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The Status of Mapping in the World **

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Paper to the 10th UNRCCA, New York, 19 to 23 August 2013
session 6 on Geospatial Data Collection, Management and Dissemination

Submitted by Gottfried Konecny, Emeritus Professor, Leibniz University Hannover, Germany; Co-Chair ISPRS Working Group IV-2 on "The Status of Mapping in the World"

1. Introduction

1. Traditionally the U.N. Secretariat played a prominent role to collect global information on the status of mapping in the world. In 1968, 1974, 1980 and 1987 the UN Secretariat has completed studies on the status of world topographic mapping. Topographic maps at that time constituted the basis for reliable geospatial information, as they do up until today.

   Topographic maps were and are principally compiled by activities of the governmental national mapping agencies (NMA's). Representatives of these agencies of the UN member countries have regularly exchanged views on the status of mapping at the UN Regional Cartographic Conferences for Asia and the Pacific and for the Americas.

   The issues of mapping have gained importance for the national and global management of resources and for sustainable development with increasing emphasis on environmental issues.

   The last summary on the status of mapping has been published by the United Nations in their publication "World Cartography" in volume XX, published in 1990 (ST/TCD/14). It reflected the status of topographic mapping surveys up until the year 1986. As of 1980 the scope of mapping also began to include cadastral mapping, as a basis for land management issues.

   The results of the published study for topographic mapping coverage of the land area of the world , separated by the map coverage available for the different continents resulted in the following summary, which also reflects the historical aspects of development in the different regions of the world:

scale/range	1:25 000	1:50 000	1:100 000	1:200 000
Africa	2,9 %	41,4 %	21,7 %	89,1 %
Asia	15,2 %	84 %	56,4 %	100 %
Australia and Oceania	18,3 %	24,3 %	54,4 %	100 %
Europe	86,9 %	96,2 %	87,5 %	90,9 %
Former USSR	100 %	100 %	100 %	100 %
North America	54,1 %	77,7 %	37,3 %	99,2 %
South America	7 %	33 %	57,9 %	84,4 %
World	33,5 %	65,6 %	55,7 %	95,1 %

The survey also revealed, that not only the coverage of maps was an important factor, but also the update rates of the topographic map. These were in summary:

scale/range	1:25 000	1:50 000	1:100 000	1:200 000
Africa	1,7 %	2,2 %	3,6 %	1,4 %
Asia	4,0 %	2,7 %	0 %	1,9 %
Australia and Oceania	0 %	0,8 %	0 %	0,3 %
Europe	6,6 %	5,7 %	7,0 %	7,5 %
Former USSR	0 %	0 %	0 %	0 %
North America	4,0 %	2,7 %	0 %	6,5 %
South America	0 %	0,1 %	0 %	0,3 %
World	5,0 %	2,3 %	0,7 %	3,7 %

Since the last publication of the data on the status of mapping there have been highly effective technology improvements in IT in sensor technology and in the availability of satellite platforms.

Foreseeing these the UN Cartographic Conferences have passed a number of resolutions to update the effort on the status of mapping within existing resources.

2. The Ninth UNRCC for the Americas in New York 2009 in its resolution 3/IX has tasked the UN to prepare a study on the status of mapping in the world by study to be directed to the national geospatial information authorities in the world.

   In this context the International Society for Photogrammetry and Remote Sensing ISPRS has offered technical support to the GGIM Secretariat.

3. In preparation for this survey by the UNGGIM Secretariat a questionnaire was jointly designed, which was sent out to the geospatial information authorities on April 27, 2012.

4. The questionnaire was designed to give answers, not only on the progress in area coverage of mapping during the last 26 years, and the status of up-to-dateness of the maps, but also on the status of introducing new technology and expanded tests in the different countries, characterizing the existing national infrastructure for mapping.

