

CONFERENCE OF EUROPEAN STATISTICIANS

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For discussion and
recommendations

Item 2 (b) of the Provisional
Agenda

**In-depth review of diversification of population census
methodology and sources**

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The present note is the in-depth review paper on “diversification of population census methodology and sources.” The purpose of the reviews is to improve coordination of statistical activities in the region of the United Nations Economic Commission for Europe (UNECE), identify gaps or duplication of work and address emerging issues.

The Bureau is invited to discuss issues raised in the paper and consider the need for further work.

I. Executive summary

1. In modernizing world, decision and policy makers need more accurate, timely, up-to-date and detailed data for realization and evaluation of rapid changes in the society. Accordingly, National Statistical Offices (NSOs) require taking steps to meet the demands of users over time in parallel with technological innovations and country circumstances.
2. Data on society is mostly provided by population and housing censuses in the smallest administrative units' detail. This makes censuses the fundamental source for determining the current status and following the changes of the population of a country. The traditional census method based on field enumeration of all individuals, however, has a number of limitations such as high costs, managing a complex field operation, working with high volumes of enumerators, long duration of data processing, providing information in ten year intervals, respondent burden of the census questionnaire, doubts about data privacy, etc. These limitations made NSOs to consider innovations on census methodology and look at different sources and methods in census taking. In the course of time, various methods have begun to be used by the NSOs depending on the country circumstances and available technology.
3. Beside different needs of the countries, there are also contributions of globalization to the census taking. Exchanging experiences between countries, different types of support provided by international bodies, international recommendations at the global (UNSD) and regional (UNECE) level and EU regulations can be counted as main contributions. Also, to obtain accurate world population figures and to have comparable data at the country level, standardization and combination of output data derived from divergent methods and data sources used by NSOs determine the needs for coordination at the international level.
4. The Conference of European Statisticians (CES) and its Bureau play a key role to coordinate statistical activities at the international level in the region of the United Nations Economic Commission for Europe (UNECE). Each year, the CES Bureau reviews selected statistical areas in depth. The purpose of the reviews is to improve the coordination of statistical activities, identify the gaps or duplication of work and address emerging issues. These reviews focus on the strategic issues and highlight concerns of statistical offices of both a conceptual and coordinating nature.
5. The CES Bureau selected in February 2015 population and housing censuses for an in-depth review. Turkey and Finland drafted this paper that provides the basis for the review. The paper gives an overview to the various census methodologies used in the UNECE region, identifies issues and challenges and makes some recommendations on possible follow-up actions in the area.
6. The paper provides a review of the current state of the making of population and housing censuses across a number of countries. The paper describes the main issues and challenges in the area. Issues are considered from a future-oriented viewpoint. The in-depth review pays particular attention to the analysis of user needs for census statistics.
7. The review is focused on the different methods of making censuses and on current issues around the census taking in the UNECE region. The paper provides a short overview of the ongoing activities of international organizations and census taking in eight different countries with different census methodologies. The report then highlights some of the issues and challenges faced by population and housing censuses, including: managerial, conceptual issues and methodological issues. Besides that, the paper highlights issues like timeliness, the legal frameworks, cooperation of various administrations and impact of the growing users' needs for more frequent and detailed census data.

8. The report concludes with some suggested requirements for the next census round and key recommendations for the work in the UNECE region. A number of countries indicated that they would support activities to receive technical support in many areas of the census. A suggestion is made for the UNECE to organise a meeting for countries interested in developing their census to be able to use sample surveys in the estimation of some census variables. UNECE could support a preparation of new guidelines on the use of registers for censuses prepared by a small task force of experts. In addition to the usual annual expert meetings – training workshops and other activities could be organized, aimed at supporting countries in the preparation of their next census.

II. Introduction

9. The CES Bureau regularly reviews selected statistical areas in depth. The aim of the reviews is to improve the coordination of statistical activities in the UNECE region, identify the gaps or duplication of work and address emerging issues. The review focuses on strategic issues and highlights concerns of statistical offices of both a conceptual and a coordinating nature. The current paper provides the basis for the review by summarizing the international statistical activities in the selected area, identifying issues and problems, and making recommendations on possible follow-up actions.

