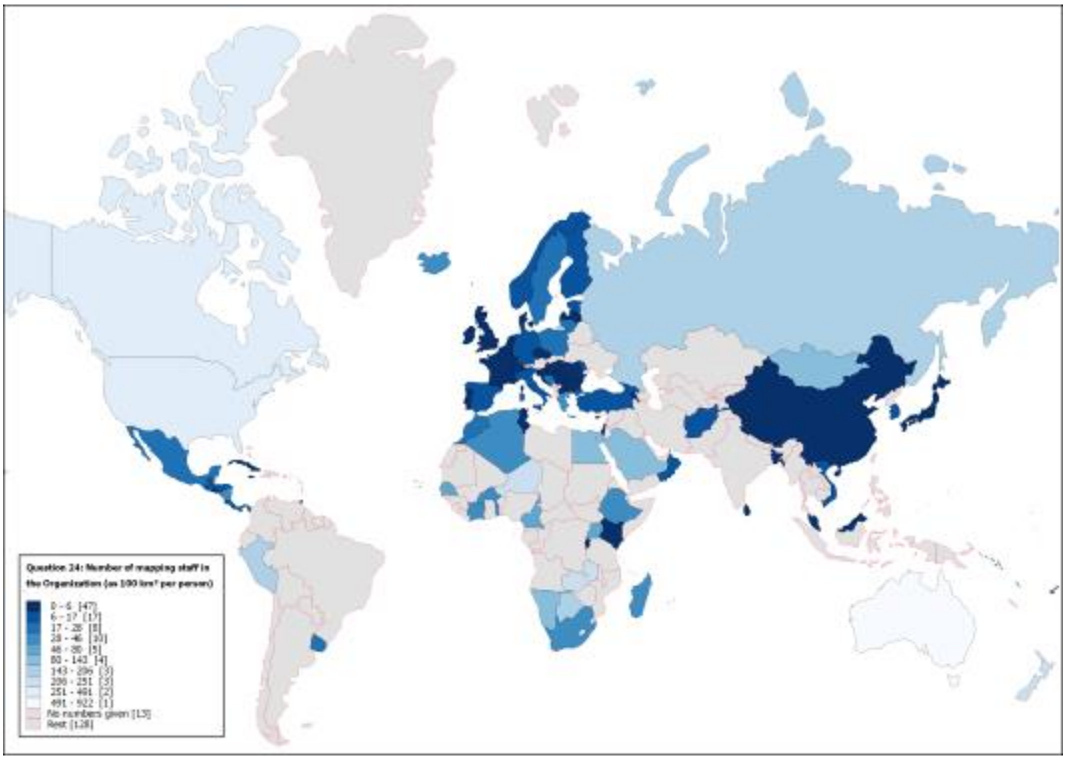


Figure 35: Question 24. Number of mapping staff in the Organization as hundreds of square kilometers of country area per person

Figure 36: Question 25. Regulatory or institutional arrangements mandating the organization to fulfil its role as the lead mapping agency

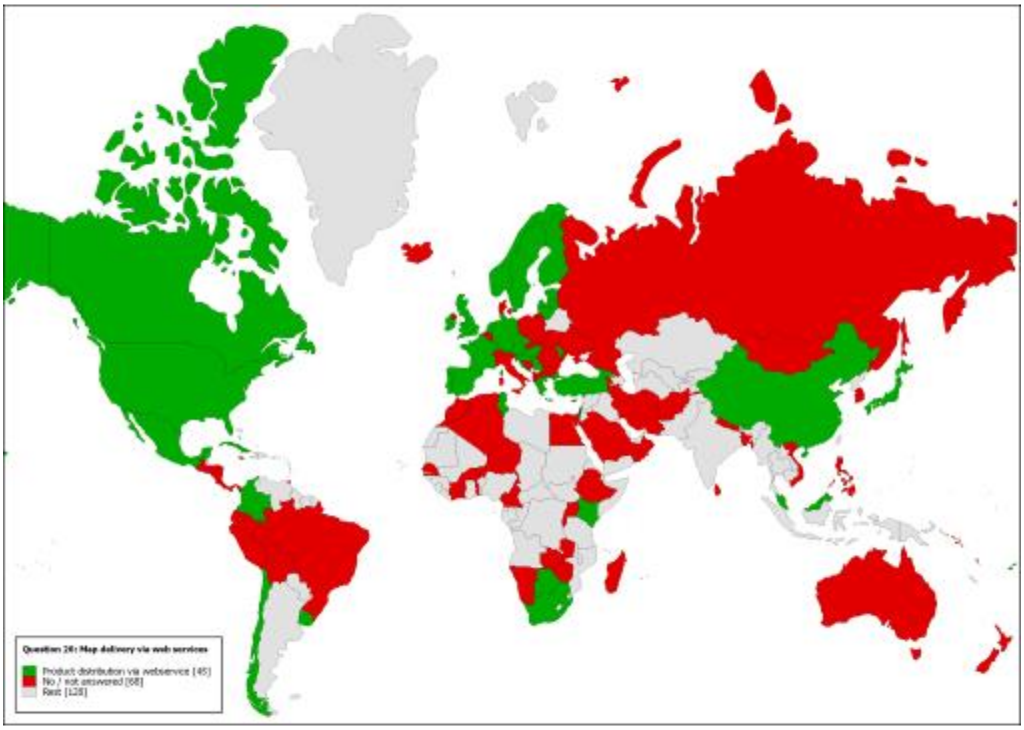


Figure 37: Question 26. Delivery of different map and data products via web services

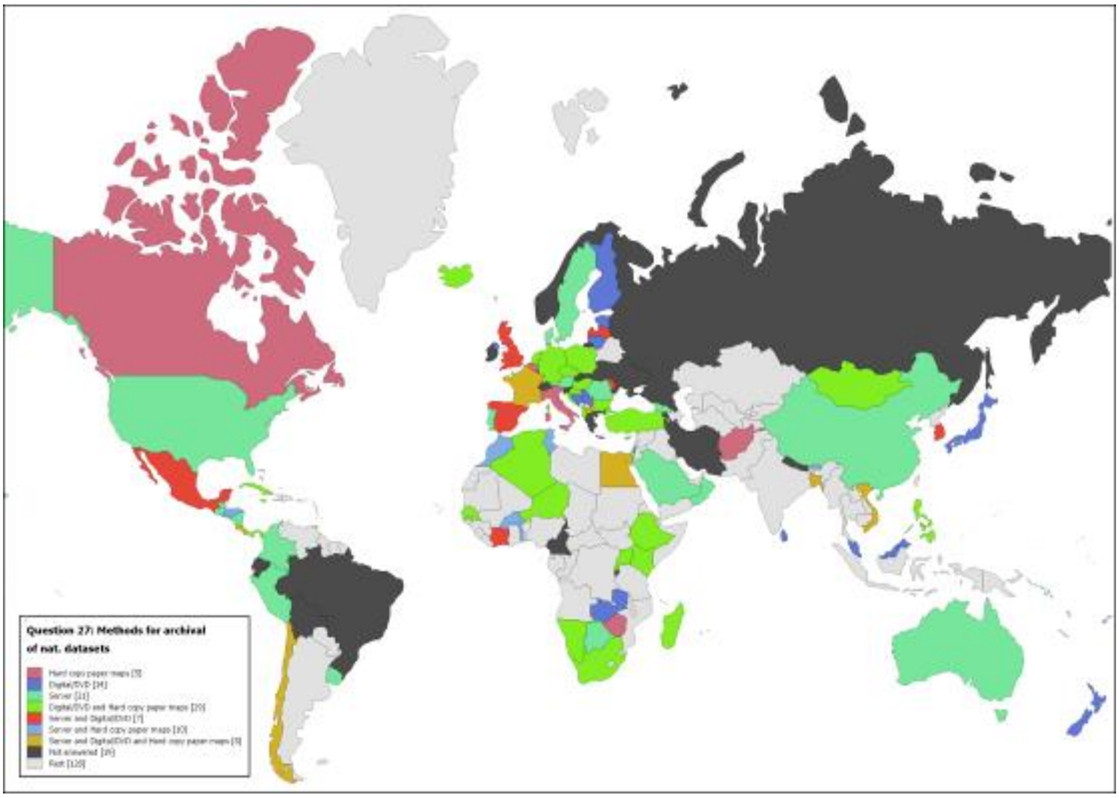


Figure 38: Question 27. Methods of archival for the national data sets

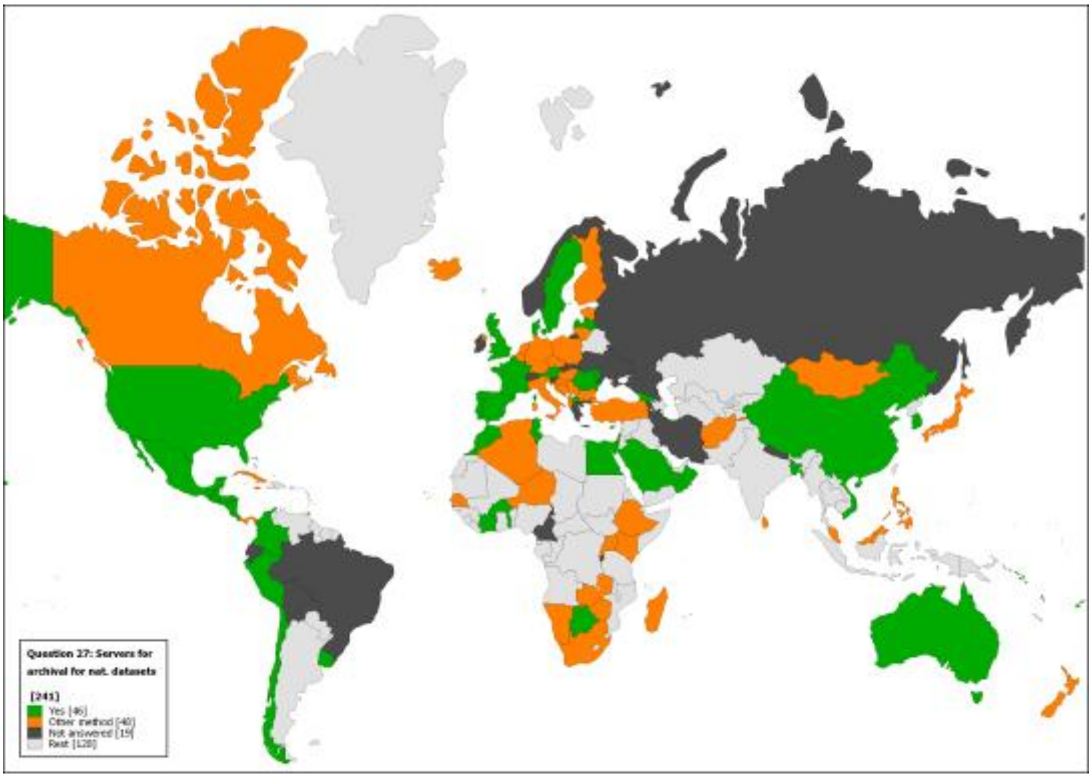


Figure 39: Question 27. Using servers/databases as method of archival for the national data sets

5 Mapping Contributions by Private Industry

As has been demonstrated, official and authoritative mapping by governments provides a reliable geospatial infrastructure, which is used for many public and private applications, but which is costly, difficult and slow to maintain. For that reason private enterprises have succeeded to launch several initiatives to provide faster update solutions in areas, which require fast update solutions. These are based on different cost and accuracy models for specific applications, which require fast updates. These applications do not replace official authoritative cartography, but they supplement it, as all such efforts utilize official cartographic products as a base to start their value added operations.

5.1 Google

Google´s prime aim is to provide a location based information system for uses of the public. What the general user wants is quick orientation about how to locate a specific object, such as a landmark, a store, a restaurant or a service provider and how to drive to it.

Geometric accuracy within the context of the neighborhood topography is of lesser importance than the addressability and the access by roads or pathways. In general, business advertising provides for the revenue to establish and to maintain the system.

Google Inc. operates by different projects, of which the following are the most important from the cartographic point of view.

5.1.1 Google Earth

Existing orthophotography coverage with ground sample distances between 0.1m and 0.5m as well as high resolution satellite imagery overages with ground sample distances (GSD) between 0.5m to 2m and beyond provide the geometric background image information, which can be interpreted by the user with respect to the searched objects, such as buildings, roads, vegetation, water surfaces. While ortho images have a high geometric accuracy related to ground features commensurate with the GSD, this is not so for building tops and tree tops. Geometric accuracy even deteriorates more for high resolution satellite imagery, since most of these images have been acquired with inclinations with respect to the vertical, unless stereo imaging permitted the generation of ortho imagery. The coverage is global for all land areas.

Nevertheless, despite some of these shortcomings with respect to official cartography, Google Earth can easily satisfy the geolocation demands for the uses Google Earth has been designed for.