   Altogether 27 questions were formulated as multiple choice questions:

   A) National Topographic Mapping Coverage: 7 questions
   1) the scales of mapping in use in 8 categories (1:1000, 1:5000, 1:25 000, 1:50 000, 1:100 000, 1:250 000, 1:500 000, 1:1 000 000 or similar)
   2) coverage of the data in km^2 or in % of the national area
   3) restrictions imposed on the availability of maps
   4) maps for sale or for free
   5) procedure of map updates by map sheet or by features
   6) methodology for updating (field surveys, photogrammetry, satellite imagery, third party data, crowd sourcing)
   7) inhouse or outsourcing operations

   B) National Imagery Acquisition (7 questions):
   8) is there a national aerial photography program flown at regular intervals; are domestic services used; is the imagery analog or digital
   9) is there a national satellite imagery acquisition program providing images at regular intervals; are these domestic sources
   10) use of radar or lidar sensors
   11) is Lidar used for DEM's and at which resolution
   12) are orthophotos produced and at which scale
   13) is there a national DEM
   14) is there the intention or use of 3D information for urban and rural landscape models

   C) National surveying and Cadastral Coverage (8 questions)
   15) are there licensed surveyors
   16) is there a national cadastral map coverage and is the NMA responsible for cadastral mapping
   17) what is the use of cadastral maps (titles, tax)
   18) are cadastral maps based on geodetic control
   19) are property boundaries monumented in the field
   20) updating methodology of property maps
   21) number of employees or private surveyors engaged in cadastral operations

   D) Organisation (6 questions)

   22) is topographic mapping nationally funded
   23) annual budget
   24) number of staff (total and technical) in NMA

25) legal or regulatory mandate of NMA
26) products in % supplied as
    - hard copy maps
    - digital data
    - online downloads
    - web services
27) archival practices

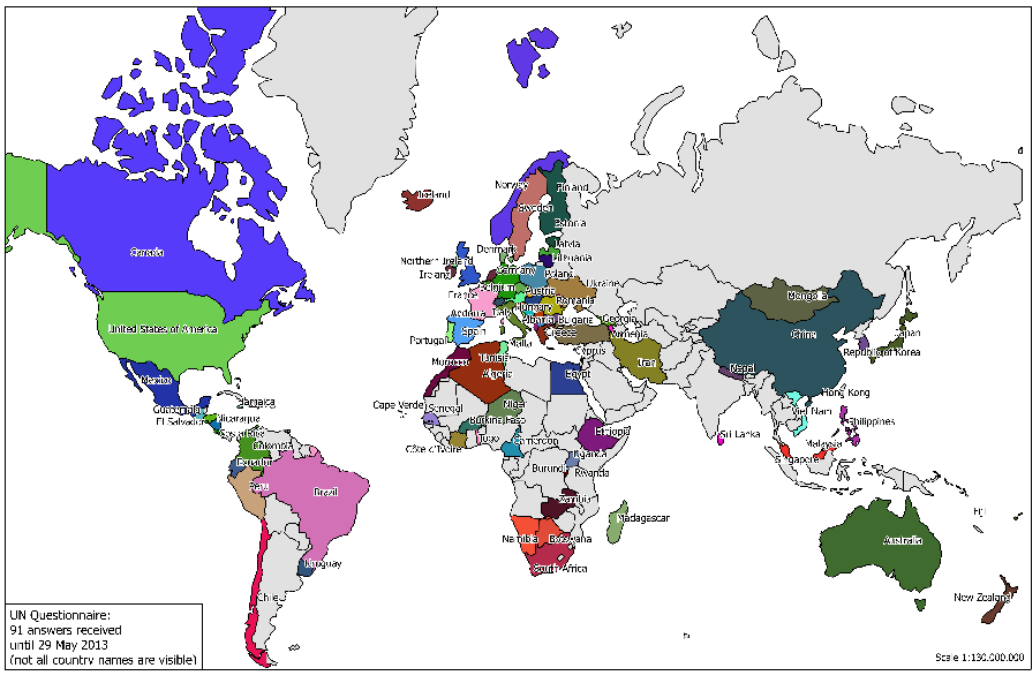
5. The questionnaire intended to provide an overview of the current status of mapping the world with characteristic questions relating to the use of new technology for mapping and the cadastre including institutional arrangements on a national level.

2. Answers of the 2012 Questionnaire Survey

6. Altogether 90 answers have been received from UN member countries. Even if all 193 (or 202 of the member states and territories) do not have their own national mapping agencies (NMA´s), this still leaves about half the countries , which have not answered the survey.

From the 90 countries having answered, 36 (out of 50) came from Europe, 15 (out of 35) from the Americas, 20 (out of 54) from Africa, 16 (out of 49) from Asia and 3 (out of 14) from Australia and Oceania. The best response was achieved from Europe and from the Americas. Obviously conflict regions of the globe did not wish to share their information globally.

