

**Committee of Experts on
Global Geospatial Information Management**

Background document
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Study on the status of mapping in the world

**The International Society for Photogrammetry and Remote Sensing (ISPRS) study on
the status of mapping in the world**

Background Document Prepared by the International Society for
Photogrammetry and Remote Sensing (ISPRS)

**The secretariat acknowledges with thanks the substantive contributions from Gottfried
Konecny, Emeritus Professor, Leibniz University Hannover**

I. Introduction

1. 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 (NMAs). 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 resulted in the following summary:

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 Regional 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, held in New York in 2009, adopted resolution 3/IX, tasking the UN to prepare a study on the status of mapping 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 UN-GGIM Secretariat.

3. In preparation for this survey by the UN-GGIM Secretariat, a questionnaire was jointly designed and sent out to all the geospatial information authorities, on April 27, 2012.

II. Design of the Questionnaire

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 km² 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) in-house 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 ortho-photos 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 is intended to provide an overview of the current status of mapping in the world with characteristic questions relating to the use of new technology for mapping and the cadastre, including institutional arrangements at a national level.

III. Status of the Responses

6. After the mailing of the questionnaire on April 27, 2012, altogether 62 responses have been received to date. This is initially a favourable response. An intensive follow-up process is continuing from the GGIM Secretariat with the help of regional committees to encourage the number of responses.

ISPRS has also addressed their national member organisations to solicit further official responses.

7. ISPRS has initiated the analysis of the responses. A MS-Access database has been developed to systematically analyse the replies to the 27 questions in a more simplified manner (see attached layouts). The database is now usable for the analysis of the responses of the first 62 countries, but it is easily expandable to a larger number of country replies. As only 62 countries have completed the forms the analysis below refers to the preliminary data set for the 62 countries.

The Access database is available to UN-GGIM. It could also be made available in expanded form to the Member States including access forms, which they could easily fill with further detailed information. The design of the database has been completed by Uwe Breitkopf of the Institute for Photogrammetry and Geoinformation, Leibniz University, Hannover.

It contains the following forms, which can be analyzed by MS-Access software.

QUESTIONNAIRE ON THE CURRENT STATUS OF MAPPING IN THE WORLD

PART A: National Topographic Mapping Coverage

Country ID:

Country Name:

Area km²:

PART B: National Topographic Mapping Coverage

Question 1:

Question 2:

Mapping Scales available (y/n)

Mapping Area per scale (in %)

Mapping Age per scale (in Years)

I - 1 : 1 000 or greater

II - 1: 5000

III - 1: 25 000

IV - 1: 50 000

V - 1:100 000

VI - 1:250 000

VII - 1:500 000

VIII - 1: 1 million or smaller

3: Access Restricted

4: Availability Sold to the public Data free of charge

5: Update Complete Features

6: Method of Update Field surveys Satellite imagery

Aerial photography 3rd party

Photogrammetric Crowd sourcing

7: Where In-house Outsourcing

PART C: National Imagery Acquisition

8: Programm of Aerial Data Acquisition Programm exists Domestic capabilities

Regular intervals Analog Digital

QUESTIONNAIRE ON THE CURRENT STATUS OF MAPPING IN THE WORLD

9: Programm of Satellite Data Aquisition	Programm exists <input type="checkbox"/>	Domestic capabilities <input type="checkbox"/>
	Regular intervals <input type="checkbox"/>	On Demand <input type="checkbox"/>
10: Lidar/Radar		Lidar/Radar <input type="checkbox"/>
11: Lidar for DEM	Coverage in km ² : <input type="text" value="0,80"/>	Pts/m ² : <input type="text" value="0"/>
12: Orthophotos	Produced <input type="checkbox"/>	Scales: <input type="text"/>
13: National DEM	Existence <input type="checkbox"/>	Scale (m): <input type="text"/>
14: 3D Models	Produced <input type="checkbox"/>	
PART D: National Surveying and Cadastral Coverage		
15: Licensed Surveyors		Existence <input type="checkbox"/>
16: National Cadastre	Map coverage <input type="checkbox"/>	National Mapping Agency responsible <input type="checkbox"/>
17: Use of Cadastral Maps	Land Registration <input type="checkbox"/>	Titles <input type="checkbox"/>
	Conveyancing <input type="checkbox"/>	Taxation <input type="checkbox"/>
	Other <input type="checkbox"/>	
18: Cadastral Maps based on Geodetic Control		Existence <input type="checkbox"/>
19: Property Boundaries Monumented		Existence <input type="checkbox"/>
20: Update of Cadastral Maps		Transaction <input type="checkbox"/>
21: Number of Surveyors	Official: <input type="text"/>	Private: <input type="text"/>
PART E: Organization		
22: National Funding		Existence <input type="checkbox"/>
23: Mapping Budget	Annual: <input type="text"/>	
24: Number of Employees	Total: <input type="text"/>	Technical: <input type="text"/>
25: Regulations or Laws		Existence <input type="checkbox"/>
26: Delivery Percentages for Map Products	Hard copy paper: <input type="text"/>	Digital Data: <input type="text"/>
	Downloads: <input type="text"/>	Web Services: <input type="text"/>
27: Archival Method	Server/Database: <input type="checkbox"/>	Digital/DVD: <input type="checkbox"/>
		Hard copy: <input type="checkbox"/>