10. The CES Bureau selected the diversification of population census methodology and sources for an in-depth review at its February 2015 meeting. Finland and Turkey were requested to prepare the paper providing the main basis for the review.

11. The review gives an overview/review of the various changes in methodology, sources and technology. The current trend on the increasing use of registers and multiple response channels (namely internet response) is likely to continue in the 2020 round.

III. Scope/definition of the statistical area covered

12. The 2010 round of population censuses has just ended in 2014, and the information available shows that there were significant changes compared to the previous rounds, particularly with regard to census methodology. In the UNECE region, there was a substantial increase in the use of alternative census methods, based in most cases on the use of registers and on multiple response channels. Internet data collection was adopted in a significant number of countries and in some cases it was the main data collection method.

13. The objectives of a census are specific to individual countries and differ according to the local circumstances. Its unique role depends on the demand for statistics existing in a country and by the content and structure of its existing statistical system.

14. The population and housing census has a central role in the administration of a country. It is the heart of an integrated national statistical system, which may include other censuses (for example an agricultural census), surveys, registers and administrative files. It provides, at regular intervals the benchmark for the population count at national and local levels. For small geographical areas or sub-populations it may represent the only source of information for certain social, demographic and economic characteristics. For many countries, the census also provides a unique source for a solid framework to develop sampling frames.

15. The role of the population census is even more important in countries where other vital statistics are not complete or accurate. In these countries, the census is the only statistical source which provides correct and detailed estimates of the population size and structure.

16. Traditionally, the definition of a census has been based on the basic principles of individual enumeration, simultaneity, universality and defined periodicity. In the last twenty years however different methods have emerged in the UNECE region whereby the census has assumed a wider concept. In some countries the traditional method based on the field enumeration of all individuals has moved to the use of data recorded in administrative registers. Furthermore, the priority of universal enumeration of individuals and their characteristics has shifted towards the need for more frequent and relevant data for the total population and the smallest local areas. Consequently, a common definition of a population and housing census for the UNECE region is now based more on the output produced rather than on the methodology used to collect the data.

17. An increasing number of countries now rely on data derived from administrative registers to produce some or all of their population and housing statistics. In these countries there is an opportunity to provide an integrated view of the country where social, demographic and economic characteristics are linked together.

18. Between 2005 and 2014, some 53 countries of a total 56 countries in the UNECE region carried out a census in one form or another. The majority of the countries (33) had a traditional census, of which nine countries reported used register information as a sampling frame or control. A register-based census was conducted in nine countries (compared to three countries in 2010 census round), a combined census in ten countries and a rolling census in one country (France). A short description of these methods is provided below¹. More detailed experiences of some countries with different census methods are presented as an appendix.

A. The traditional census

19. In general, traditional censuses use two alternative main methods of enumeration. Either census enumerators collect the information from the households through an interview and fill out of census forms, or forms are filled in by members of the household (self-enumeration). In this last approach, the forms are delivered to the households and collected back by enumerators or by mail.

20. Some countries use two types of questionnaires to reduce the amount of information to be processed. A sample of the population gets an extensive long form while a short form is used for the rest of the population. This method has its advantages: it reduces the amount of time and labour to process the collected information and limits the complexity and costs of the census operations. However, since the information collected with long forms only represents a sample of the population, census results on detailed characteristics (covered in the long form) are not available for small areas or small population groups. This approach has been used in the United States and Canada since the 1970s.

21. Although the concept of the traditional census is relatively simple, its implementation is a huge and very complex operation that requires significant financial resources (employing enumerators, supervisors, etc., printing, distributing, collecting census forms, entering the data, data processing). Moreover, in a traditional census, the costs are concentrated around the year when data are collected and are much lower in the other years of the census cycle. This cost distribution over time can create problems in management and budgeting.