5.1.2 Google Maps

Google Maps is a product usually derived, wherever possible, from authoritative cartography. It has been designed to supplement Google Earth with a cartographic output containing place names, road names and building addresses. It serves the ideal function of superimposing images with line graphics. Even though Google Maps may be derived from authoritative cartography, the feature content is much less elaborate and reduced to the intended geolocation function. The 3 models for creating Google Maps are shown in Fig.40: a) relying on authoritative data in North America, Europe, Australia as "Google Ground Truth" b) Map Maker outsourced, leaving the initiative of mapping using Google Earth to other companies (Africa, Middle East, India) c) "Video Rental" model offering Google Earth imagery to other countries for mapping use (Russia, China).

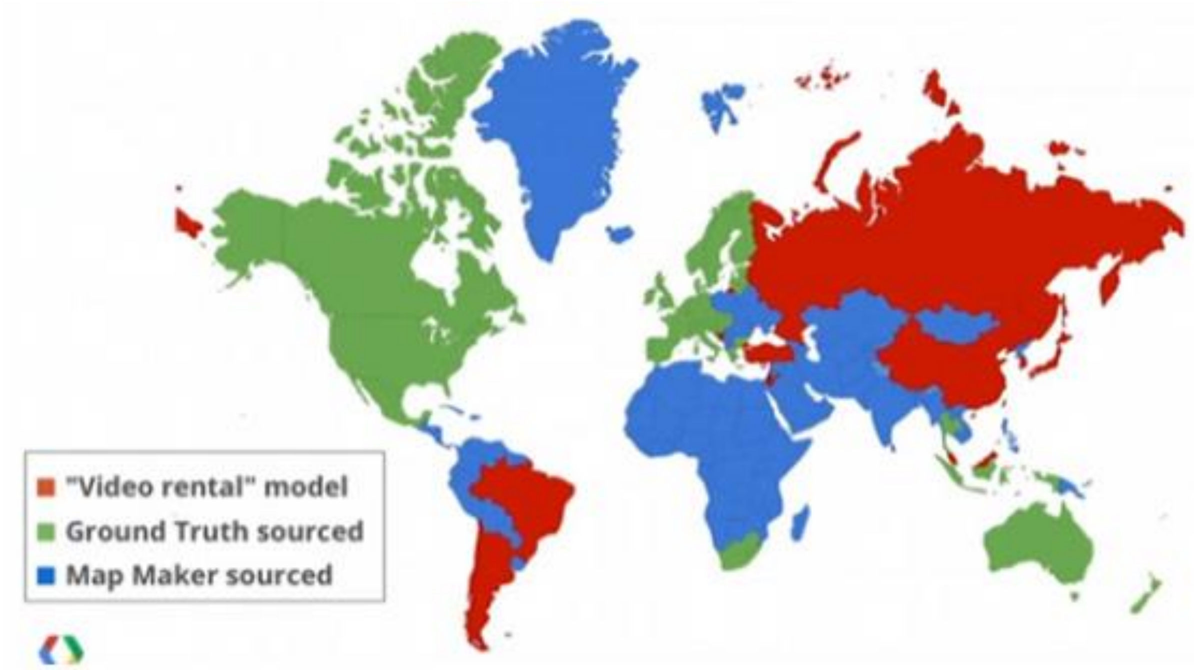


Fig.40 Google Maps

5.1.3 Google Street Map

Google Street Map has been developed as a tool to image buildings and streets with street furniture along urban roadways. This is done by vehicle based cameras, located by GNSS signals. In some communities the imaging of building facades has met resistance by some members of the population, which did not wish to show them to the public on the web. Nevertheless Google has pursued street mapping for the sole reason to update the Google Maps content as an internal operation.

In this manner Google Street Map has proved to be an effective tool to quickly update the Google Maps content for buildings and roads. The update of these features can generally be done much faster than by the regular update intervals for authoritative mapping without a reporting system in operation and without a multitude of fast survey options, rather than by a centralized mapping procedure. For coverage see Fig.41.

Fig.41: Google Street Map Coverage

5.1.4 Google Ground Truth

In the attempt not only to update the map content, but also to maintain a high level of geometric accuracy, the Google Ground Truth project has been launched for a number of countries in North America, Europe, Australia and South Africa, in which authoritative cartography has been merged with the results of high tech operations, such as Google Street Map, see Fig. 42.

Fig.42: Google Ground Truth

As Google regards the progress of these projects as a confidential matter, it is not possible to make a more detailed account of the progress made.

5.2 Microsoft Bingmaps

Microsoft considered Google to be their strongest competitor, while Bingmaps has the same objectives as the Google efforts. Therefore care has been taken to achieve a higher resolution and a more accurate geometry than Google Earth.

This was possible by limiting the area of interest to the continental USA and to Western Europe, where there were no flight restrictions. Furthermore, the imagery used for Bingmaps consisted solely of digital aerial imagery flown by the company owned Vexcel Ultracam cameras.

The coverage of the countryside for the USA and for Western Europe was completed at 30cm GSD, and the urban areas were imaged at 15cm GSD. Whether the originally forseen updates of every 3 years can be achieved as planned, is still an open issue. See Fig.43(a,b,c,d).

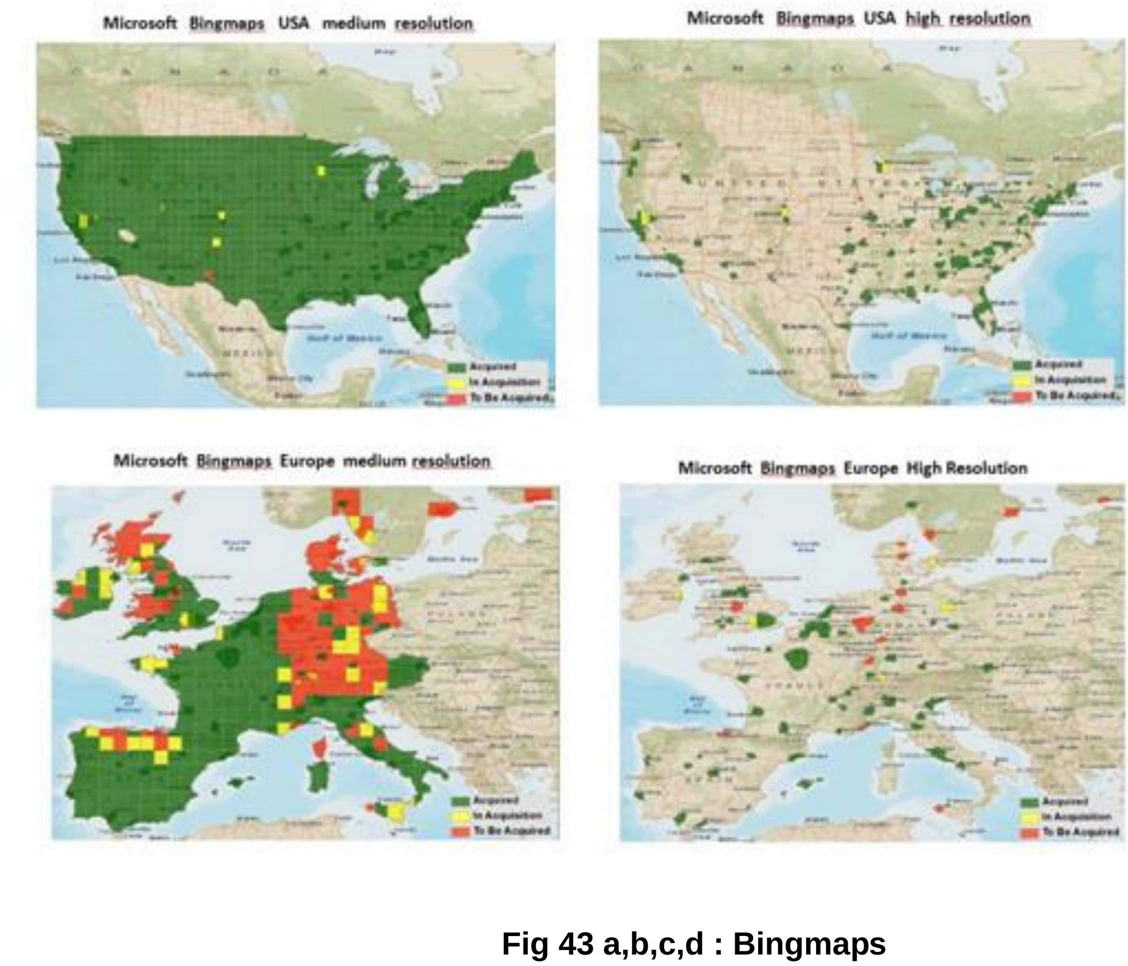


Fig 43 a,b,c,d : Bingmaps

5.3 Yandex

Another approach has been undertaken by Yandex in the Russian Federation, which was also applied in Turkey by the company Yandex.

Yandex has procured high resolution satellite imagery from Digital Globe for the entire territory of the Russian Federation at 0.5m GSD and at 1m GSD. The objects of interest were building blocks, single buildings, roads, creeks. They could be identified and mapped from the images. The geocoding of the mapped information was done by accuracy augmented GNSS code receivers with 2 to 3m accuracy on the ground. In this way Yandex succeeded to generate digital maps for about 300 urban conglomerations in Russia and Turkey.

Yandex, like international car navigation system suppliers, was also interested in car traffic routing, providing real time traffic congestion options for the agglomeration of Moscow.

5.4 HERE

When the Finish company Nokia bought Navteq, the global car navigation system efforts were continued by the subsidiary HERE.

HERE makes car navigation systems based on their own maps for 196 countries of the world, 116 countries of which have voice guided navigation and 44 countries of which with live traffic services.

Of interest are roads and points of interest. This also includes unidirectional restrictions of traffic flows.

In Europe 15% of the map´s content is updated every year, modifying or adding 1.1M km of roads, creating 700 000 new points of interest and adding 600 000 speed cameras.

In the Russian Federation 800 000 km of roads change after 6 months, ans so do 120 000 street names, 22 000 turn restrictions, 3400 one way streets, 38 000 speed limits and 8700 directional street signs. See Fig.44:

Fig.44 HERE Global Coverage

5.5 TomTom

TomTom has a road navigation coverage for 118 countries extending over North America, Brazil, Argentina, Europe, the Russian Federation, India, Indonesia, Thailand, Australia, New Zealand, West and South Africa. See Fig 45

Fig 45: Tomtom Global Coverage

6 Mapping by Military Organizations

Like it happened during the cold war period, when the US and the USSR military organizations considered it their goal to conduct mapping operations in what they considered to be crisis areas, this practice was recently revived by about 30 nations from Europe, North America, Australia, New Zealand, Japan, Rep.of Korea and South Africa, when they launched the Multinational Geospatial Co-Production Program MGCP. The goal of this program is to generate up-to-date 1:50 000 digital maps for potential crisis areas of the globe in Asia, Africa, the Middle East, the West Indies and the Pacific Ocean. Benefitting from this activity are the UN cartographic section, which utilizes these maps to create information for crisis mitigation. See Fig 46:

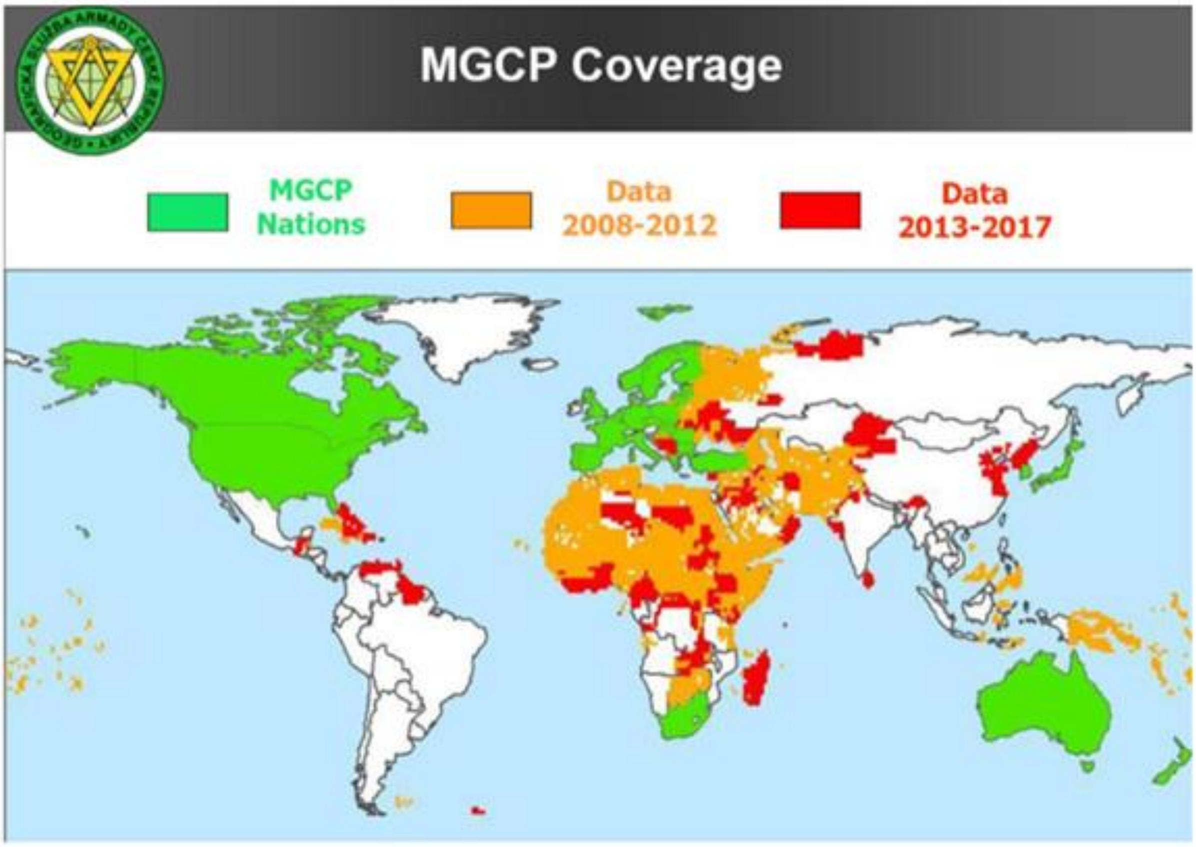


Fig 46: MGCP Mapping Coverage

7 Summary of Results

- 113 UN Member countries have responded to the 2012-2014 UNGGIM-ISPRS Survey. It has been shown, that nearly all reporting countries have modernized their facilities to adopt modern GNSS, digital imaging and GIS technology in their operations, which are still handicapped by lack of funding and staff shortages.
- While in 1986 the world was basically covered by 1:250 000 maps, progress in technology has now made it possible to state that topographic mapping of the globe at 1:50 000 scale, relevant to sustainable development, has been reached.