8. The preliminary findings are as follows:

A) National Topographic Mapping Coverage

- 1) Most NMAs have only listed their coverage for the scales, for which they are responsible. No mention was made in some responses of the large scale coverage of urban areas under responsibility of the municipalities. 21 listed map coverages in category I, 32 in category II, 36 for III, 58 for IV, 32 for V, 56 for VI, 32 for VII and 42 for VIII
- 2) Some NMAs have provided graphical indexes of their map coverage, and some have even indicated the last update of the maps, but the supplied data were inconclusive with respect to the data coverage in km² or in % of the national area.

Some NMAs have listed links to their web-sites. Most of these are in their national languages. Again it is very difficult to extract the desired information.

- 3) In most countries, the maps are freely accessible without restrictions. Only 14 countries (out of the 62) have restrictions on maps.
- 4) In 53 countries, map data are for sale in analog and digital form. Generally only small scale overview maps are available through the web. In 11 countries they are offered at no cost, and 5 countries do not sell the maps to the public.
- 5) 52 countries update their maps. 18 countries do not have regular map updating programs and update the maps only on demand, but 32 carry out regular updating by map sheets and 20 by features.
- 6) The methodology of updating is generally by photogrammetry supported by field surveys in large and medium scales and from satellite images at large scales. 48 countries list field surveys, 50 aerial photography, 44 photogrammetry, 39 satellite images, 36 third party surveys and 10 crowd-sourcing.
- 7) 53 NMAs have in-house mapping operations (36 in-house only), 24 practice outsourcing (7 have only outsourcing) and 17 have both.

B) National Imagery Acquisition

- 8) 39 countries have a national aerial photography program, 37 have domestic capabilities, but only 26 fly at regular intervals, the others procure imagery on demand. 49 countries use digital imagery (31 digital only), 26 traditional analog imagery and 18 utilize both types.
- 9) Only 21 countries have a national satellite imagery acquisition program. 9 have domestic imagery providers. 13 request images at regular time intervals, but 45 request images from the suppliers on demand.
- 10) Radar imagery is used in cloud prevalent countries, and Lidar in most developed countries. Developing countries have not introduced this technology. Altogether 34

countries use radar or lidar sensors.

- 11) Lidar is used for DEMS mainly in the developed world.
- 12) Orthophoto technology is generally used in 57 countries to bridge the time gap for map updates.
- 13) National DEM's are established in 48 countries.
- 14) With exceptions from the developing countries 33 countries are interested in 3D modelling information for viewing urban landscapes.

C) National surveying and cadastral coverage

- 15) 51 countries have licensed surveyors for property surveys.
- 16) A national cadastral map coverage is available in 41 countries, but only 30 NMAs have the responsibility for it.
- 17) The use of cadastral maps is generally for securing titles (45), for taxation (39), for land registration (50), for conveyancing (36) and for other reasons (16).
- 18) In 52 countries cadastral maps are based on geodetic control.
- 19) In the majority of countries (43) property boundaries are monumented in the field.
- 20) Updating of property maps in 42 countries is done by transaction procedures.
- 21) The number of employees or private surveyors engaged in cadastral operations is usually much larger than the personnel engaged in topographic surveys.

