

The 2010 round of Population and Housing Censuses in the world

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Summary

The 2010 World Population and Housing Census Programme, covering the years 2005-2014, is underway. 94 countries or areas have already undertaken a census, which represents more than one fourth of the population of the world. More than 50% of the censuses will be conducted in 2010 and 2011.

With an average cost of 2.9 US dollars per capita, the census entails very high costs for countries and many developing countries request the support of international sponsor institutions to finance the gap.

To tackle these issues, amidst increasing demand for statistical information, countries invest in technology and/or alternative methodologies in order to reduce costs, improve the quality and the timeliness of the dissemination of their census results. The 2010 round witnesses the spread of technologies such as Geographic Information Systems, handheld devices, Internet questionnaires, Optical Character Recognition Data Capture, and web-based dissemination. Alternative methodologies such as register-based censuses are contemplated by a growing number of countries, including countries with no existing population register. Rolling censuses are used for the first time in this round, but their successful implementation in France and the United States is promising.

This paper presents the main results of a survey conducted by the United Nations Statistics Division and the United Nations Regional Commissions to monitor the progress of the 2010 round of Population and Housing Censuses in the world.

1. Introduction

Since more than six decades, the United Nations Statistical Commission plays a leading role in supporting the implementation of censuses in the Member States. During its thirty-sixth session in March 2005, the Statistical Commission launched the 2010 World Population and Housing Census Programme covering the period 2005-2014. The three essential goals of the programme were for Member States to agree on a set of acceptable international principles and recommendation governing the conduct of a census; to conduct a census at least once during the period 2005-2014 in every country; and to disseminate census results in a timely manner (United Nations, 2005).

The 2000 round was characterized by a certain number of failures in its implementation. Indeed, 27 countries or territories did not carry out a census during the period 1995-2004, mainly in Africa where about half of the population was not enumerated. The main reasons included the political situation (instability, conflicts), but also budget issues linked to the heavy financial burden of the census for a country, in addition to a certain disengagement of international sponsors. Moreover, the quality of some of the censuses carried out during this cycle has been questioned, especially in terms of coverage of the population.

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2. The implementation of the 2010 round of population and housing censuses

The situation seems better for the current 2010 round. At the end of May 2010², 94 countries or territories had already carried out a census (Fig. 1). They represent 26% of the world population. In 2010, 53 censuses are planned, but the peak will intervene in 2011, with 63 countries, of which European countries under the terms of the European Community Regulation. On this date, 93% of the population will have been enumerated. However, 7 countries or areas did not plan a census yet, and a certain number of censuses, in particular in Africa, were already postponed for one year or two. For example, 64 censuses were expected to be conducted in 2010 two years ago, actually only 53 are still planned for this year.

Table 1. Number of census taken/scheduled by region and year, 2010 round

Region	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	No census scheduled	Total
Africa	1	6	5	6	5	11	7	5	4	3	4	57
America, North	2	4	1	1		14	11	3	1			37
America, South	2	2				4	2	4				14
Asia	6	4	2	3	4	14	8	2		3	3	49
Europe	1	3		1	2	4	35	1	1			48
Oceania	3	8	2	1	3	6		2				25
Total	15	27	10	12	14	53	63	17	6	6	7	230

If half of the censuses will be taken in 2010 or 2011 at the global level, the situation is less concentrated in Oceania and Africa, where 24% and 32% only of the territories will undertake a census in 2010 or 2011, compared to 68% in North America and 78% in Europe.

Table 2. Proportion of countries or areas undertaking a census in 2010 or 2011, by region

Africa	32%
America, North	68%
America, South	43%
Asia	45%
Europe	78%
Oceania	24%
Total	50%