- There are still gaps in providing updated information in developing countries. These need to be closed with a goal of no data to be older than 5 years.
- New technologies, such as those used by Google and by Yandex could help to reach this goal in priority areas.

8 Future Activities

- ISPRS has created working group IV-2 to accompany the UNGGIM-ISPRS project.
- This working group has successfully provided the needed discussion forum for the task.
- It will be the future goal of this group to assure that the data collection and analysis will be sustainable by cooperating with UNGGIM and UN-GEO
- A near goal will be the expansion of the work to include global land cover mapping as a task.

9 References

UN Secretariat document E/CONF78/BP7 1986, prepared by A. J. Brandenberger & S.K. Ghosh, published in World Cartography XiX, 1990

UN Secretariat document E/CONF78/BP8 1986, prepared by G. Konecny, published in World Cartography XIX, 1990

Annex “B”

The Status of Topographic Mapping in the AP region

Authorized by Prof. Gottfried Konecny, the head of the action, WG 3 of UNGGIM-AP analyzed the received questionnaires with focus on AP countries/regions.

Among the 60 UNGGIM-AP member countries/regions, 14 returned the questionnaires, including Australia, China, Fiji, Iran, Japan, Malaysia, Mongolia, Nepal, New Zealand, Philippines, Republic of Korea, Singapore, Sri Lanka, Vietnam. From the returned questionnaires, we can see these AP countries:

- All country have national topographic maps/databases. The scale of map/databases changes in different countries. But most countries have 1:250, 000 and 1:50,000 scale. (Fig.1)
- About 57% countries have restricted access or limited circulation to the maps/data. The other 36% have no restrictions or limitations (Fig.2)
- About 64% countries allow public access to the map/data. 14% don’t allow public access. (Fig.3)
- About 64% countries charge for use of the map/data. 21% countries don’t charge for use of the map/data(Fig.4).
- About 57% countries provide web-based map services or meta-data service. 28% countries have not provide on-line services yet.(Fig.5).
- About 43% countries have national satellite imagery acquisition program, but only half of them have domestic satellite imagery capability. 50% countries have no national satellite imagery acquisition program. (Fig.6 and Fig.7).