¹ See also: Valente, P., 2015. Censuses: Current Approaches and Methods. In: James D. Wright(editor-in-chief), *International Encyclopedia of the Social & Behavioral Sciences*, 2nd edition, Vol 3. Oxford: Elsevier. pp. 296–301.

22. Some countries using the traditional census model have reported that it is increasingly difficult to enumerate population with high mobility and multiple residences like young professionals, students, workers, retired people, or other categories that commute regularly between two or more places). Moreover, identifying the place of usual residence of these people is often complicated.

23. Several countries have reported an increasing reluctance of the population to participate in the census. This can be due to various reasons and is more common among specific subgroups like aged population, ethnic minorities, etc.

24. Finally, there are also some problems with the outputs produced by traditional censuses. Publishing census results often takes a long time because of the large amount of information that is being processed. There is also need for data more frequently than every ten years, which is often the case with the traditional census.

B. The register-based census

25. An alternative to the traditional census is the register-based census. It is built around a set of basic registers that contain comprehensive data on the units that are to be described in the population and housing census. The most common registers used are population register, building and dwelling register, business register, social security registers and educational registers.

26. The data on different registers are normally combined by a unique identification number which is used in all administrative registers. Also, all statistical units are linked to each other by means of the identification system: persons to the dwellings/household-dwelling units and buildings, employed to their employers/enterprises and establishments. Similarly, it is possible to locate all units geographically by the map co-ordinates.

27. The development of a totally register-based population census system is a long process. It requires significant initial investments, good co-operation between national statistical institutes and the authorities responsible for different registers. Legislation that allows the use of administrative data sources for statistical purposes has a central role in developing the register-based statistical system.

28. One disadvantage of the register-based census system is that the data to be collected are limited to those available in registers, and the quality of the statistics depends on the coverage and quality of the registers themselves. However, statistical agencies can combine data from different registers to assess and increase quality and derive new variables. Another method of providing the data on variables that do not exist in registers is to make use of results from existing household sampling surveys, like in the Netherlands Virtual Censuses in 2001 and 2011.

C. The combined census (registers and field data collection)

29. Many countries have registers with population and other data that could potentially be used for a census, but coverage and quality of the data are not sufficient for producing reliable census data. Sometimes key variables, like occupation, educational attainment or the composition of households are not available in registers.

30. Some countries have adopted a combined methodological approach where some information is taken from registers while other information on selected variables is collected through field operation. This can be done by using census forms completed by all households in a way similar to the traditional census or by means of ad hoc sample surveys. In addition to collect information on topics that are not covered in registers, the data collected in field operation can be used to evaluate the coverage and accuracy of register

data. For this reason, this method is sometimes used to transition from a traditional to a fully register-based census.

31. The balance of the amount of data collected from different sources varied from country to country. For example, in the 2010 census round Estonia reported that only one per cent of its data were taken from registers, whereas Switzerland derived 97 percent of its data from registers.

32. Often, when a combined census approach is used, the respondents have the opportunity to fill in the web-based census questionnaire. In the 2010 Census round, eight of total ten countries where the combined method were used, had a possibility to answer in web.

D. Rolling census

33. In the rolling census, the data are collected by cumulative and continuous field data collection over a long time period compared to other census method where the reference time is very exact date and the data collection takes place in a short time period. Using this method there is no need for data from any administrative register. This method was developed conceptually in the 1970s and it has been used only in France since 2004.

34. Data are collected in the field every year in the various municipalities in a rolling base, like in France in a 5-years cycle. Census results are based on rolling average calculated over the 5-year cycle and updated yearly.

35. The main advantage of this method is that the data are provided more frequently (every year) than every tenth year. Also the costs of data collection and processing are spread over time instead of being concentrated in few years around the census date.

36. However, this method is very complex and it is hard to implement. A disadvantage is that this approach no longer provides a simultaneous snapshot of the whole population. Both over- and undercounting can occur, given the possibility of migration between regions. In this method, the comparisons between areas due to different enumeration times can be complicated.