² 2010 World Population and Housing Census website, UNSD

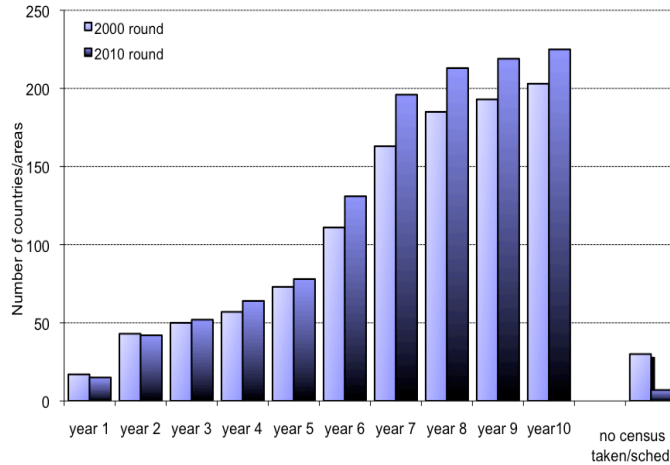


Figure 1. Number of census taken by year, 2000 and 2010 rounds

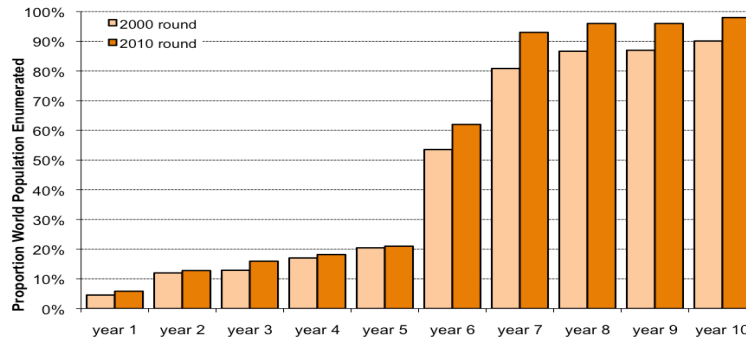


Figure 2. Cumulated percentage of population enumerated by year, 2000 and 2010 rounds

3. The cost of the census

The census is the most costly statistical operation and many countries face difficulties to finance this operation. A regular survey conducted by the United Nations Statistics Division monitors the costs of national censuses (in dollars of the United States) and their breakdown. The most recent data from this survey cover 129 countries or territories that represent 66% of the world population. The median census cost per capita is \$2.9, but varies among regions.

In Asia, Africa and South America, the median cost of the census is around \$2 per capita, but reaches \$5.7 in Europe and \$9.8 in North America. Oceanian countries face the highest costs, due the combination of small population, which increased the cost per capita, and their geographical characteristic of archipelagos. With a cost per capita of \$46, the 2010 census of the United States is the most expensive census, not considering Oceanian countries.

The cost per capita of the 2010 census of Brazil amounts to \$4.4, higher than the average of South American countries. The huge surface area of the country, with remote areas difficult to reach, as well the investment in new technologies justify the higher cost, which anyway remains inferior to the median European cost per capita.

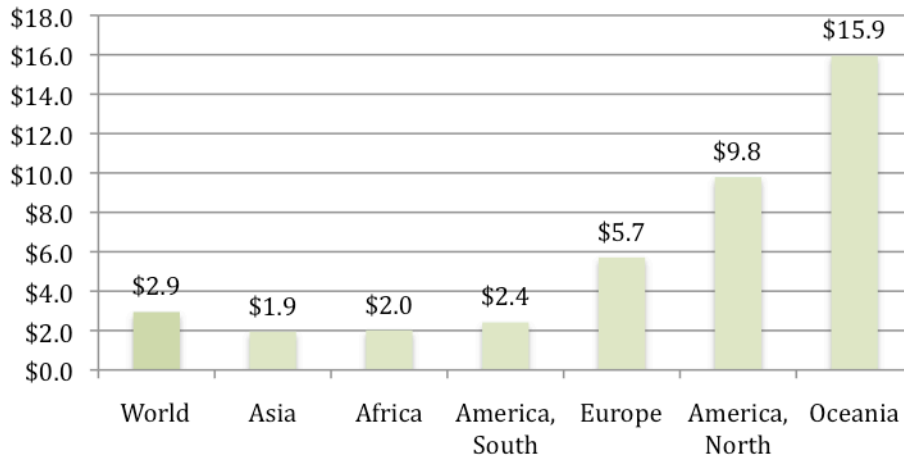


Figure 3. Median census cost per capita in US dollar by region, 2010 round

As shown in Figure 3, there is a certain negative relation between the size of the population and the cost per capita because of some fixed costs, such as questionnaire design or computer programs development, as well as decreasing marginal costs for example for printing and data capture.