Fig.1 Scale of Map in countries/regions

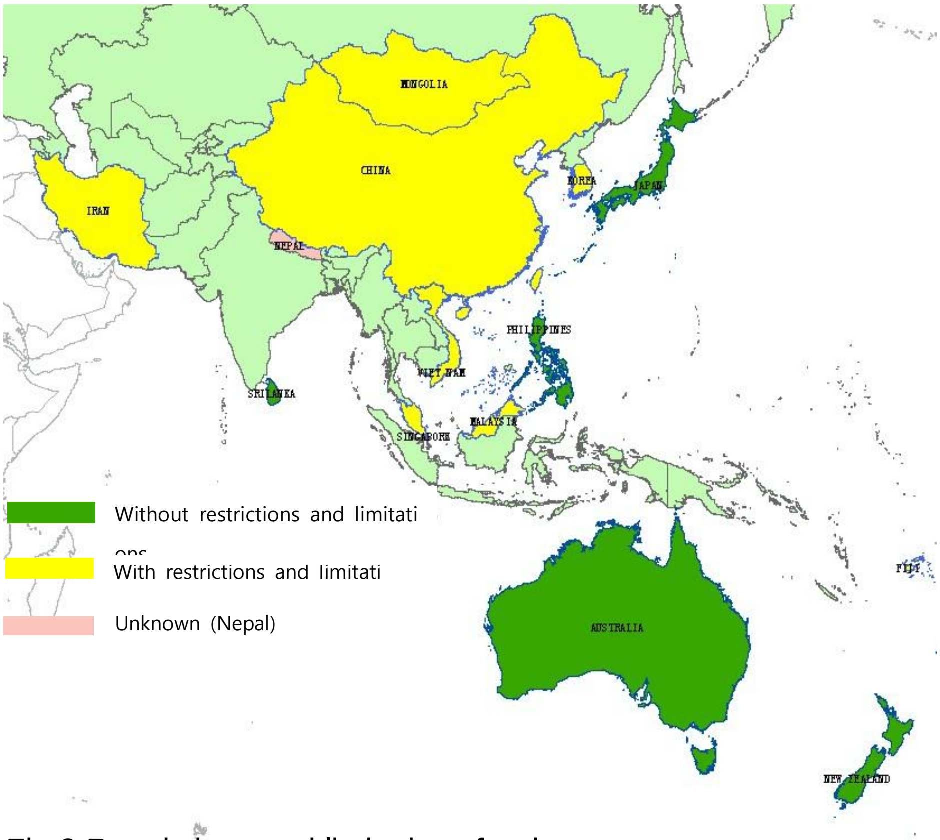


Fig.2 Restrictions and limitations for data access

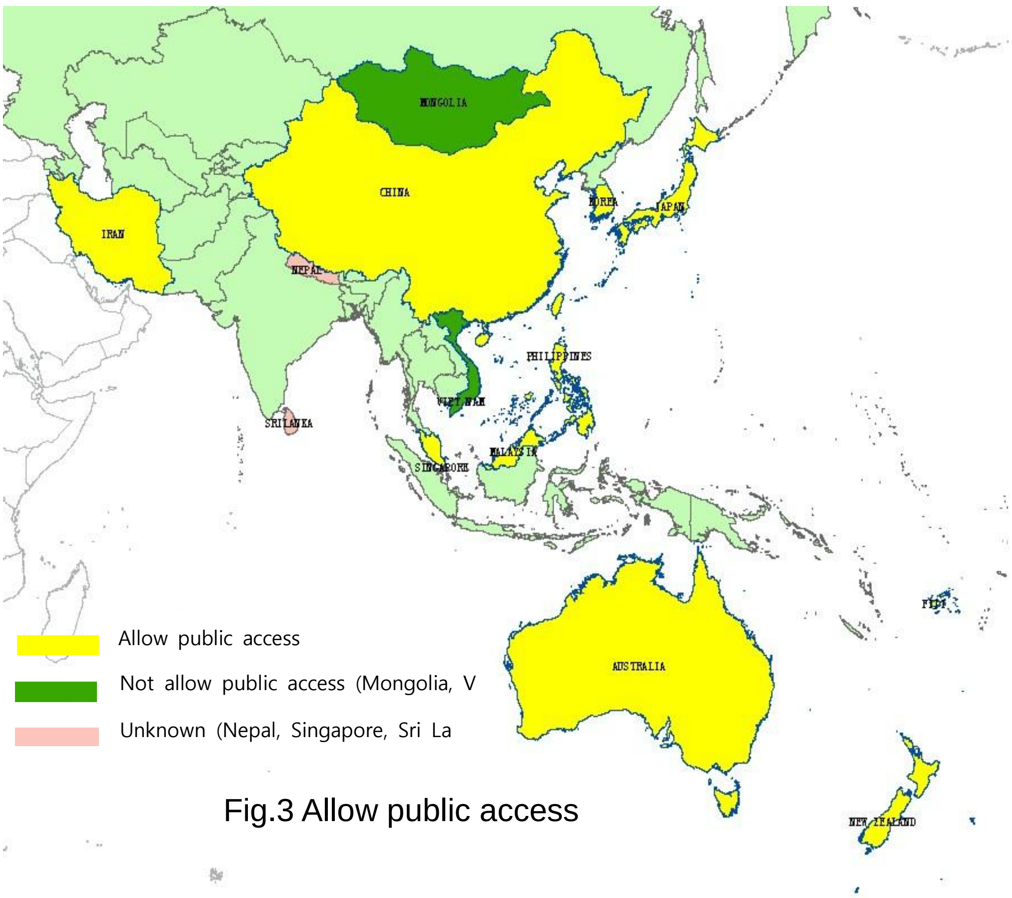


Fig.3 Allow public access

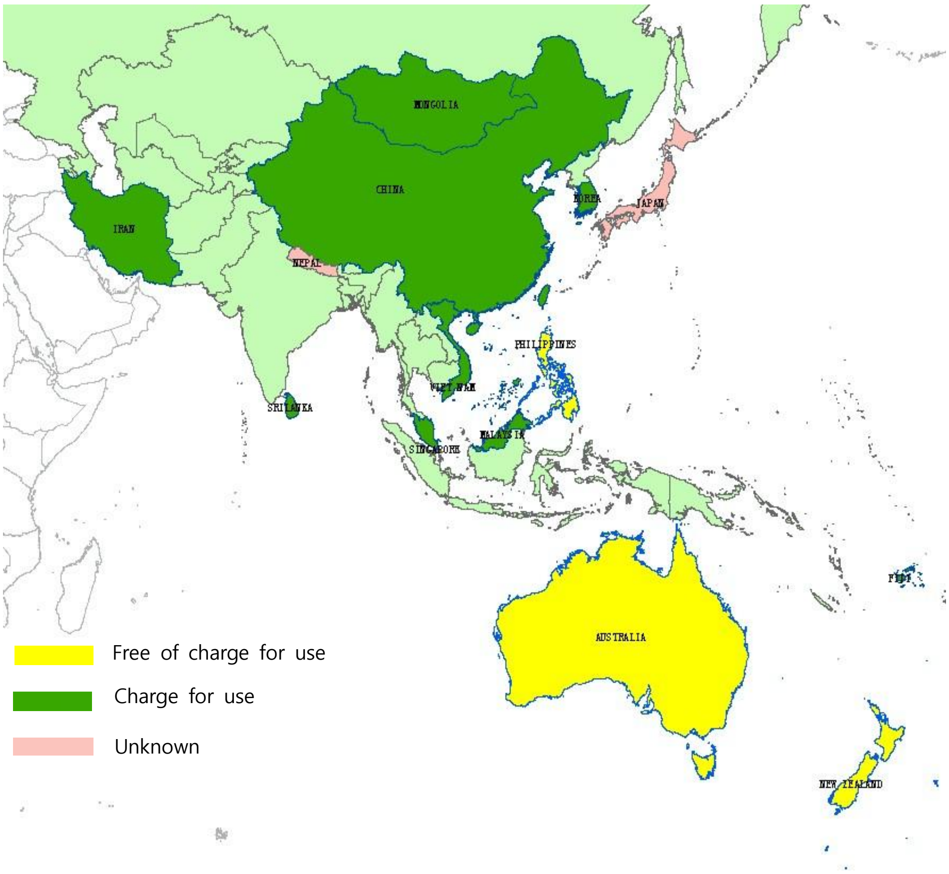


Fig.4 Charge for use

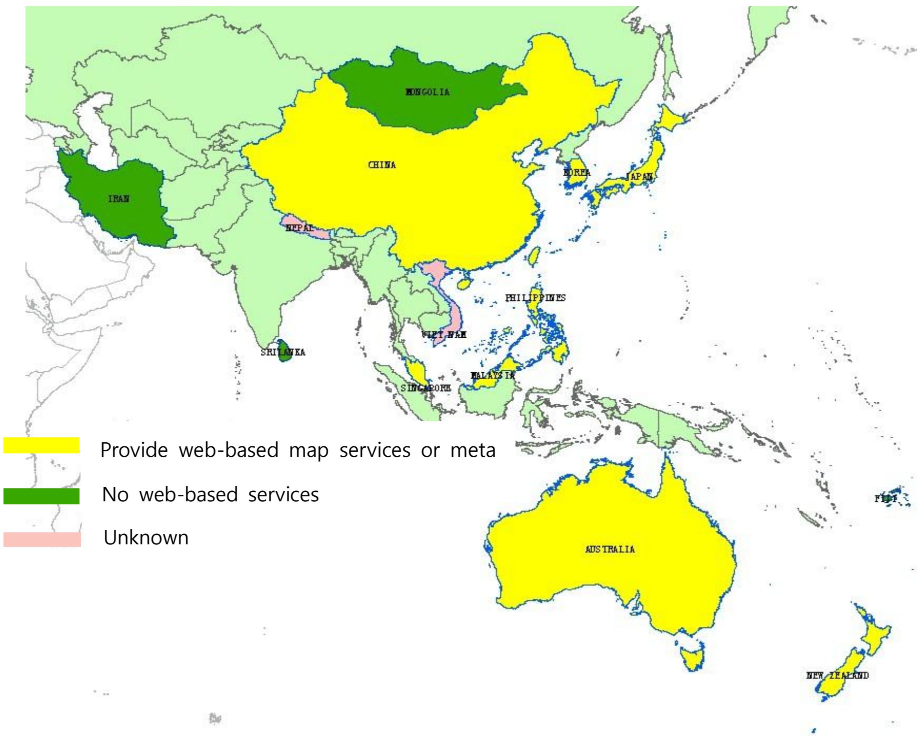


Fig.5 Web-based map services or meta-data service

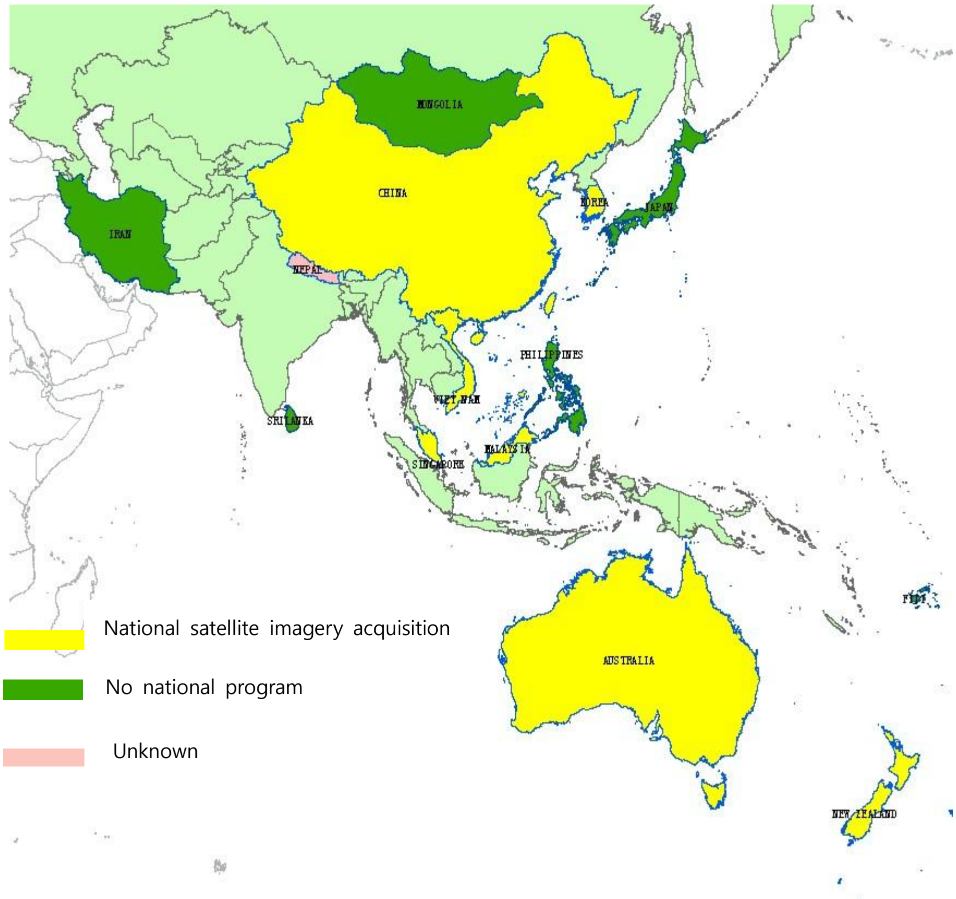


Fig.6 National satellite imagery acquisition program

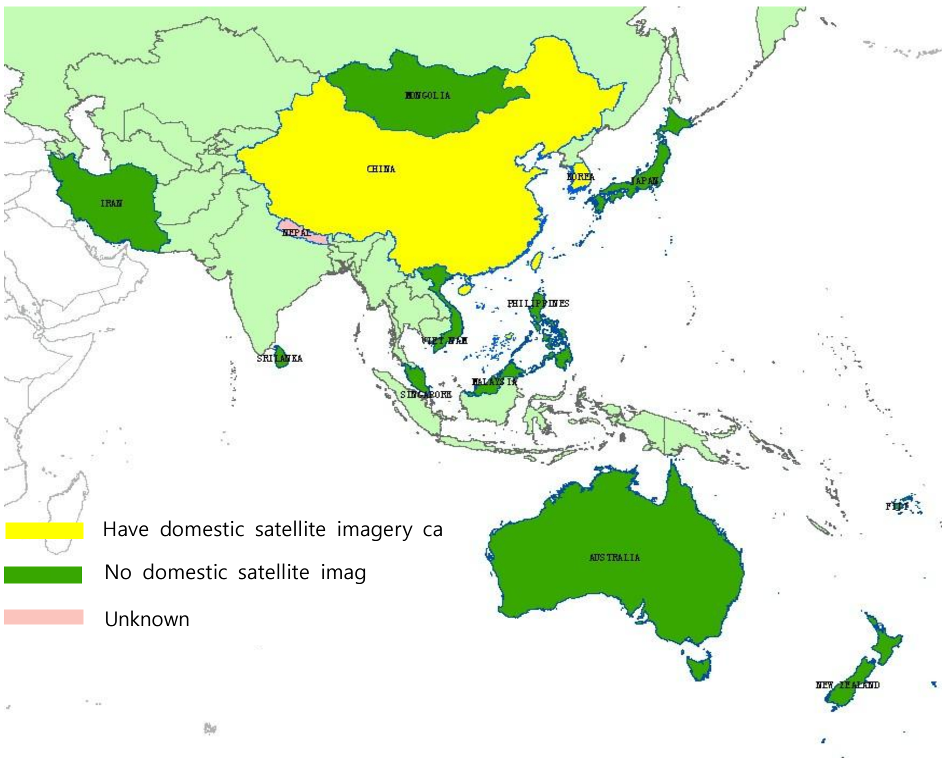


Fig.7 Domestic satellite imagery capability

Based on the analysis, we know that governments around the world are not succeeding to complete or update their mapping requirements at the critical scales 1:5000 to 1:50 000; Imagery from satellites and digital aerial cameras offer a faster and more cost effective technology; more efforts should be done on web-based geo-information access and location-based services; industry can help to supplement missing governmental information; And new mapping products (such as street view, indoor map and navigation map, etc.) should be added into the NSDI.

We suggest UN-GGIM-AP request the member countries support the questionnaires by providing the information, and make further efforts, such as training and technology exchange, to promote the web-based geo-information sharing and collaborative LBS.

Other sources have been used to obtain the mapping status during the investigation, including (1) International Map and Geospatial Data Vendors; (2) Geospatial Industry; (3) Military Agencies and UN Cartographic Section in peacekeeping operations; (4) Regional Bodies; (5) Regional UN Activities

Annex "C"

ACQUISITION AND MAINTENANCE OF PLACE-BASED INFORMATION IN AUSTRALIA

1. **Use of various sensors, imagery and volunteered geographic information for more rapid acquisition and update of authoritative geospatial information;**

LiDAR

Australia is currently undertaking the largest single lidar acquisition in the southern hemisphere, covering an area of 80,000 square kilometres in the Murray-Darling river basin which is one of Australia's primary agricultural areas. The lidar, which includes some collection of the emerging full waveform lidar, will be used in the modelling of water flow and vegetation canopies in areas of environmental sensitivity.

Whilst the project is continuing, some early conclusions can be drawn.

- Large-area acquisitions of this type of information can be problematic due to the very large volumes of information acquired. This in turn makes processing of information very slow, and even more slow if the information requires reprocessing. Acquisition projects such as this should be designed to allow rapid production of initial elevation products, but be captured to allow later processing of more detailed land cover and building/vegetation structure products.
- Where possible, given that the majority of cost in such projects is in aviation, any airborne acquisition should include multiple sensors, including the acquisition of imagery. Imagery assists in the quality assurance of the lidar but if acquired correctly can also be a source of information in its own right.

Volunteered geographic information

Whilst volunteered geographic information has been in use to a limited degree in the past in more developed nations via feedback to mapping authorities, it is now appearing to be a quick and relatively straightforward approach to collecting information where none exists.

This has been demonstrated through work between Australia and Indonesia through the Australian-Indonesian Facility for Disaster Reduction and the local Indonesian Openstreetmap community. The challenge for more established mapping programs is working out how to make best use of volunteered geographic information to update already-established geographic information datasets. This is still an area for investigation.

2. Piloting and evaluating the usage of fundamental, multiple-use geospatial information for local, national and regional applications

Since 2004 Australia has been working steadily on an approach to the re-use of the best-available geospatial information for applications across multiple scales. This is a particular issue in Australia because of our federated system of government which shares responsibility for fundamental geospatial information across different levels of government. The reasons for doing this are to:

- Reduce the cost of acquisition and maintenance of fundamental geospatial information across the levels of government
- Maximise the number of uses of the same fundamental geospatial information, nationally and regionally
- Ensure that fundamental geospatial information meets the varied legal and policy needs of government, including public safety

The challenges Australia has faced in doing this include:

- New uses of fundamental geospatial information are emerging. The current quality of fundamental geospatial information does not meet these needs.
- Ensuring information meets international standards and that there are common or translatable taxonomies and ontologies, so that information can be transformed efficiently
- Custodians understand how their information is being used
- Custodians are supported financially, and have the appropriate technical expertise, to maintain a richer base of fundamental geospatial information
- Different licensing and pricing regimes within states or provinces may inhibit the availability of potential multiple-use geospatial information
- Difficulty in assessing the economic impact of fundamental geospatial information as a whole.

What Australia is now doing is:

- Improving the organisation of grid-based or point-cloud based information such as elevation and imagery to allow for easier generation of products, and more versatile applications particular monitoring change through time. This has usually involved organising scene-based, sensor-based or survey-based information into a nationally-consistent, sensor-agnostic grid of information that can store an observed value of reflectance for any particular point on the grid for a specified point in time. For satellite-based observations which high return frequencies, a number of observations through time can be gathered, stored and analysed. This has improved the ability to map environmental changes through time and across different scales – for example, monitoring vegetation health or the growth of large farm dams – which could not be done before. Australia is now embarking on a similar approach for elevation data and is exploring ways to include higher-resolution, historic aerial photography into this system.

- Undertaking a rigorous mapping of the dependencies between the different fundamental geospatial information datasets across different levels of government. This is to ensure that custodians of the different datasets are aware of how their data is being used, and to identify where in this supply chain additional funding needs to be spent to fix data quality issues.
- Evaluating a process for the maintenance of country-wide and regional vector products from higher-resolution datasets maintained by custodians (and possibly volunteered information). At this stage this involves investigating the use of a series of "identifiers" which uniquely identify a feature, and which different source datasets can then map into. Any changes in the sources can then be flagged to instigate a change in the country-wide product.
- Identifying more specific use cases which demonstrate how fundamental geospatial information has an economic, legal or policy effect. This will have to be done on a sector-by-sector or dataset-by-dataset basis. For example, it can be shown how an improvement in the certainty of measurement of tidal levels at Australian ports can mean more exports can be made from that port, which would result in an increase in export revenue.

Annex “D”

CONTINUE THE STUDIES ON FAST ACQUISITION AND UPDATE OF PLACE-BASED DATA IN MALAYSIA

INTRODUCTION

The Department of Survey and Mapping Malaysia (DSMM) has been the forefront of the spatial enablement in Malaysia. In the area of rapid changes, the department has planned to introduce Unmanned Aerial Vehicle (UAV) for rapid imagery acquisition. UAV is a small unmanned aircraft that can be programmed to run the flight based on a flight instruction input that has been included in the navigation software in the aircraft.

COMPONENT OF UAV SYSTEM

The UAV system has five main components namely aircraft, UAV control system, cameras, image processing software and supporting vehicle. The UAV system is called Pteryx system. This is a portable and winged UAV that has a total takeoff weight below 5kg. The flight duration can be up to 120 minutes. It can be assembled easily and this system is autopilot. The temperature suitable for this UAV ranges from -40 ^{o}C to 85^{o}C; the wind is up to 5m/s. The ceiling of UAV operation can be up to 2500m and the range of UAV operation can be up to 40km. The take-off method is using bungee launcher while the flight and landing method is fully autonomous. It can also be programed to land the UAV using parachute.

The cameras used in the UAV system are Digital Single-Lens Reflex (DSLR) camera and Shortwave Infrared Camera. The infrared camera is designed to augment the DSLR camera in enhancing the classification of land cover and land use mapping. The system is also equipped with the software called Pix4UAV to generate orthomosaic, Map tiles, DSM, Point cloud, Triangle model and AAT & BBA parameters from the data collected by the UAV system.

CASE STUDY I

The UAV was investigated in generating an orthophoto mosaic for town map production. Malaysia town map revision depended on how often the town area is spatially captured. The traditional method of acquiring aerial photo through aircraft platform is costly and not economical for the map updating of small area.