Fig. 1 shows the countries having answered the questionnaire.
Fig. 1



7. This means, that the first two questions of the survey, the current map coverage At a particular scale range and and its state of currency cannot be answered from The questionnaire answers alone. For this reason we consulted the data bases of established international map vendors, such as Eastview Geospatial in Minneapolis, Minnesota, USA to make an assessment of the current state. Eastview is well known for their ability to supply geospatial data at most scale ranges on a global level. These data are either produced by the countries themselves, which by various channels have found their way to the USA. Or they have originated from military mapping conducted by the USA or the former Sovjet Union. As dates for the data are also available, it becomes possible to assess both coverage and age of the material available though the vendor. While a definite numerical result cannot be presented at the time, it can Nevertheless be concluded, that the land area of the globe has been mapped at the scale range 1:50 000, which is a critical scale for most activities required for sustainable development of the globe.

   Fig.2 shows the countries, which have not replied, but for which Eastview Geospatial can supply map data produced in these countries at the respective scales.

   Fig.3 shows these countries for which military maps produced by the USA are available.

   Fig.4 shows these countries for which military maps in the former Sovjet Union are available.

   Fig. 2

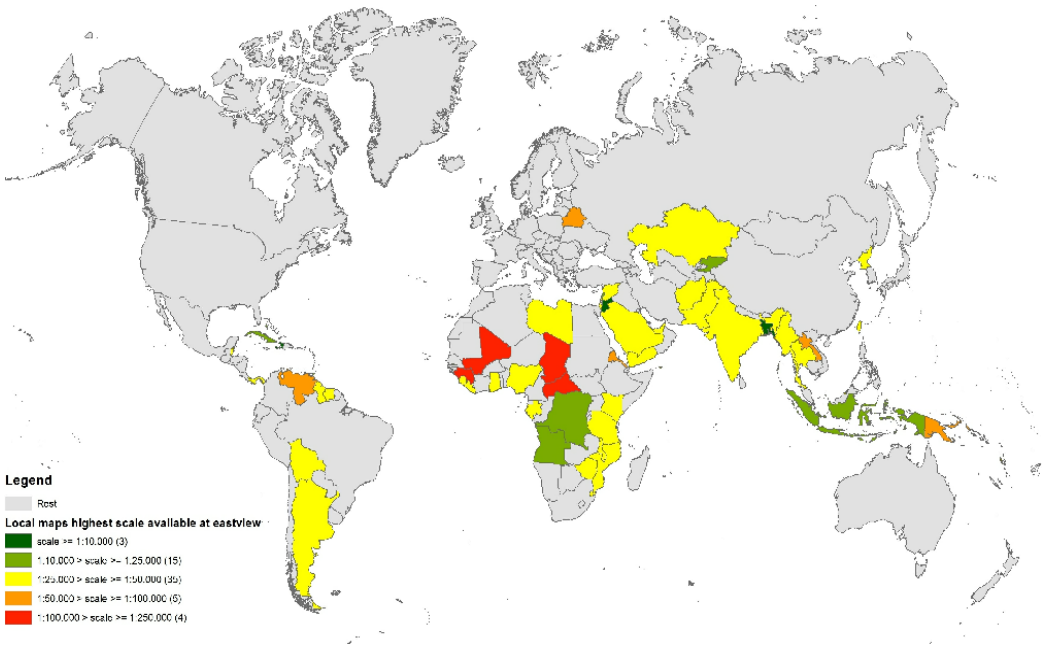


Fig. 3

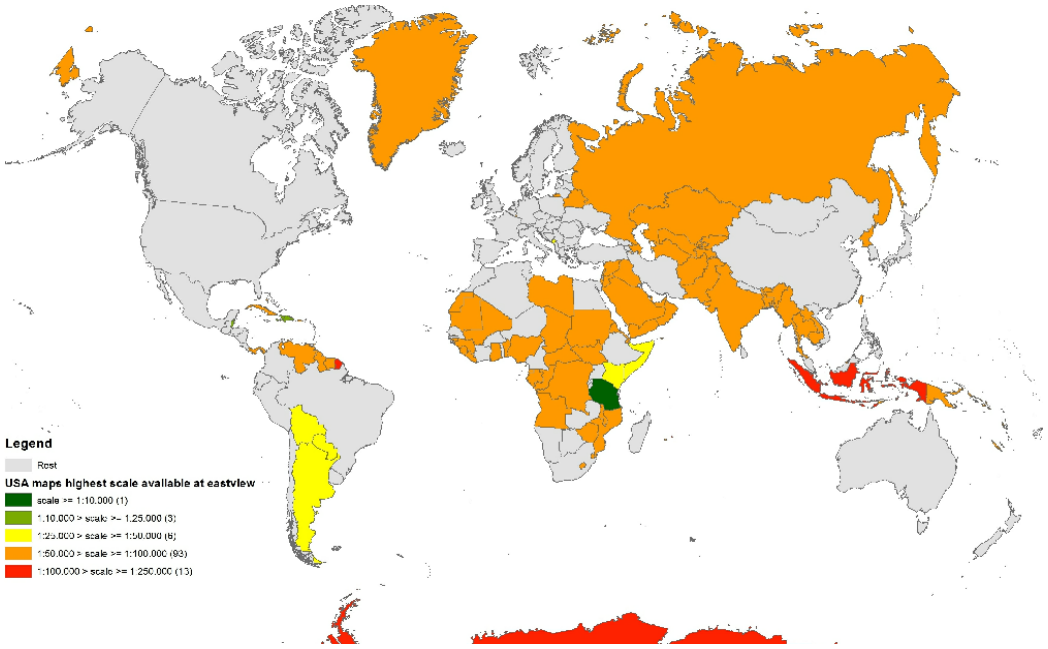

Legend
Rest
USA maps highest scale available at eastview
scale >= 1:10.000 (1)
1:10.000 > scale >= 1:25.000 (3)
1:25.000 > scale >= 1:50.000 (6)
1:50.000 > scale >= 1:100.000 (93)
1:100.000 > scale >= 1:250.000 (13)

Fig. 4

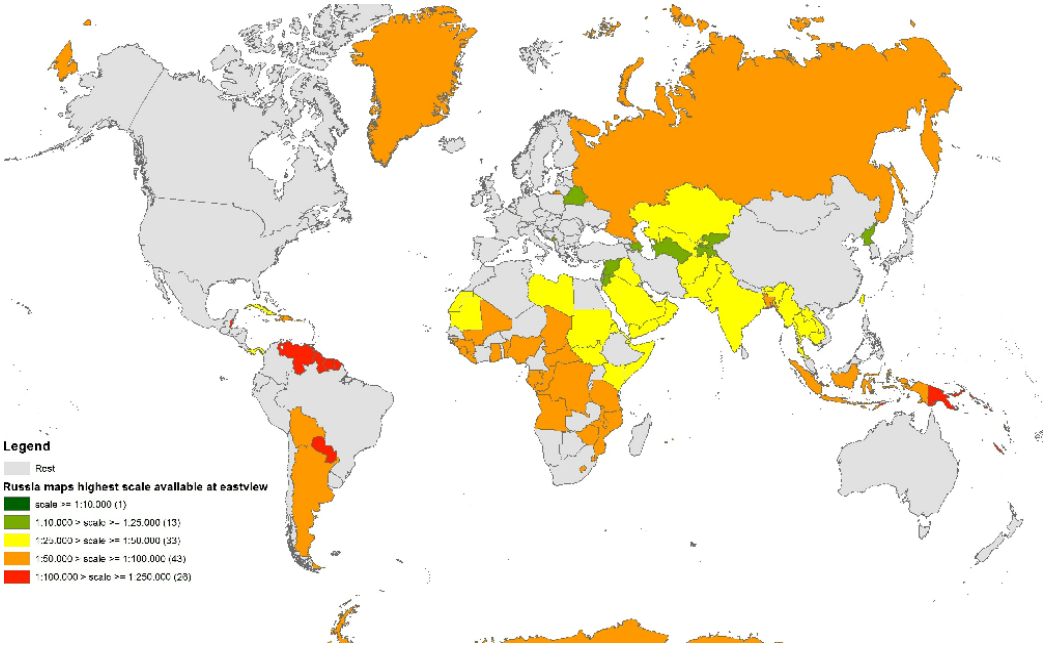
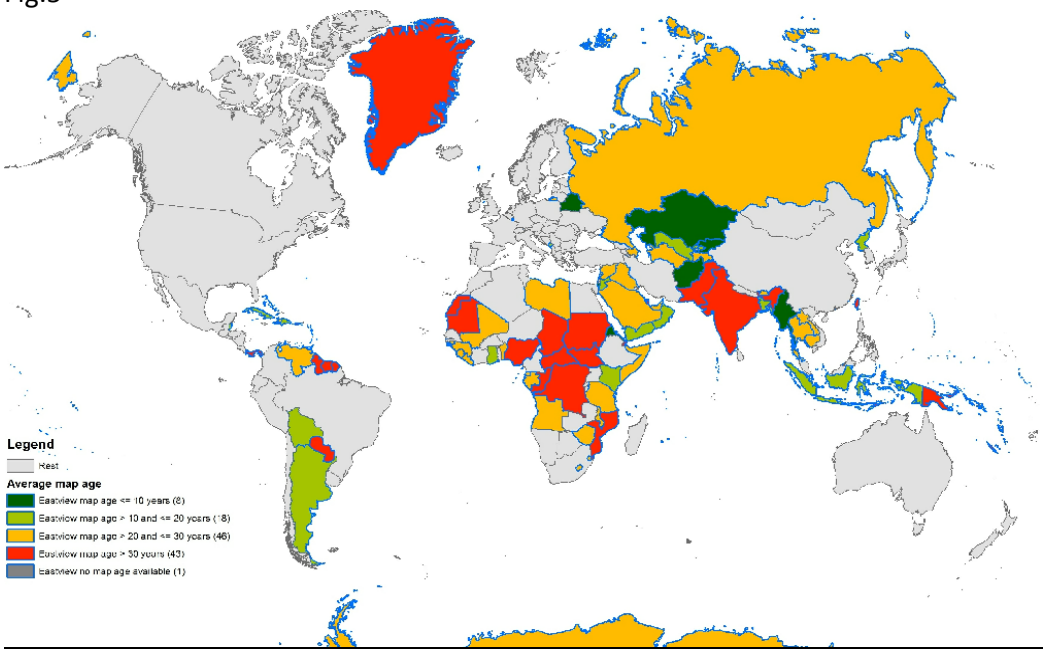