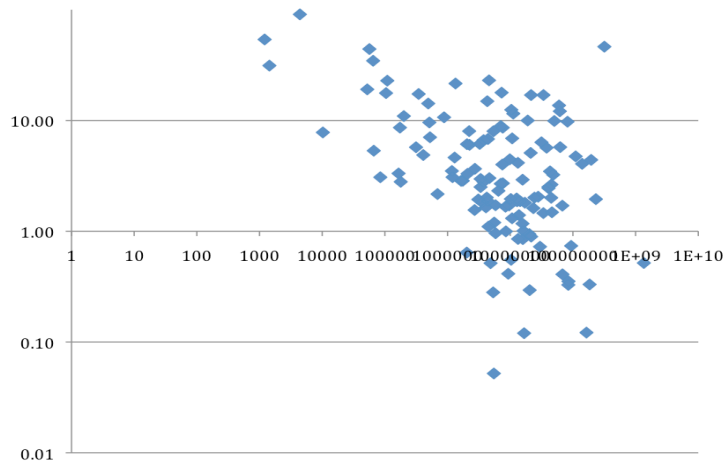


Figure 4. Median cost per capita in US dollar by population size of the country/area, 2010 round, log-log scale

Many developing countries are not able to finance the total cost of their census and have to request financial support from international sponsors. In Africa, the average proportion of the census budget covered by the national budget is only 56%, whereas this proportion is 83% in Oceania, 84% in Asia, 93% in North and Central America, and 100% in South America and Europe.

What are the respective costs of each activity? Table 3 gives the average breakdown by broad census activity for each region. The variation across the various activities for different countries will depend on a number of factors including: labour costs within the country, density and spread of population across the country, difficulty in accessing some parts of the territory,

mode of enumeration used (mail, personal interview, drop off/pick up of the questionnaires, internet...), and level of sophistication of technology. Despite the fact that labour costs vary widely across the regions of the world, the cost of staff for enumeration tends to dominate the overall budget of most censuses. Most regions spend an average of 30%-50% of the census budget in enumeration.

In average, countries devote 10% of the budget for the preparation, 1,6% for the pilot census, 6% for cartography (delineation of enumeration areas and preparation of maps for the enumerators), 4% for the publicity campaign and communication, 4% for printing (questionnaires and other documents), 2% for transportation, 8% for equipment, 1% for post-enumeration evaluation, 10% for data processing (data capture, coding and editing), 2% for analysis and 4% for dissemination.

The most important variations are found for cartography, depending on the size of the country but also on the availability of existing maps. Many countries, for example in Africa or in South America, have devoted an important part of the budget to develop a Geographic Information System for the 2010 round, as explained below. The portion of the budget put on dissemination also varies different across the regions, Europe, Oceania and North America devoting more than 4% of the budget to disseminate the results of the census. Nevertheless, it is encouraging to see in Africa, where previous censuses were notably under disseminated, countries have taken into consideration this issue and allocated in average 3.5% of the budget to dissemination.

This suggests that there might be reasonable interval ranges for each of the categories that could be used for apportioning budget when planning for future census rounds, regardless of the country or region in question. Of course, these intervals may shift somewhat in the future, as the tendency towards the increased use of more sophisticated and costly technologies is adopted.

Table 3. Breakdown of census budget by activity by region, in percentage, 2010 round

Activity	Africa	America, North	America, South	Asia	Europe	Oceania	World
Preparation	7.4	9.0	4.8	10.4	12.3	17.4	10.4
Pilot census	0.9	2.2	1.6	1.0	2.6	1.1	1.6
Cartography	12.9	8.9	32.4	2.3	2.9	1.3	6.3
Publicity	4.1	2.9	4.2	6.0	3.5	4.3	4.3
Enumeration	44.5	44.1	36.4	49.8	37.5	32.7	42.9
Printing	3.7	4.4	1.8	5.0	3.6	3.1	4.1
Transport	3.0	1.2	0.5	2.0	1.1	1.6	1.8
Equipment	4.7	5.6	6.5	8.0	10.3	5.3	7.5
Evaluation	0.9	1.2	0.5	1.2	1.2	0.4	1.0
Data processing	5.5	12.2	6.9	5.5	13.4	17.5	9.5
Analysis	1.7	1.8	2.5	1.4	2.8	5.9	2.2
Dissemination	3.5	4.0	1.3	1.6	5.5	5.1	3.7
Other	7.4	2.6	0.7	5.6	3.4	4.4	4.8
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0
<i>Number of responding countries</i>							
	17	11	2	22	24	5	81

4. Methodological approaches

The traditional way of conducting a census, by the means of canvassing the whole country at a time, is still the dominant method and more than 80% of the countries are implementing or plan to implement a traditional census for the 2010 round. In Europe, only 54 % of the countries will conduct a traditional census. The advantage of the traditional approach lies in its ability to provide a snapshot of the entire population at a specified period and the availability of data for small geographic domains. But this method involves huge costs as well as important problems of organization. In addition, some problems of quality are encountered, especially in urban areas where households can be easily missed by the enumerator.