D) Organisation

- 22) In general topographic mapping is nationally funded in 55 countries.
- 23) Some countries (34) list their budget and this is proof that mapping is a very substantial highly regarded operation.
- 24) The number of staff engaged in mapping in the developed countries exceeds the number of staff in the developing countries.
- 25) In most countries (57) NMAs have legal or regulatory status.
- 26) Even in developing countries the supply of digital map data exceeds that of analog products. Online and web delivery of map data is generally only available in developed countries. 56 countries list hard copy maps as possible output, 55 digital media, 30 downloads and 28 the web.
- 27) All countries care about archiving their map data in analog or digital form. 25 list servers, 36 DVD's or disk and 29 hard copy.

The information collected will eventually be used to develop country profiles, to identify good practices and lessons learned in the provision and dissemination of timely geospatial data.

IV. Discussion

9. Another Access database has been created by ISPRS to compare the results of the current 2012 UN-GGIM study data with the data of 1986 published in World Cartography XX, 1990.

To compare the country data between 1986 and 2012 it is necessary to relate the areas of the countries of the world to the current status, as some countries have merged (e.g. Yemen) and some have split (e.g. Sudan – South Sudan). This is no problem, if the data for mapping coverage are available for each scale at a km² basis.

10. Resolution 3/IX (E/Conf 99/3) of the UNRCC-A, held in New York in 2009, recommended that the study should take into consideration official national mapping agencies, other institutions, and the private sector, including both the status of technological and legal issues pertaining to geospatial data.

11. In this regard, ISPRS has established contact with the following private sector institutions, in the hope that they will communicate for the purpose of the study their acquired imagery and mapping coverage:

- Google Earth and Google Maps (imagery and maps)
- Microsoft Bingmaps (imagery and maps)
- TomTom (road features)
- Navteq (road features)

12. ISPRS has also established contact with the commercial map providers:

- Eastview Geospatial, Minneapolis, Mn., USA
- ILH Stuttgart, Germany

These companies provide internationally available maps for sale, including map indexes which can help to verify the information obtained in the surveys and permit to supplement missing data.

13. The questionnaire survey conducted by the UN-GGIM Secretariat has not only provided the requested data, but the questionnaires have also identified discussion partners, with whom it will be possible to clarify the desired information, so far missing.

14. According to the schedule drafted in December 2011, the project is on schedule.

15. In continuation, the following schedule is proposed as indicated in the table.

no.	task	responsibility	time	status
1	Design of questionnaire	G. Konecny & E. Jaeger, Hannover	till Jan 20, 2012	completed
2	Verification of questionnaire - with EuroSDR	C. Heipke & K. Mooney, EuroSDR	till Feb 20, 2012	completed
	- with ISPRS Secretariat	- Chen Jun, ISPRS & Ms Shang Yaoling & Dr. Zhao Renliang	till Feb 20, 2012	completed
3	Submission for revision to UN-GGIM Secretariat	- G. Konecny, Hannover to A. Laaribi/ G. Scott, UN-GGIM	till March 1, 2012	completed
4	Contact to private enterprises with request for cooperation: - Google - Microsoft - Navteq - TomTom - Eastview Geospatial - ILH Stuttgart	G. Konecny	till April 1, 2012	completed
5	Compilation of addresses and mailing	A. Laaribi	Mail by April 27, 2012	completed
6	Receipt of answers by UN-GGIM	A. Laaribi	Responses between June 1 and July 27, 2012	completed
7	Transmission of received data	A. Laaribi to G. Konecny	June 5 to July 24, 2012	completed
8	Review by ISPRS Secretariat	- Chen Jun, ISPRS & Ms Shang Yaoling & Dr. Zhao Renliang	by July 24, 2012	completed
9	Preparation of interim report to UN-GGIM	G. Konecny	by July 27, 2012	completed
10	Interim presentation UN-GGIM in New York	G. Konecny	August 13-15, 2012	in process
11	Interim presentation at ISPRS Congress, Melbourne & solicitation for missing answers	G. Konecny	August 25-31, 2012	in process
12	Inputs by GGIM Committee and advice regarding finalization of project	A. Laaribi for collection of suggestions	August 15-Sept 15, 2012	proposed
13	Communication with regional and national members for supply of missing data	A. Laaribi	October 1, 2012	proposed

14	Detached draft analysis of survey	G. Konecny	Nov 1, 2012	proposed
15	Preparation of joint report by GGIM and ISPRS	A. Laaribi & G. Konecny	December 31, 2012	proposed
16	Presentation of results at the Second High Level Forum on GGIM, Doha, Qatar		February 4 , 2012	proposed