Legend
Rest
Russia maps highest scale available at eastview
scale >= 1:10.000 (1)
1:10.000 > scale >= 1:25.000 (13)
1:25.000 > scale >= 1:50.000 (33)
1:50.000 > scale >= 1:100.000 (43)
1:100.000 > scale >= 1:250.000 (28)

Fig. 5 shows a summary of all sources combined for the assessment of the age of mapping available in the world

Fig.5



8. It should not be forgotten, that defense geospatial data provision efforts, publicly not reported, are still continuing around the globe, for example the efforts of the NATO members to compile a common global digital data coverage at a resolution level comparable to a 1:50 000 or a 1:100 000 scale map. This project has become known under the name of Multinational Geospatial Co-production Program (MGCP), in which 29 countries participate, which have already said to have covered 25% of the globe.

9. The answers to questions 3 to 27 of the questionnaire have provided a general assessment at least for the 90 reporting countries of the geospatial infrastructure available around the globe available to governmental authoritative mapping. The results have been published as a GGIM3 Background Paper Report of the July 2013 Cambridge Conference. A few pertinent examples are shown here in Fig. 6, 7 and 8:

   Fig. 6 shows the restrictions on public availability of maps

   Fig. 7 shows the practice of NMA´s using in house facilities for mapping or outsourcing