To resolve these problems, many countries have developed alternative methods to conduct a census. The most important one is the use of administrative registers to generate census data. The idea emerged in the 1970s and has been debated and tested to various degrees since then but was really implemented in the 2000 round of censuses. One of the essential preconditions of this approach is that the country should have an established central population register of high quality and good coverage linked with a system of continuous updating. The primary advantages of a register approach are reduced cost for the census process and greater frequency of data. However, establishing and conducting administrative registers involve higher costs than the census alone may justify. In addition, the information available is limited to the one available in the registers, and the introduction of new topics is sometimes impossible.

A growing number of countries are conducting a register-based census. Among them the Northern European countries, which have a long tradition in the domain, but also new comers like Turkey or Slovenia, that are experiencing a register based census for this round. The difficulty for Turkey is to build the register and use it for the census at the same time. India is also building a population register, with the aim of using it later to complement the census. It is noticeable that in India, the decision to build a population register was taken after the Mumbai attack, for security purpose.

In addition, some countries developed a mixed approach, whether it is a combination of full enumeration and registers as in Italy, Latvia, Lithuania or Spain, a combination of register-based census, sample survey and traditional census of households as in Poland, a complete integrated system of registers and surveys as in the Netherlands.

The second way of renovating the methodology is followed by France and to a certain extent by the United States. Based on the ideas of Leslie Kish, it consists in carrying out a rolling census. The rolling census is a continuous cumulative survey covering the whole country over a period of time. In France, the results are obtained by cumulating data over five years. The main advantage of this approach is the higher frequency for updating data: a traditional census provides an update every 5 or 10 years, whereas a rolling census provides annual updates. Another advantage is in smoothing the burden and cost of the census. Further, it is possible to improve the process year after year and test new technologies. The central disadvantage is that this approach no longer provides a simultaneous snapshot of the whole population, complicating comparisons between areas enumerated at different times, even if data are adjusted to have the same reference period.

France has implemented a full rolling census in 2004 and since then conducts regular annual surveys. The United States replaced in 2005 the long questionnaire of the decennial census by a rolling survey named American Community Survey (ACS), but preserved the decennial census with a short questionnaire. The first results of the ACS combining three years of investigation were produced in 2008.

Many countries are interested in this method, in particular those not having a register of population and not planning to have one. For example, experimentations are conducted in Brazil with the aim of testing the possibility of implementing a rolling census for the 2020 round.

Table 4. Census methods in use for the 2010 round

Region	Traditional census	Administrative registers	Combination enumeration + register	Multiple Sources	Rolling census	Traditional census + rolling survey	Total
Africa	52						52
America, North	32	1				1	34
America, South	13						13
Asia	42	2	1	1			46
Europe	27	15	4	3	1		50
Oceania	25						25
Total	191	18	5	4	1	1	224

5. Cartography

The use of advanced technology is another way to improve the efficiency of the census. Cartography is one of the domains of the census that have the most benefited from technological innovations. The fast growing capabilities of Geographical Information Systems (GIS) and the easier access to satellite images, associated or not with coordinates obtained by Global Positioning System (GPS), have considerably improved the quality of the maps produced for census enumerators.

The accuracy of the delineation of enumeration areas and the quality of their representation on a map have indeed a crucial impact on the quality and reliability of census data. In the enumeration phase, maps play a vital role in guiding enumerators to dwellings and other places where people are likely to be during the enumeration period. They are important in ensuring full and unduplicated coverage of geographic areas (United Nations, 2008).

Some countries, like South Africa (Basson, 2007), delineate the enumeration areas directly on aerial or satellite images and send then the personnel on the ground to refine the delimitation and to capture coordinates GPS of equipment (schools, hospital...) and of all the dwellings, in order to build a Dwelling Frame. This preparation in the office reduces the field work and save resources and time. The analysis and the diffusion of the census results also benefit from the functionalities from the geographical information systems, by the comparison of the data of census with data geographical or coming from other sources.