The specification for the accuracy requirement for the orthophoto production using normal aerial photo campaign was used to assess the accuracy of the orthophoto production using UAV. Mersing town was selected as a pilot project. A total of 399 still images and eight GCPs over Mersing Town with the size of 3.72 sq km were captured. The result using Pix4UAV software showed that the orthophoto production conform the accuracy requirement for town map production. The orthophoto mosaic has yet to be used for map updating but the data has been used to produce an orthophoto map as in Figure 1.

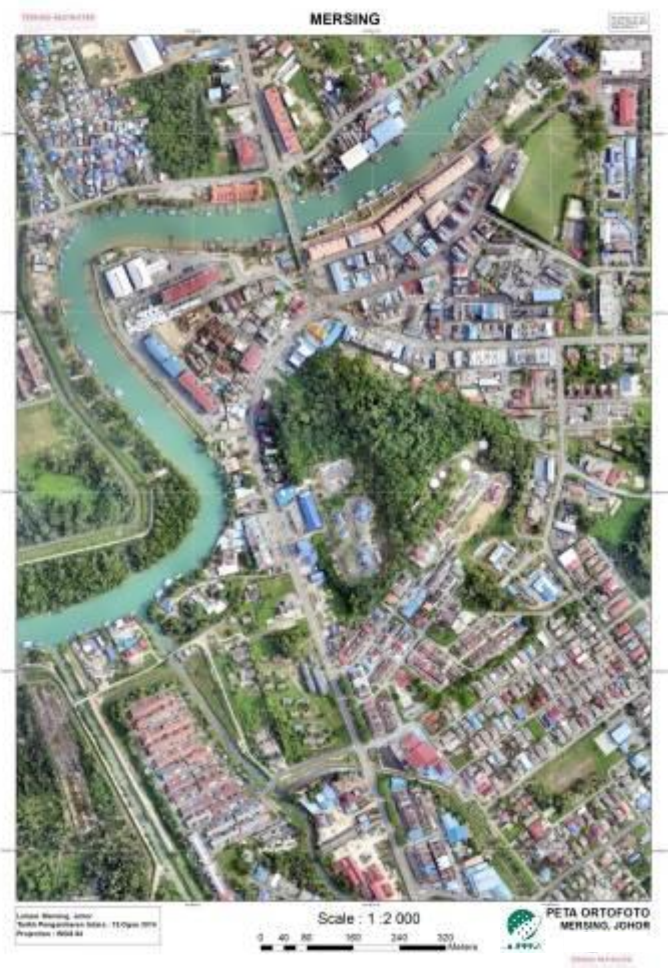


Figure 1. Orthophoto Map over Mersing Town

CASE STUDY II (LOGGING MONITORING)

Uncontrolled logging activity has negative impacts on the economic and ecological systems of optimal forest management. Although Remote Sensing technology has been used in monitoring this activity, it is quite costly to monitor a small area and especially in highland area that always covered by cloud. Therefore, DSMM has been tasked by the government to capture imageries over the area using UAV.

The deployed UAV has successfully captured imageries which in turn used to generate orthophoto over the logged areas (Figure 2). The orthophoto data was then overlaid with cadastre lots and this information was further utilized by the relevant government agencies in analyzing the impact of the logging activities.

Figure 2. Orthophoto Map over Logging Activities Area

CASE STUDY III (SUPPORT FOR HUMANITARIAN ACTIVITIES)

The UAV also played an important role to support humanitarian operation but was deployed in small scale due to its limitation in suitable areas for taking off and landing. The UAV team was tasked to capture imageries for orthophoto map production for critical areas during a post-flood operation.

The aim was to assist relevant government agencies for the planning and project development over the areas. Figure 3(a) shows an orthophoto map over Alur Gading, Kuala Lipis. The map shows the affected areas located nearby the main river. Figure 3(b) shows the status of temporarily constructed bridge to replace a damaged bridge in Temerloh Town, Pahang. The orthophoto map was able to be produced within the time frame and able to serve the stakeholder for further decision making process.

(a) (b)

Figure 3. Orthophoto Map over Flooded Areas

CASE STUDY IV (SUPPORT FOR MONITORING NATIONAL DEVELOPMENT PROJECT PROGRESS)

There are several government agencies requesting DSMM to provide the latest imageries over national project development areas for progress monitoring activities. It is not economical to conduct a conventional aerial photo mission due to the size of the Area of Interest (AOI) which is generally less than 1 km^2. Furthermore, the location of the AOI is normally far from the airport in which the operational cost would be high.

DSMM has provided the UAV support selectively due to the limitation of department capability in terms of man power and time. Figure 4 shows the orthophoto of national development project over an area in Kuantan, Pahang. The stakeholder of the project was very satisfied with the orthophoto provided.

Figure 4. Orthophoto Showing the Status of National Development Project.

CHALLENGES OF THE UAV IMPLEMENTATION

Suitability of the area for taking off and landing is very crucial to the fixed wing UAV operation. It is quite challenging to find the area of at least 300 meters long and 150 meters wide that is near to the observation areas.

Weather is another factor that needs to be seriously taken into consideration while performing the mission planning. It is recommended the operation be carried out between 0900 to 1100 and 1400 to 1700 for better quality pictures. Wind speed also plays a significant role in the UAV operation and proper planning is required. Therefore it is important that the operator is always aware to the weather forecast so that the planning would be more effective.

CONCLUSION

UAV is a new platform that can be used to capture imagery data and it is the alternative method to conventional aircraft platform. The UAV system contributed significantly to the rapid acquisition of imagery data to support various applications. The introduction of the UAV system would expedite the geospatial transformation programme in order to meet the demand of spatially enabled government and society.

Annex "E"

NIA Working Group on Trends in National Institutional Arrangements UN - GGIM

UN-GGIM UNITED NATIONS COMMITTEE OF EXPERTS ON GLOBAL GEOSPATIAL INFORMATION MANAGEMENT

Survey Report on the Role of Volunteered Geographic Information

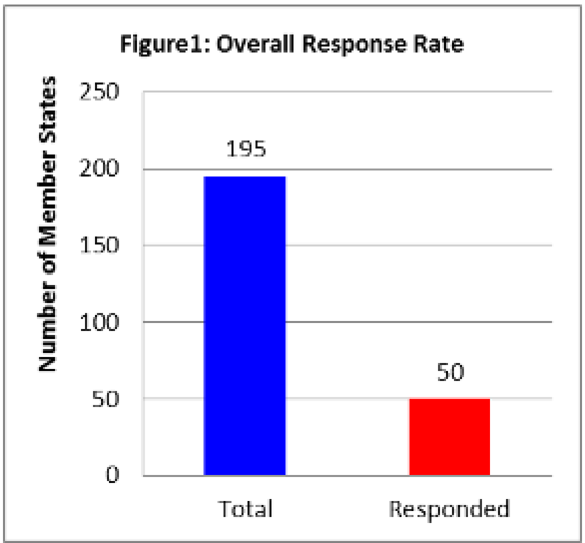
Prepared by UN-GGIM National Institutional Arrangements Task Group 3

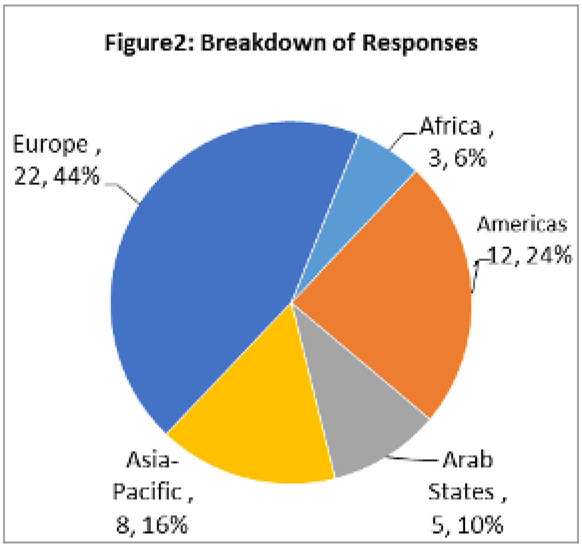
1. Introduction

This report presents the findings from the questionnaire on the Role of Volunteered Geographic Information (VGI). The questionnaire aims to identify the role of citizens as users and producers of VGI and its impact on Geospatial Information (GI) systems.

2. Response rate

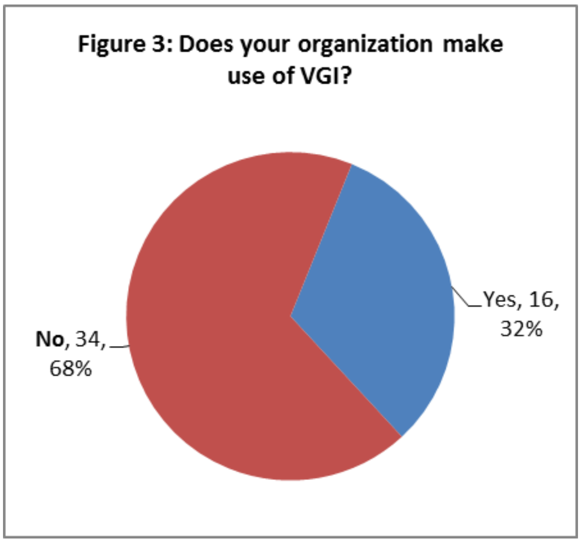
2.1. The questionnaire was circulated to 195 Member States of the United Nations from 25 February to 27 March 2015. 50 of the Member States have responded to our questionnaire as shown in Figure 1. Figure 2 shows the breakdown of the respondents by region.

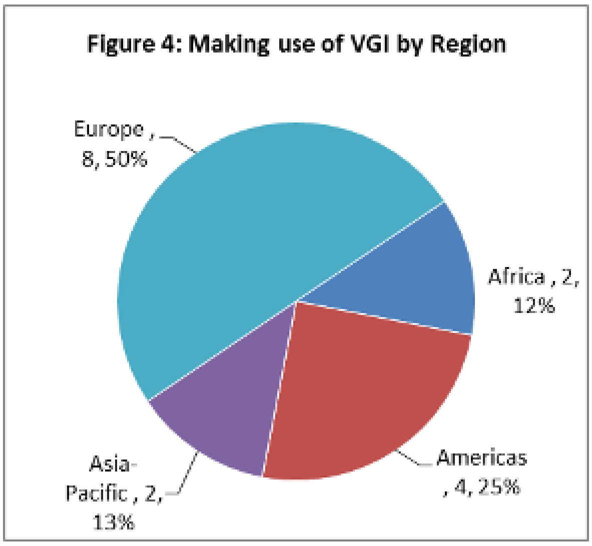




3. Making use of VGI

3.1. Out of the 50 Member State respondents, 68% (or 34) is not making use of VGI as shown in Figure 3.





4. Leading contributors of VGI

4.1. The leading contributors of VGI are citizens (28%), experts (21%), NGOs (19%), and the private sector (17%), as shown in Figure 5.

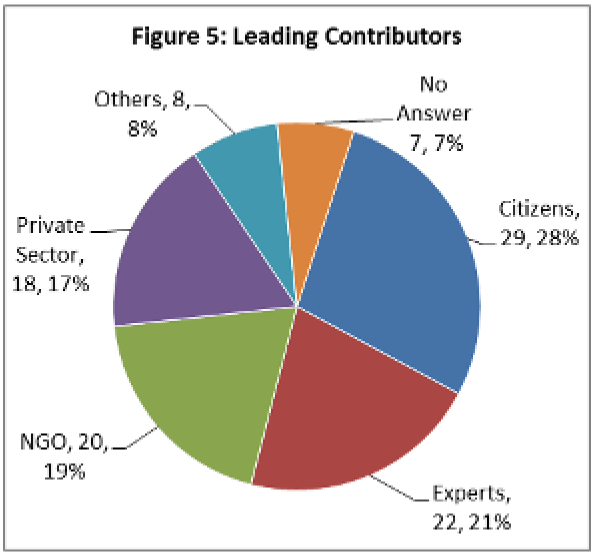


Figure 5: Leading Contributors

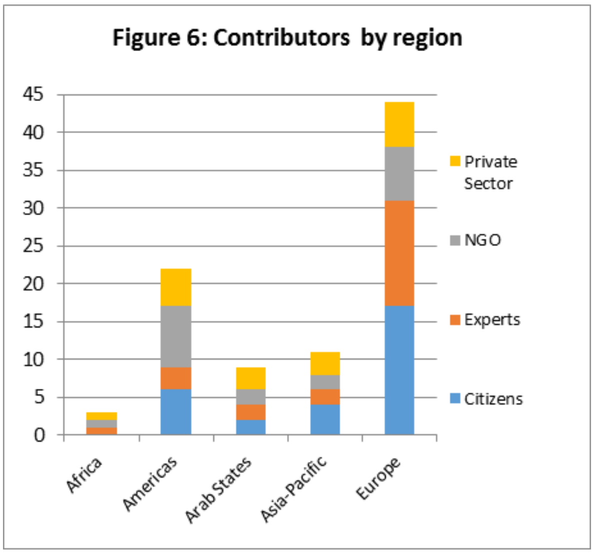


Figure 6: Contributors by region

The leading contributors are next broken down by region as shown in Figure 6. Citizens are the leading contributors in Europe; and NGOs are the leading contributors in the Americas.