   Fig. 8 shows the availability of a cadastral coverage for the country

Fig.6

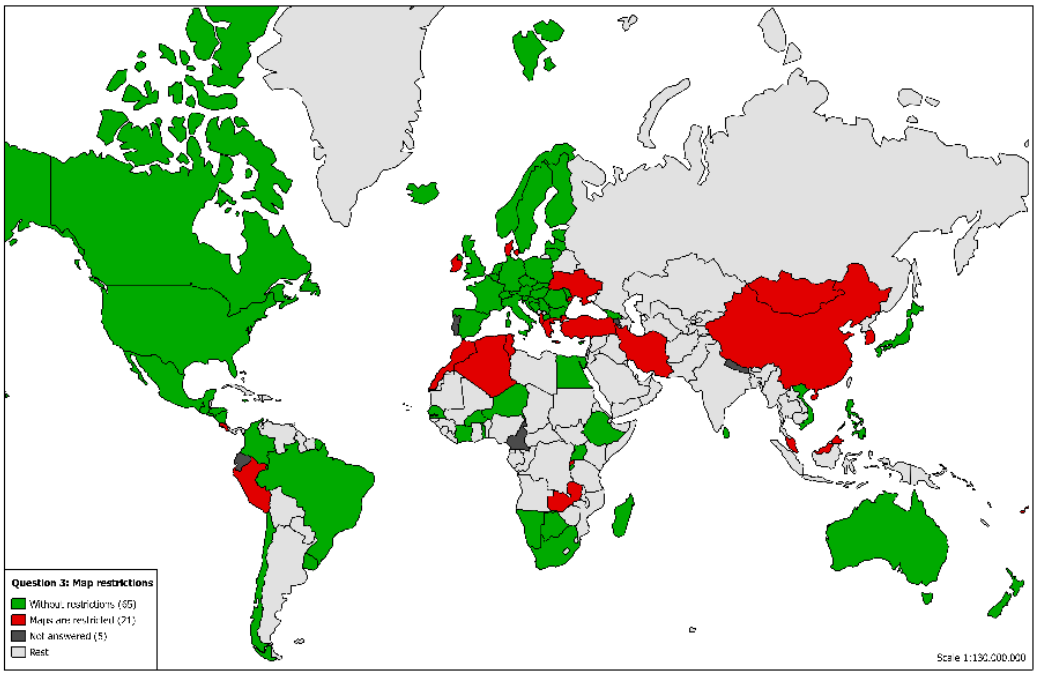

Question 3: Map restrictions
Without restrictions (65)
Maps are restricted (21)
Not answered (5)
Rest
Scale 1:130.000.000

Fig. 7

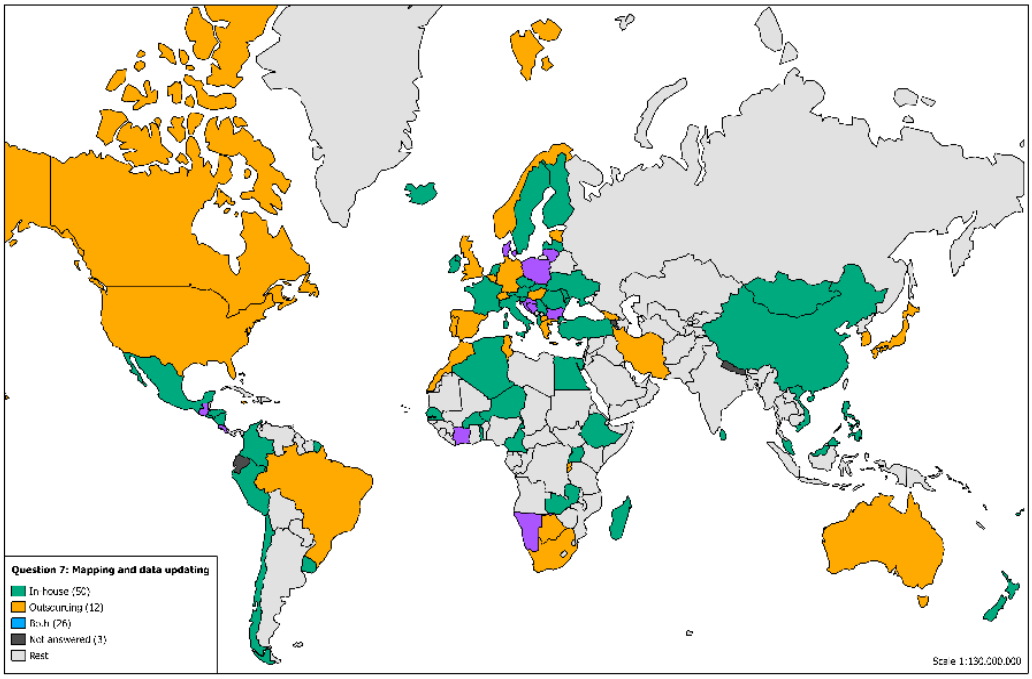
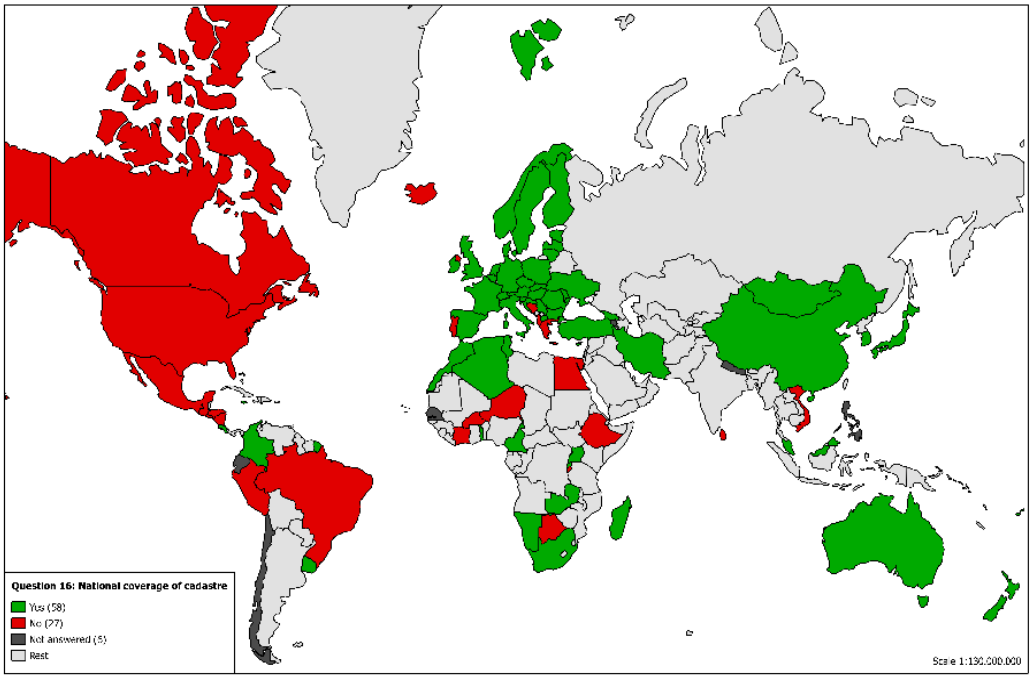