In Brazil (Fortes, 2007), census mapping is subdivided into a rural and an urban component, both of them digital, corresponding to a hybrid solution of raster data (topographic and cadastral maps) and vectorial data (municipal boundaries, enumeration areas delineation, information derived from GPS surveys, etc.), the latter structured on Geographic Information Systems. The important innovation is the National Address File for Statistical Purposes - CNEFE, prepared from records of units surveyed in 2000. This file aims at covering addresses of the residential and non-residential units of the country, including those in rural areas. In the rural area, the geographical coordinates necessary to geo-coding rural properties are also collected, as well as health and education establishments.

The use of GIS and digital maps is now very developed in South America and Africa (Figure 5). In Africa, many projects have been launched during the 2010 round to digitize existing sketch maps or use satellite images to prepare the census cartography. Unfortunately, some countries still face financial or staffing issues to carry out successfully these projects.

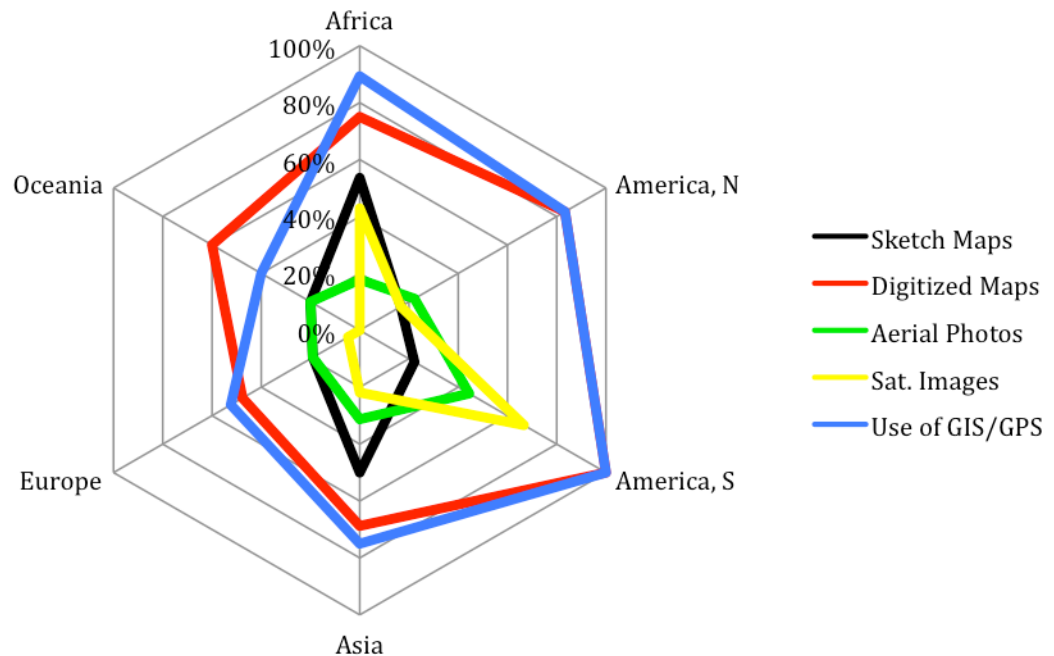


Figure 5. Technology used for census cartography, in percentage, by region. 2010 round (134 responding countries/areas)

6. Pilot Census

International Recommendations (United Nations, 2008) advise to conduct a comprehensive test of all census procedures before the census. This test is often called a “pilot census”, or “Dress rehearsal”. It is recommended to undertake a set of tests of all ICT components related to the field work, data entry and processing well ahead of the census itself. This is particularly important if a new technology is being introduced, such as questionnaires scanning, Internet data collection or use of hand-held devices. The pilot census is often taken exactly one year before the planned census so as to conform to the expected seasonal patterns of climate and activity.

Almost 90 % of the 134 countries or areas for which responses are available for this item, have conducted or planned to conduct a pilot census, in average 14 months before the census date. Actually, 50% of the countries/areas conduct a pilot census exactly one year before the census, 40% between one and two years, and 10% more than two years before the census. This latter situation is more likely due to a postponement of the census.