5. Leading users of VGI

5.1. The leading users of VGI are citizens (21%), experts (18%), NGOs (15%), and the private sector (17%), as shown in Figure 7. The breakdown of leading users of VGI by region is shown in Figure 8.

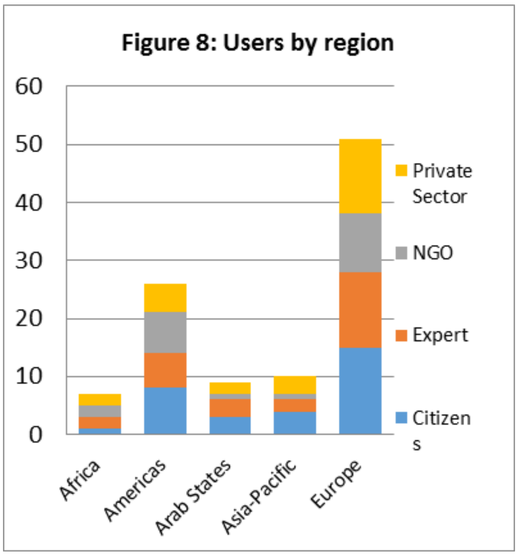


Figure 8: Users by region

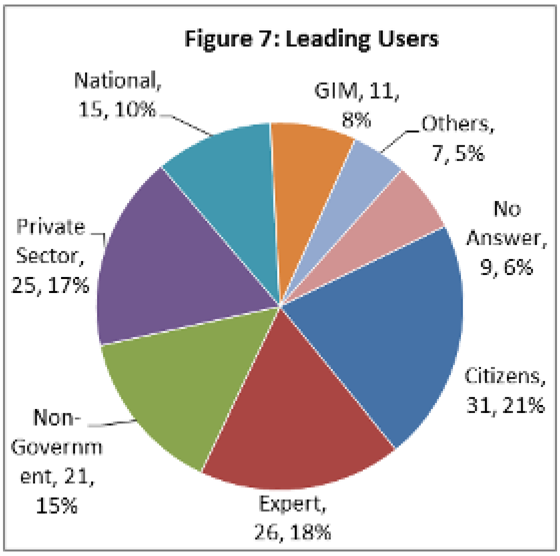
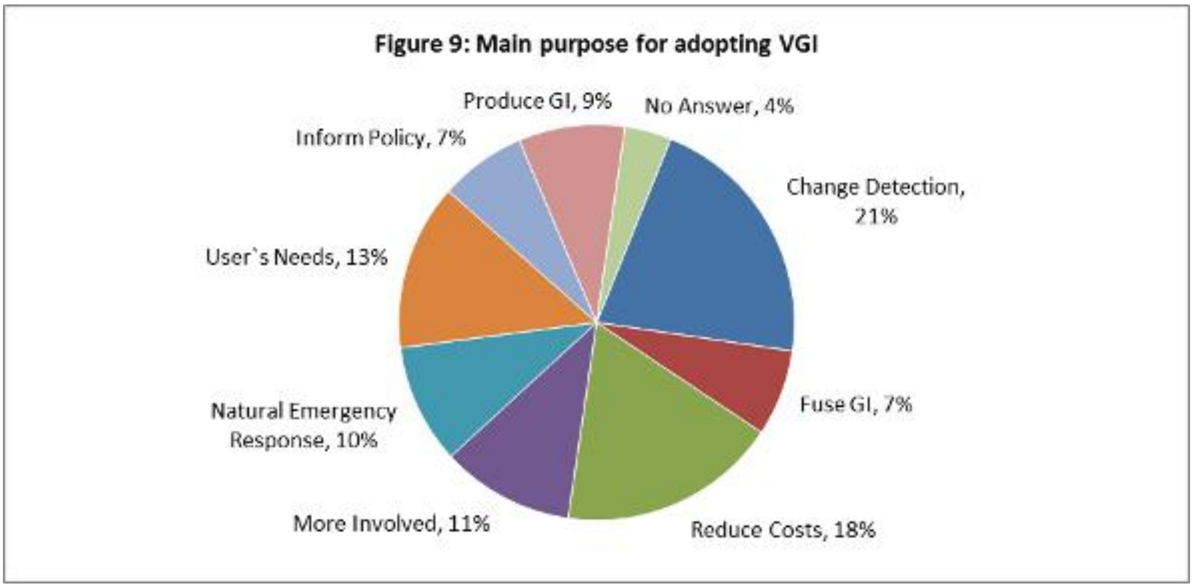


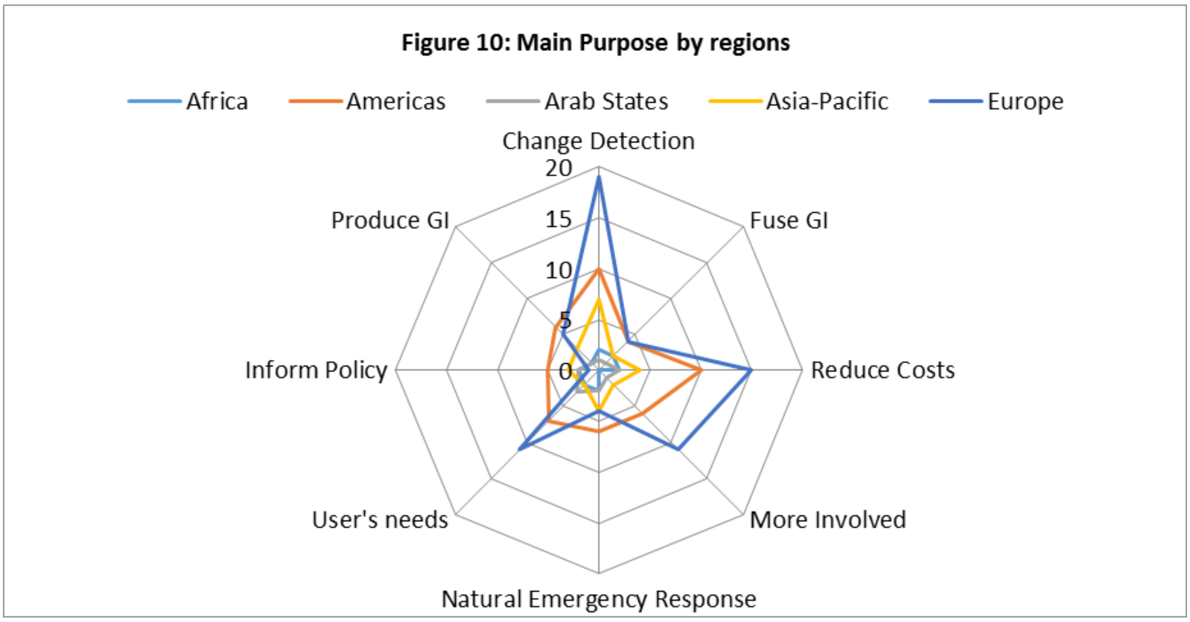
Figure 7: Leading Users

6. Main purpose for considering adopting VGI

6.1. The main purpose for considering adopting VGI is for change detection (21%), reducing costs of data collection (18%), satisfying user's needs (13%), and for natural emergency response (10%), as shown in Figure 9.



6.2. The breakdown of the main purposes by region is presented in Figure 10. Change detection and reducing costs of data collection take high positions in each region.



7. Importance of VGI

7.1. We asked Member States to rate the importance of VGI from 1 to 5, with 1 indicating a very low importance and 5 indicating a very high importance. The results are shown in Figure 11, with medium importance rated as the highest (34%).

8. Advantages of VGI

8.1. The breakdown in the advantages of VGI by region is presented in Figure 12. Updating the newest data accounts for 30% and the speed of data collection accounts for 29%.

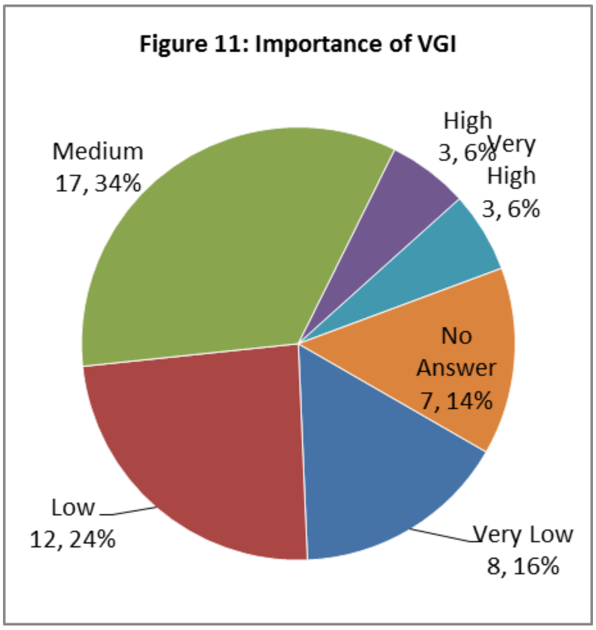


Figure 11: Importance of VGI

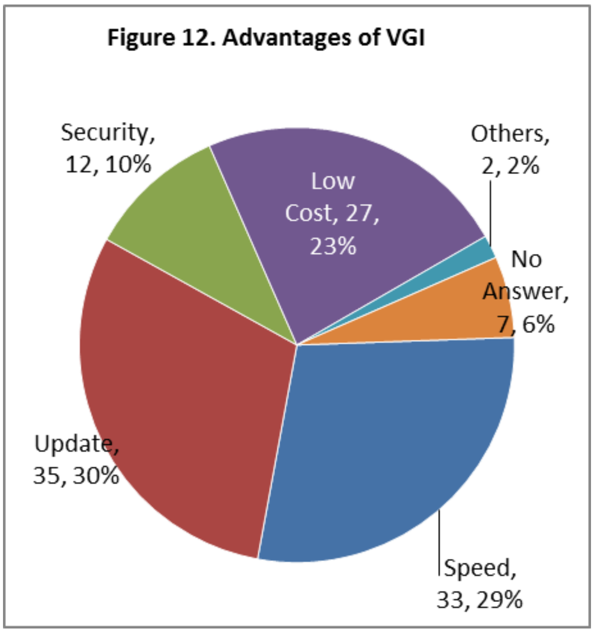


Figure 12. Advantages of VGI

9. Weaknesses of VGI from the data and contributor's perspectives

9.1. The breakdowns for the weaknesses of VGI from the data and contributor's perspectives are presented in Figure 13 and Figure 14 respectively.

9.2. From the data perspective, the key weaknesses of VGI include its quality (28%), assurance or reliability (27%), and wrong data (23%), as shown in Figure 13.

9.3. From the contributor's perspective, the key weaknesses of VGI include the lack of expertise (36%), participation (30%), and identifying needs of VGI (21%), as shown in Figure 14.

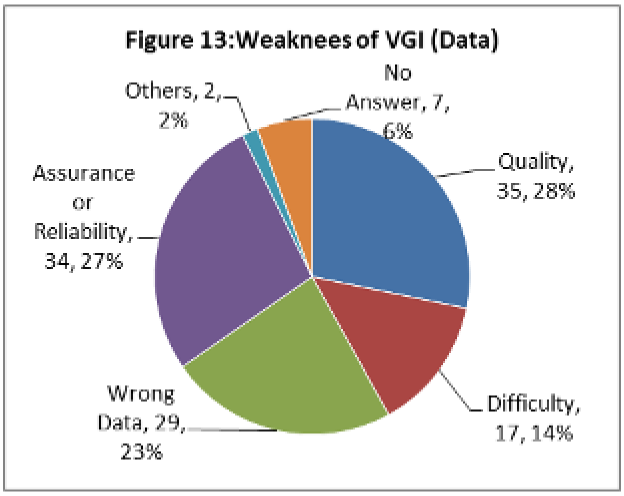


Figure 13:Weaknees of VGI (Data)

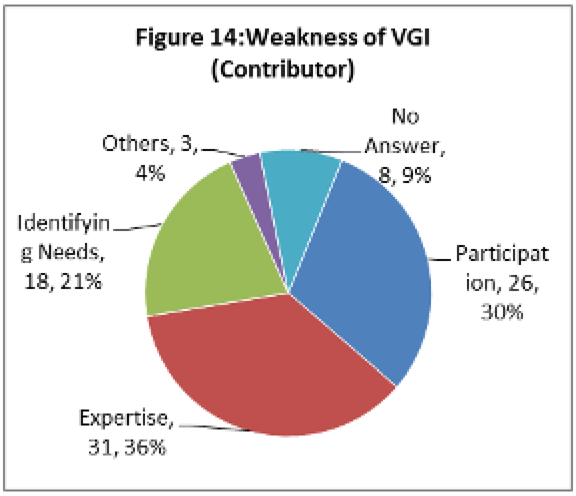


Figure 14:Weakness of VGI (Contributor)