Question 7: Mapping and data updating
In house (52)
Outsourcing (12)
Both (26)
Not answered (3)
Rest
Scale 1:130.000.000

Fig. 8



10. At a time, when new technologies have paved the way to supplement authoritative governmental mapping by efforts from industry using imagery, GNSS tools, communication devices and IT data base capabilities an attempt must also be made to recognize these highly relevant contributions in attempt to effectively challenge some of the past deficiencies of traditional mapping approaches leading to the provision of timely geospatial information needs, commensurate with the present requirements of society.

    The major players are Google, Microsoft, Navteq and TomTom:

    Google has acquired imagery acquired from high resolution satellites and from aerial imaging. After its geocoding it has provided a basis for identifying objects of interest on that image base known as “Google Earth”. It has merged these data together with map data obtained from authoritative sources under “Google Maps”. A separate program, “Google Street View” has been added to add details and to update “Google Maps”. Wherever possible Google has made significant progress with these efforts on all continents. To add quality control a new program “Google Ground Truth” has been established over a period from 2007 to 2012 in the USA and in Western Europe, in which the sometimes outdated or inaccurate data sources in “Google Maps” have been updated or improved using new imagery.

    Microsoft has introduced an orthohoto mapping program using Microsoft-

Vexcel digital aerial cameras for the USA and for Western Europe using ground Sample distances of 30cm for rural and 15cm for urban areas to provide the Services of “Bing Maps”.

The international efforts of Navteq and TomTom to provide detailed navigational information on roads have likewise been extended to all continents. Even though these systems essentially only covered features of interest to road users, these efforts are likewise very remarkable.

UNGGIM provides an excellent platform to discuss how the technologies Introduced in these industrial efforts may become of mutual benefit for authoritative mapping efforts by governments.

In addition crisis situations, such as natural or human disasters have already proven, that mobile communication devices, particularly those equipped with GNSS location capabilities, have been able to provide accurate geo-location information rapidly for objects not contained in databases. Examples from ushahidi.com are known from the Haiti earthquake disaster and from Kenya.