7. Mode of enumeration

In a majority of countries, the enumerator interviews the population and fills the forms (paper or electronic) himself. This mode of enumeration is the main one in developing countries,

where part of the population may not be literate enough to fill the questionnaire. It is used marginally in developed countries, for example as in the United States to obtain responses from household that didn't send back their questionnaire. In one fourth of countries, the population is self-enumerated, that is to say that households receive a questionnaire by mail and have to send it back (mail-in mail-out) or an enumerator drops off the forms and comes a few days later to pick them up.

The 2010 round witnesses the rise of Internet data collection. Reasons for developing an Internet option are numerous, including general government policy (Australia, Canada), cost reduction issues (Korea), or strong public demand related to new lifestyles and privacy concerns (Australia, New Zealand). Australia and Canada obtained rates of responses by Internet of about 9% to 16% in 2006 and are expecting a significant increase for their next census in 2011.

32 countries or territories will offer to the whole population, or only to the population in selected areas, the possibility to fill the census forms through the Internet. Logically, 23 among the 32 are countries where the population is self-enumerated. But 9 countries using face to face interviewers, including Brazil, have developed an on line application for census data collection.

Table 5. Methods of enumeration by region, 2010 round

Region	Face to face Interview	Self-enumeration	Internet
Africa	28	3	
America, North	16	6	5
America, South	9		1
Asia	30	9	10
Europe	25	16	14
Oceania	4	3	2
World	112	37	32

Note: the columns don't add up as some countries/areas may use several modes.

Some countries, Colombia, Brazil, or Oman, have decided to invest massively on the portable data capture, using handheld devices such as Personal Digital Assistant (PDA). Oman (Oman, 2004) was the first country to implement PDA data collection in 2003, for the Governorate of Muscat. Colombia conducted the 2005 census with PDAs during an extended period of enumeration to reduce the number of PDAs needed. Brazil conducts the census 2010 by means of more than 110.000 PDAs equipped with a GPS functionality, after having successfully carried out the agriculture census and a population headcount in 2007 using PDAs. The interest of such devices lies in the possibility of integrating consistence and validity checks during the interview of the household, to transmit the data instantaneously, and to facilitate the control of the enumerators' work, for example by checking that coordinates GPS collected correspond to the enumeration area assigned. Of course, PDAs cannot be used for self-enumeration, but only for face to face interviews, either in the whole country or only for non-respondents to a first mail stage.

For the 2010 round, at least 13 countries will use PDAs for the data collection, as main mode of data collection or in combination with other modes, such as paper questionnaires or Internet. There is an obvious regional effect, as it is easier to learn from neighbours. In South America, Paraguay and Uruguay will follow the example of Colombia and Brazil, and in the Persian Gulf, United Arab Emirates benefit certainly from the experience of the Sultanate of Oman.

The cost of such devices is still high, but however is to be compared to the costs of printing, transport and capture of paper questionnaires. But actually none of the countries using PDAs for the data collection of their census have published a cost-benefit analysis.

8. Data processing

Data processing covers the capture of the data collected as well as the steps of coding, control and editing. If data collection via Internet or PDA provides immediately the data in electronic format, paper questionnaires still need to be captured.

Technologies of questionnaires capture are also in constant progress, in particular with regard to the technologies of optical data capture. Rapid advances in technology have greatly increased the speed and reliability of producing census databases in an accurate and timely manner. These technologies are now affordable and many countries use them or plan to use them for their census. Nevertheless in the recent past many countries have faced difficulties in mastering these technologies, sometimes by lack of preparation or sufficient knowledge to avoid the numerous pitfalls.

Optical data capture methods include Optical Mark Reading (OMR) and Optical/Intelligent Character Recognition (OCR/ICR). OMR uses special scanners to automatically extract data from the census form by the recognition of marks (such as tick boxes or multiple choice lozenges) in specific locations on the form. OCR/ICR uses software that attempt to recognise handwritten text on each census forms' scanned image. Few countries, only 9, will use only Optical Mark Recognition technology. The use of OCR/ICR in combination with OMR becomes more frequent, and 59 countries at least are using this technology for the 2010 round.

However, 34 countries at least will consider manual data entry, mainly in Africa but also in Oceania, due to the small size of some of them.

To assign classification codes to the various written responses on the census form, there is a need for a coding system. The coding system can be clerical or computer assisted, with various degrees of automatism. For the 2010 round, computer assisted coding is in progression. Only 1 among 5 countries will resort to strictly manual coding, using code books, whereas the others will carry out automatic or computer assisted coding.