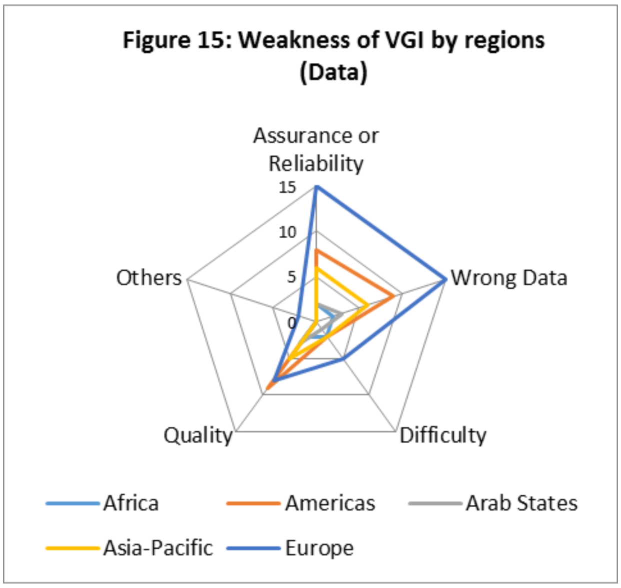


Figure 15: Weakness of VGI by regions (Data)

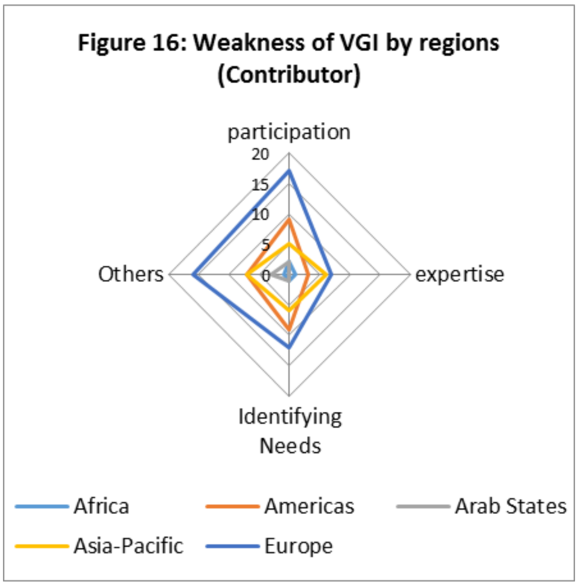


Figure 16: Weakness of VGI by regions (Contributor)

9.4. As shown in Figures 15 and 16, the weaknesses of VGI from the data and contributor's perspectives show similar patterns when broken down by regions.

10. Items needed to tackle the weaknesses of VGI (Data perspective)

10.1. As shown in Figure 17, 31% of the respondents have indicated that establishing a system for verifying and assuring VGI collected data is needed.

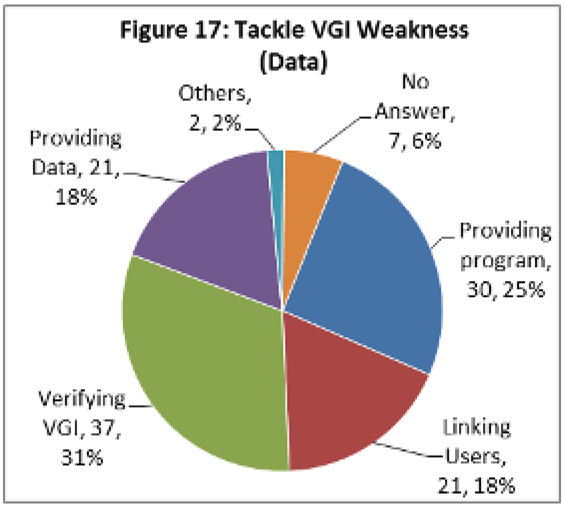


Figure 17: Tackle VGI Weakness (Data)

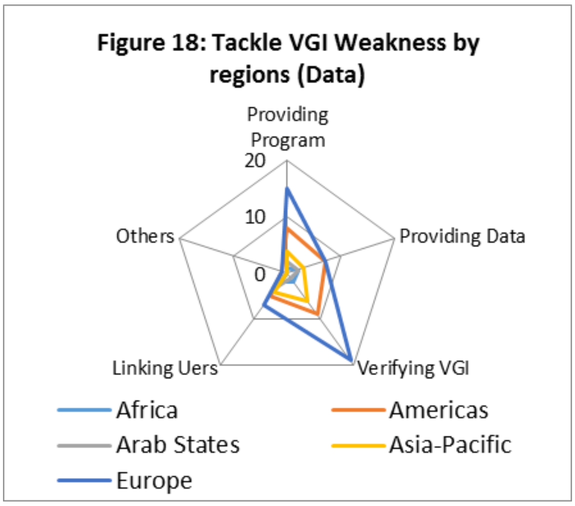


Figure 18: Tackle VGI Weakness by regions (Data)

10.2 The breakdown by region is shown in Figure 18. It shows that establishing a system for verifying VGI is the most needed to tackle the weaknesses of VGI from the data perspective.

11. Items needed to tackle the weaknesses of VGI (Contributor's perspective)

11.1. 22% of the respondents have indicated that educating for enhancing user's VGI expertise is the most important in tackling weaknesses of VGI from the contributor's perspective, as shown in Figure 19.

Figure 19: Tackle VGI Weakness (Contributor)

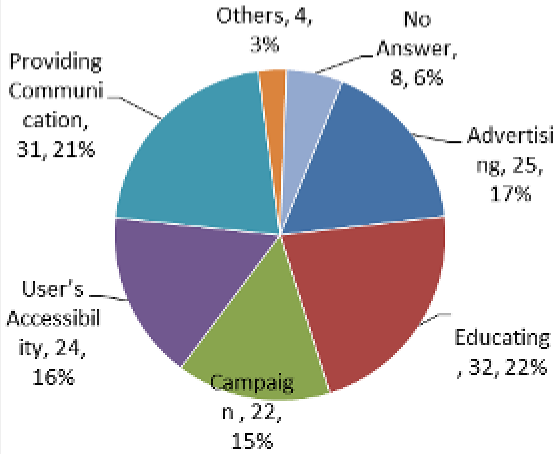
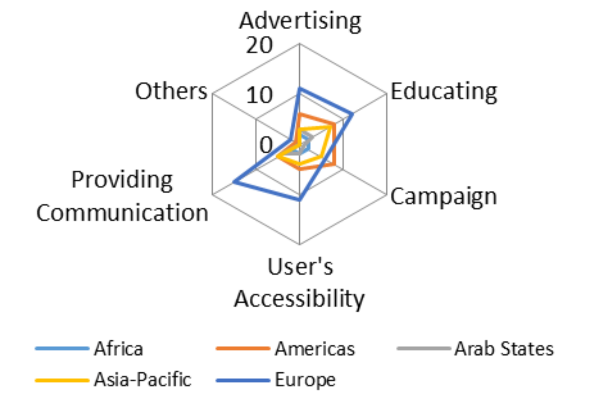


Figure 20: Tackle VGI Weakness (Contributor)



11.2. The breakdown by region is shown in Figure 20. It shows that educating VGI expertise is still the most important in tackling the weaknesses of VGI from the contributor's perspective.

12. Other thoughts on the role of VGI and its impact on GI systems

12.1 A major concern is data quality and verification.

12.2 VGI is an important and growing source of information for GI.

12.3 Community sourcing will be able to tackle some weaknesses of VGI e.g. data quality because community sourcing relies on trustworthy partners, e.g. local authorities, public services and governmental agencies.

13. Conclusions

13.1. From the survey responses, NMOs are in the early stages of introducing and making use of VGI.

13.2. Citizens are critical contributors and users of VGI. Domain experts, NGOs and the private sector also play major roles to contribute and use VGI.

13.3. The main purpose for adopting VGI is in change detection and in reducing the costs of data collection. NMOs also need to consider using VGI to satisfy users' needs.

13.4. The main advantages of VGI are to increase the speed of data collection and for updating datasets. However, VGI also has major weaknesses in areas of data quality and data assurance. Additionally, the shortage of expertise and participation in VGI are the main weaknesses in the contribution process.

13.5. In tackling the weaknesses of VGI, NMOs can establish systems for verifying VGI data and provide programs to contributors for managing certified data. NMOs can also advertise and facilitate the understanding of VGI and provide communication channels between producers and VGI-users.

13.6. VGI would likely be a major emerging source for rapidly collecting geospatial data in areas of change detection and in updating of datasets. However, there are concerns about the shortage of quality assurance and participation. The challenge, moving forward, is to identify the advantages and weaknesses of VGI across the data and contributor's perspectives, and to encourage Member States to develop the best-practices concerning the collection, quality-assurance and application of VGI.

Annex “F”

THE CASE STUDY ON WEB-BASED DISTRIBUTED GEO-DATA MANAGEMENT AND ON-LINE SERVICES

1. Case in China

1.1 Background

The administration of geographic information in China operates under the principle of unified leadership and decentralized organization, including national level, provincial level, municipal level and county level. The National Administration of Surveying, Mapping and Geo-information of China (NASG) is the leading organization in the central government in charge of geographic information in the whole country. Under the unified administration of NASG, the national level, provincial level and municipal level geo-spatial databases are constructed and maintained with funding from the national, provincial and municipal governments separatly. Generally the scales of national level database include 1:1 million, 1:250,000, 1:50,000. The scales of provincial database include 1:10,000 and 1:5,000. The scale of municipal level database include 1:2,000, 1:1,000 and 1:500. National Geomatics Center of China (NGCC) is the government agency for national level databases construction, maintenance and distribution. There is one similar agency in each province and municipal, responsible for the databases within the area.

With decades efforts, the national level databases has covered the whole territories including 1:1 million, 1:250,000 and 1:50,000 scale. While the provincial database (1:10,000) covers more than 50% territories and larger scale data cover most of downtown areas. In the meanwhile, great volume of satellite images and aerophotos have been collected. Recently more and more images come from Chinese surveying satellites such as ZY-3, etc. According to statistics, there are already about 1158 TB images in the National image database, among them 965 TB aerophots and 194 TB satellite images. There are several versions of low resolution (≤ 2.5 meter) satellite image covering the whole land area. Most of the urban areas have been covered by high resolution images (higher than 1 meter).

These databases effectively alleviated the urgent need from social-economic development. However, challenges arise accompanying with the further and wider application of the place-based information. One of the most urgent challenges is the one-stop access and integrated-usage of the multi-scale and distributed databases.

To solve this problem, a program was initiated by NASG in 2009 to establish the national platform for common geo-spatial services, with Chinese name TIANDITU which means Map World.

1.2 . General Structure

TIANDITU is the web-based platform that integrates the dispersed geospatial information resources into a "one stop" online geospatial information service system. It is designed as an important part of the geospatial framework for Digital China, aiming to promote geographic information resources sharing and improve the capability and efficiency for better services. As shown in Fig.7. The platform consists of national nodes, provincial nodes and municipal notes (or data centers). The nodes are connected by Internet or Intranet. Each node manages the data in his administrative area and publishes the corresponding services conformed to OGC standards. All services will be registered in the service management system and be accessed by the users via the unique portal and website (Fig.8). The data sources come from various surveying and mapping agencies, enterprises, professional agencies, social organizations and volunteers. Data specifications have been defined according to the requirements of web services and all data should be processed to meet the specifications. Ordinary users can use the website to browse maps, locate places, measure distances or areas, plan car driving routes. Professional users can access TIANDITU's resources via service URLs to development value-added services and applications. TIANDITU also provides many Application Programming Interfaces (APIs) to facilitate integration of its service resources and various systems or websites.