In terms of editing, that is to say checking non-responses and inconsistencies and fixing them, the majority of countries use a combination of automated and manual system. Only 20% of the countries use a completely automated process, and only 5% a strictly manual one. Manual editing has the serious drawback of introducing human bias in the correction of errors. Among the software packages used for edition and imputation, CSPRO, developed by the US Bureau of Census, is the most popular, with more than 32 countries/areas using it.

9. Evaluation

It is commonly accepted that a population census is not perfect and that errors can and do occur at all stages of the census operation (United Nations, 2010). Errors in the census results are classified into two general categories - coverage errors and content errors. Coverage errors are the errors that arise due to omissions or duplications of persons or housing units in the census enumeration. Content errors are errors that arise in the incorrect reporting or recording of the characteristics of persons, households and housing units enumerated in the census. Many countries have recognized the need to evaluate the overall quality of their census results and have employed various methods for evaluating census coverage as well as certain types of content error.

Numerous methods are available for estimating coverage and content errors of censuses. Demographic analysis and post enumeration surveys are the two major methods for evaluating census data. Two thirds of the countries or territories conduct a Post Enumeration Survey to evaluate the coverage of the census, among them 75% to evaluate also some content errors. In Africa, Asia and South America, almost 80% of the countries undertake a PES, versus only 40% of the Oceanian countries. Nevertheless, many countries faced difficulties to achieve successfully a PES during the previous round of censuses and requested technical assistance for the current round. In response, the United Nations Statistics Division organized over the last year a series of workshops on census evaluation and published guidelines on the implementation of PES.

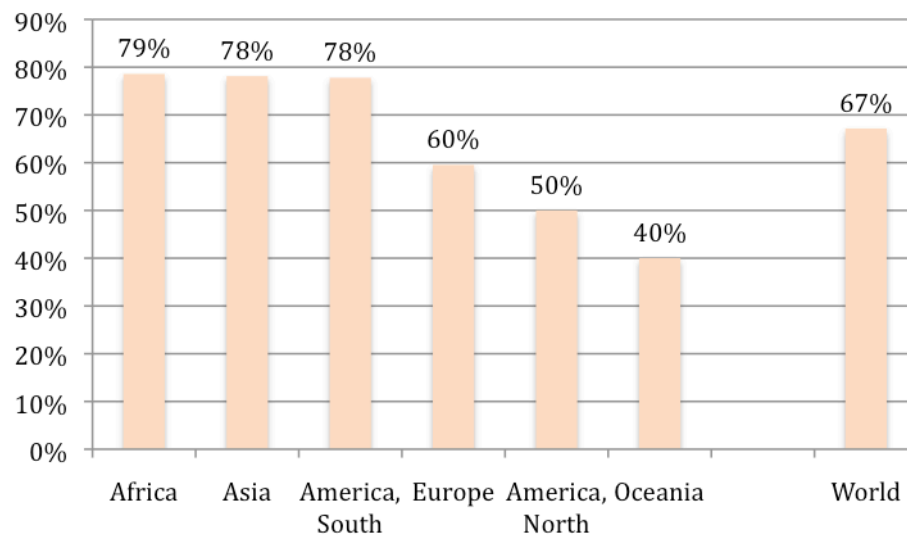


Figure 6. Proportion of countries implementing a Post Enumeration Survey, by region. 2010 round (134 responding countries)

Only one third of the countries implementing a PES use the results to adjust the census figures. Finally 15% of the countries undertake only demographic analysis to evaluate the quality of their census.

Three among four countries publish an official report of the census evaluation and the quality of the census data, however detailed is this report.

10. Dissemination

Dissemination was the weakest point of the censuses of the 2000 round. Many developing countries could not fully disseminate the census results to the public. But a census is not complete until the information collected is made available to potential users in a form suited to their needs. A wide range of statistical products can be made available to the public, the private sector, government agencies, local authorities and the academic and research communities (United Nations, 2008).

The information may be included in published tables or reports for general distribution, produced as tables in unpublished form for limited distribution or stored in a database and supplied upon request.

Almost all countries/areas present their census results in printed publications. However Sweden, Italy, Denmark, France, Singapore, Greenland, Australia and Belgium have indicated that they will not publish paper reports of census results.

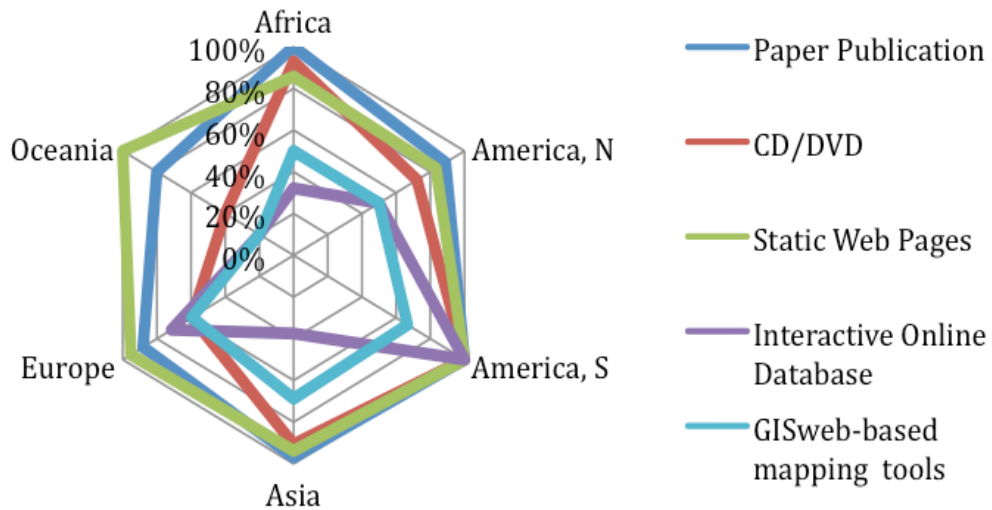


Figure 7. Technology used for census dissemination, in percentage, by region. 2010 round (134 responding countries)

The use of the Internet to disseminate at least static web pages is now well established, but only half of the countries/areas will disseminate interactive online databases, giving the possibility to users to make their own requests. South America appears as leader in this domain as all the 9 responding countries plan to offer online databases. In Africa, where the access to the high-speed Internet is still scarce, only one third of the countries intend to develop such interactive online databases. The use of GIS web-based mapping tools is growing and half of the countries of areas express intentions in this domain.

The dissemination of micro-data represents a very powerful way of giving opportunity to advanced users, such as academics, to perform their own tabulations and research by themselves. On average, more than 50% of countries/areas will disseminate micro-data to the public, but only 32% in Africa.

In addition, it is recommended to establish an “on request” service for users who require aggregates not available through other means. This is especially relevant in situations where outside users cannot obtain census micro-databases. About 72% of responded countries are providing service to address individual requests, but only 40% in Oceania and 64% in Africa. Among the countries where the service is available, 73% of them indicated that they were or will charge a fee.

Table 6. Dissemination by region, 2010 round

Region	Micro data	Tabulation upon request		System to Archive Data
		Available	If available, fee charged	
Africa	32%	64%	67%	71%
America, N	56%	72%	62%	56%
America, S	78%	100%	89%	78%
Asia	56%	78%	64%	81%
Europe	62%	71%	83%	79%
Oceania	60%	40%	100%	40%
World	54%	72%	73%	73%

(134 responding countries, 28 in Africa, 18 in North America, 9 in South America, 32 in Asia, 42 in Europe and 5 in Oceania).

Archiving census data is of critical importance, and many censuses have been lost in the past due to lack of appropriate storage and archiving mechanism. International organizations or institutions, such as the World Bank or the IPUMS (University of Minnesota) expend a lot of efforts to provide either tools for census or surveys documentation and archiving, or centre to host documented census micro-databases. It is still worrying that only 73% of the countries or areas responding to the UNSD questionnaire indicated that they will use a system to archive their census data. Nevertheless, the fact that almost 3 out of 4 African countries declare to have a system to archive census data is promising, as Africa is the most problematic region in terms of census data conservation.

11. Final remarks

This mid-round analysis of 2010 Round of Population and Housing Censuses provides a first picture of the implementation of censuses in the world. If the situation appears better than for the 2000 round, countries still face difficulties in carrying out such a huge statistical operation, especially in the developing world. The main issues remain the budget, but also the lack of skilled personnel, in particular to process, analyse and disseminate the results. But developed countries also face financial problems in a context of reduction of public expenses and budget deficits.

Similar assessment will have to be conducted as the end of the round to draw conclusions of the utilisation of new technologies as well as alternative methodologies and propose directions for the 2020 round.

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