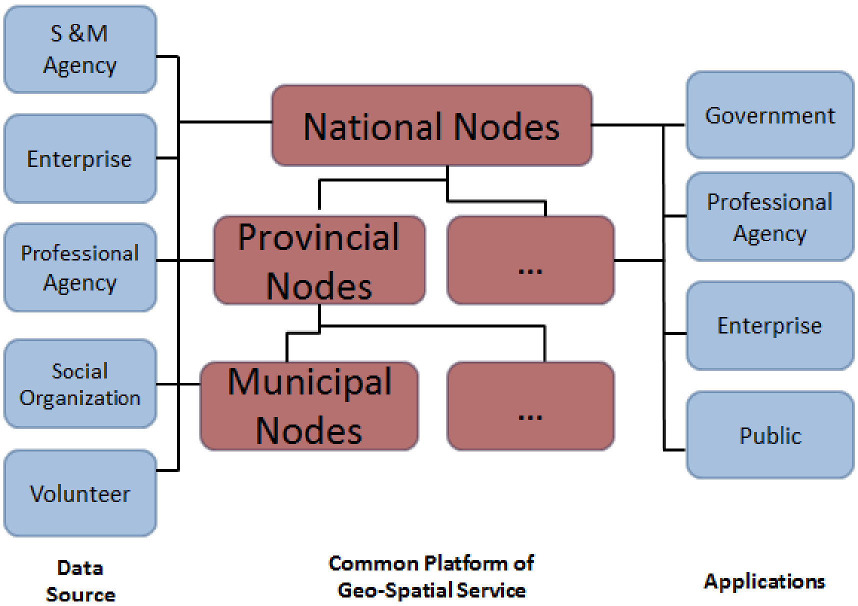


Fig.1 General Structure of the Platform

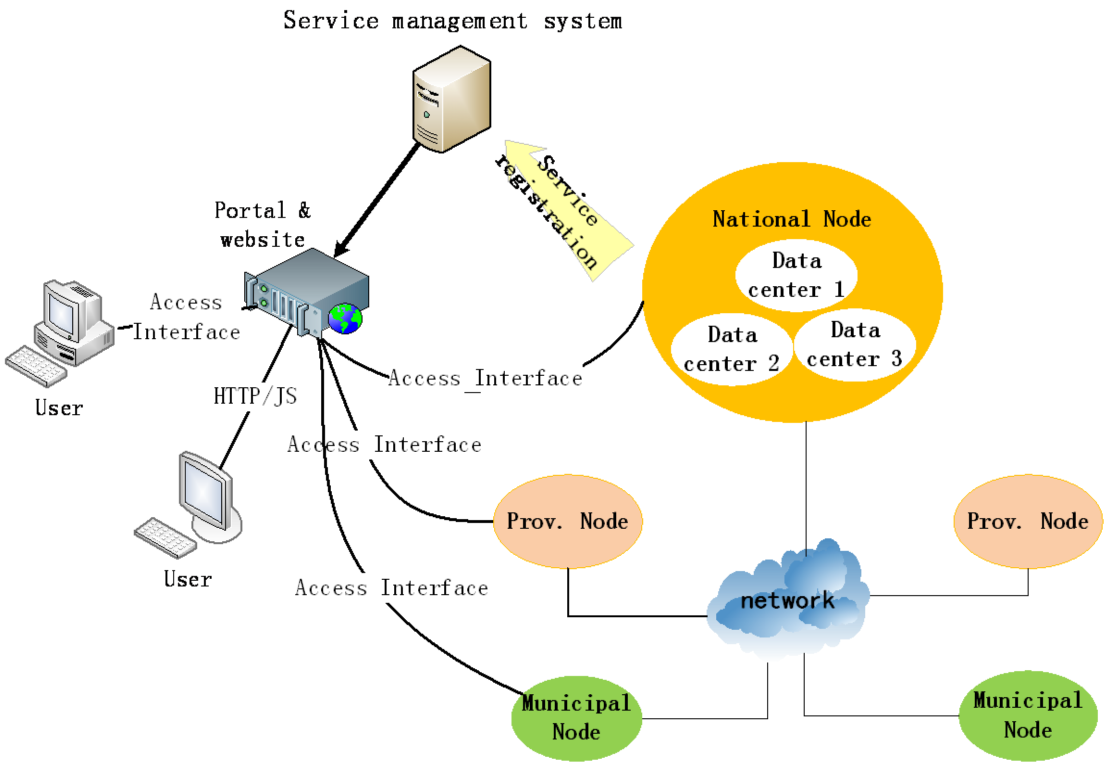


Fig.2 Operation Pattern of the Platform

1.3 Main Achievement of the Platform

TIANDITU was first launched in October 2011 that marked significant progress of NASG on improvement of service manner, service ability and the industrial supporting. With 3 years progresses, 1 national node with 3 data centers, 30 provincial nodes and 165 municipal nodes have been established and connected. TIANDITU now can provide abundant geo-spatial services including vector road network (in navigation data model) and 2.5 meter image covering the whole Chinese territory, building outlines and 0.5 meter image covering more than 450 cities/towns, and more than 20 million POIs. Full-scale data update has been down once a year and feature updating have been down every day.

One updated version has been launched each year. English beta version was launched in March 2013. The version for Chinese e-government network was launched in May 2013. The version with Mongolian placename and Uygur language placename were launched in 2014. It has been assigned as the authorized platform for publishing the images from Chinese satellites and aerophotos. TIANDITU has published abundant geospatial information within China, and multi-resolution images of other countries/regions. .

Thousands of applications have been established based on the services of TIANDITU. It has become a well-known national brand of web-based geospatial information service platform, featuring with rich and detailed content, high quality and efficient service. The agreement between Tianditu and Beidou system was signed. The Chinese national LBS platform will be established based on Tianditu, Beidou, with constant image supply from Chinese satellites and topographic data from both surveying and mapping agencies and industries. It will provide navigation and place-based services for the “one belt and one road” region.

Further efforts will done to enrich data resources, improve service functionality, and expand application range. International cooperation based on TIANDITU for techniques and software sharing, staff training, service integration will also be promoted.

2. Case in Australia

Australia has been developing the *National Map* which is a globe-based visualising platform based on open standards. The platform - Cesium – is a Javascript library which uses WebGL for graphics, is open source, and free for commercial and non-commercial applications. 3D globes and 2D maps can be created in a web browser without a plug-in, using published OGC-compliant web feature services and web mapping services. *National Map* is purposed to discover and visualise fundamental geospatial information available under unrestricted licensing – it is not a delivery mechanisms as such at this stage, but can refer users to access points to either download data or consume web services. *National Map* will be launched in the middle of 2015.

This particular approach was chosen to showcase the use of open, low-cost approaches to the discovery and visualisation of fundamental geospatial information. The design of the system is such that the interface does not rely on proprietary software (and hence has minimised ongoing software costs). The web services are maintained separately, and can therefore be consumed by other portals (both proprietary and non-proprietary.) This approach would be recommended as a cost-effective means for establishing a mapping platform, which also supports open standards and approaches.

Annex "G"

Capability to deliver and use geospatial information

1. Held the ISPRS TC IV Symposium on 'Geospatial Databases and Location Based Services' in May 14-16 2014 in Suzhou, China

The Mid-term Symposium of ISPRS Technical Commission IV on "geospatial database and location based services" was held during 14th to 16th, 2014 in Suzhou City, Jiangsu Provice, China. It was organized by the ISPRS Technical Commission IV, hosted by the National Geomatics Center of China. It got supports from the Chinese National Administration of Surveying, Mapping and Geoinformation; Chinese Society for Geodesy, Photogrammetry and Cartography; GNSS & LBS Association of China; China Association for Geographic Information Service; National Nature Science Foundation of China; Jiangsu Provincial Bureau of Surveying, Mapping and Geoinformation; and Suzhou Municipal Bureau of Land and Resources. It was sponsored by Tianditu Co. Ltd.; Beijing Geoway Software Co. Ltd.; Geo-Compass Information Technology Co. Ltd. and Lenovo Group.

There were total 320 registered participants form 17 countries and regions took part in the symposium, among them 10 student volunteers and 49 free visitors from local universities and surveying & mapping agencies. Total 42 ISPRS officers attended the Sympsoium, including 4 Council Members, 4 Honorary Members, 4 Technical Commission Presidents and 1 TC secretary, 28 Working Group chair/co-chair/secretaries, and the Editor of ISPRS Book Series.

Eleven themes were designed, including 10 on the Working Group topics and one ICA-ISPRS TC IV joint theme. Total 129 abstracts/papers were received. After evaluation by the Scientific Committee members, 83 full papers were published, including 68 papers in ISPRS Archives and 15 papers in the peer-reviewed ISPRS Annals.

Nineteen Oral sessions with 86 presentations and 2 poster sessions with 43 presentations were organized. The oral sessions include 1 keynote session, 2 plenary session and 16 oral technical sessions.

The Symposium started with the opening ceremony in the morning of May 14th. Three keynote speeches were delivered in the keynote session following the opening ceremony. The first one was entitled 'Street View Maps based LBS' given by Prof. Deren LI from Wuhan University. He is the ISPRS Honorary Member, Academician of Chinese Academy of Sciences and Chinese Academy of Engineering. After briefly introduction the system architecture of LBS, demands of various users, he discussed the street view maps and mobile mapping technology, the application and development of the industry, and the service mode and applications. The second keynote speaker was Prof. Georg Gartner, President of International Cartographic Association. His topic was ‘Service-oriented cartography and Location-based Services’. He briefly reviewed the status and vision of LBS. Then he discussed 3 phases of LBS development, they are technology-driven, data-driven, and user-driven LBS. The third keynote speaker was Bryant Austin, the experimental multi-media artist from Studio: cosmos, USA. With the topic on ‘The Art of Creating 1:1 Scale Full Body Photo Mosaics of Whales’, he shared the highlights of his twenty year evolution to create 1:1 scale photo mosaics of whales, taking inspiration from NASA's approach to create ultra-high resolution photo mosaics of our planets and moons. He also provided insight into the methods and techniques required to safely create such photographs.

Opening ceremony of the symposium

The 2 plenary sessions were held in the afternoon on May 14th. ISPRS Congress Director Lena HALOUNOVÁ presented ‘Why you should participate in the XXIII ISPRS Congress in Prague?’ She introduced the preparations of the XXIII ISPRS Congress in Prague and called the participation. Gottfried Konecny, ISPRS Honorary Member and co-chair of ISPRS WG IV/2 presented the status of global mapping and updating based on UN supported questionnaire. ISPRS President Jun CHEN reported the approach and results of 30-m global land cover mapping conducted in China. ISPRS 2nd vice President Marguerite Madden presented the geovisualization and analysis of animal behavior, habitats and conservation. Jan-Peter Muller, chair of ISPRS WG IV/3 delivered a presentation on the status of CEOS-WGCV Terrain Mapping from Satellites. E. Pattabhi Rama Rao, chair of WG IV/4 presented the applications of geospatial technology in ocean information and advisory services. Bert Veenendaal, chair of WG IV/5, presented the development of a flexible higher education curriculum framework for geographic information science. Sisi Zlatanova, chair of WG IV/7, talked about the challenges and opportunities in 3D indoor modelling and navigation. Xin Ren from National Astronomical Observatories of the Chinese Academy of Sciences introduced the DEM reconstruction and preliminary scientific exploration planning of the Chang'E 3.

Sixteen oral technical sessions with 73 excellent oral presentations, and 2 poster sessions with 43 presentations were held during May 15h to 16th, focusing on “Methods for the Update and Verification of Geospatial Databases”, “Global Status of Mapping and Geospatial Database Updating”, “Global DEM Interoperability”, “Geospatial Data Infrastructure”, “Web and Cloud Based Geospatial Services and Applications”, “Sensor Web and Internet of Things”, “3D Indoor Modeling and Navigation”, “Planetary Mapping and Spatial Databases”, “Computing Optimization for Spatial Databases and Location based Services”, ” Global Land Cover Mapping and Services” and “LBS and Ubiquitous Cartography”.

Technical exhibitions were organized during the symposium. Eight exhibitors attend the exhibition, including GIS software, graphic workstation, image processing platform, unmanned aircraft system, web maps etc. Chinese computer-maker Lenovo Group, as the most typical one of them, brought four-screen solution for data processing which generated lots of attention from users intrigued by features like price and efficient performance. The on-line geographic information service platform MapWorld (Tianditu), developed by National Administration of Surveying, Mapping and Geoinformation of China (NASG), also drew lots of attention.

Social events were organized during the symposium. The welcome reception with live traditional Chinese music play in the evening of May 14th offered delightful opportunity for relaxing and catching up with friends. The beautiful city of Suzhou with the history of more than 2500 years, and the comfortable atmosphere, spiced up the symposium.

The symposium was a great success. We anticipated a well-attended symposium but our grandest expectations were exceeded. The quality of both the papers and the presentations was quite high. The symposium provided good opportunities for scientists, researchers and practitioners to discuss cutting-edge technologies, exchange research ideas, and promote international collaboration.

2. **Hosted the Seminar for Developing Countries on the Global Web-based Geoinformation Services during October 14-27 in China, with the funding from Ministry of commerce of China**

The seminar was organized by Academy for International Business Officials (AIBO), Ministry of Commerce, P. R. China. It was hosted by the National Administration of Surveying, Mapping and Geoinformation.

This seminar included presentations and field trip. All presentations were given by government officials or experts, covering topics such as “General Review of China”, “China’s Opening-up & Economic Development”, “Brief Introduction of Modern Surveying and Mapping Technology”, “ICT-based Management of Geospatial

Projects”, “Progress of Web-GIS”, “Multi-resource Data Management and Efficient Image Processing”, “Land Cover Classification Based on High Resolution Images”, “Cloud-based Geospatial Information Service Platform”, “Web-based Geospatial Inforamtion Applications in Governmental Agencies” .

Participants visited Tianjin, Shanghai and met with local government officials and researchers, visit local geographical survey department and exchange ideas with them to get a better understanding of China’s geographic information service development and at the same time seek opportunities for more cooperation.

The invited participants of the seminar were officials at director’s level in surveying and mapping administrations from Ethiopia (1 person), Ghana (1 person), Zimbabwe(1 person), Kenya (1 person), Mauritius (1 person), Namibia(1 person), Nigeria (1 person), Uganda (1 person), Zambia (1 person), Cameroon(1 person), Madagascar(1 person), Indonesia(1 person), Laos (1 person), Vietnam (1 person), Sri Lanka (2 people), Mongolia (1 person), Georgia (1 person), Palestine (2 people), Jordan (1 person), Ecuador (1 person), Cuba (1 person), Vanuatu (2 people).

3. Others

Australia continues to assist in providing geodetic support to Pacific nations, Australia providing advice to Pacific Island nations on methodologies for the delimitation of their maritime boundaries or use of elevation information, and Australia and New Zealand providing hydrographic charting support to various Pacific nations.

WG officers reported the WG activities in various international events.