E. Trends of census methodology

37. Even if new census methodologies and technologies are increasingly used in recent years, the traditional census approach is still the most commonly used method in the world.

38. From 1970 register data were used for the first time in Census in the Nordic countries, which started to develop the register-based census. In 1980, Denmark conducted a fully register-based census, as the first country in the world, and ten years after, in 1990, Finland followed. At this time, register data were also used in some other countries (other Nordic countries, Singapore). For the 2000 census round, the number of countries using alternative census methods increased significantly in Europe. Three countries conducted the register-based census and five countries conducted the combined census.

39. In the 2010 census round, the trend was more and more from the traditional census towards to the alternative methods: nearly 36 per cent of the countries in the UNECE region adopted new methodologies based on the administrative registers and combinations of sources to produce census information. Besides this, 30 per cent of countries conducting the traditional census reported using register data as a sampling frame or control data.

IV. Overview of international statistical activities in the area of population and housing censuses

40. Besides countries designing their census methodology according to their specific circumstances, international comparability is one of the main important issues to be taken into account. Standardization of census variables, their definitions and breakdowns should be outlined by some international organizations. Also, these organizations provide valuable inputs to the NSOs by facilitating the sharing of experiences and providing technical assistance while conducting such a complex operation.

41. This section provides a brief overview of the past and ongoing census activities of UNSD (United Nations Statistical Division)², UNECE (United Nations Economic Commission for Europe)³ and Eurostat⁴.

A. United Nations Statistical Division (UNSD)

42. The United Nations Statistical Division (UNSD) of the Department of Economic and Social Affairs (DESA) has a role as the secretariat of the 2010 and 2020 World Population and Housing Census Programmes. It has acted as the umbrella organization for setting standards, providing technical expertise and training and setting priorities as needed at the launch of the 2010 Census Programme since 2005.

43. For 2010 World Population Census round, the Division also developed and issued international census guidelines including the *Principles and Recommendations for Population and Housing Censuses, Revision 2*; the *Handbook on Geospatial Infrastructure in Support of Census Activities*; the *Handbook on Population and Housing Census Editing, Revision 1*; *Measuring the Economically Active in Population Censuses: A Handbook*; the technical report entitled “*Census data capture methodology*”; the technical report entitled “*Post enumeration surveys: operational guidelines*”.

44. The Division developed a software package, CensusInfo, to help countries to disseminate census data and conducted training workshops on the use of the software.

45. In the period 2006-2014, UNSD conducted 59 regional, sub-regional and national workshops with 1420 participants from 140 countries in order to help countries process to prepare for and carry out their censuses and to analyze and disseminate the results. The Division provided technical assistance to national statistical authorities on various country-specific aspects of the census process in order to strengthen their capacity to plan for and carry out population and housing censuses.

46. The Statistics Division carried out two surveys on national practices for censuses of the 2010 round and prepared two comprehensive documents. The first survey was carried out in 2009/2010 in collaboration with UNECE. A working paper entitled “*Report on the results of a survey on census methods used by countries in the 2010 census round*” was issued. The second survey was undertaken in collaboration with the United States Census Bureau in 2011. The division prepared a report entitled “*Overview of national experiences for population and housing censuses of the 2010 round*”.

² UNSD Main Site: <http://unstats.un.org/unsd/default.htm>

³ UNECE Statistical Division Main Site: http://www.unece.org/stats/stats_h.html;
UNECE Population Unit Main Site: <http://www.unece.org/pau/Welcome.html>

⁴ Eurostat Main Site: <http://ec.europa.eu/eurostat>

47. In December 2014, the Statistics Division prepared another comprehensive report on the implementation of the 2010 World Population and Housing Census Programme and a timetable for the development of the 2020 World Population and Housing Census Programme, including the *Principles and Recommendations for Population and Housing Censuses: the 2020 Round, Revision 3*.

48. The report⁵ provides a brief overview of the implementation of the 2010 World Population and Housing Census Programme, including information on national participation in the 2010 census round, successes and challenges and a summary of activities carried out by the Statistics Division in support of the 2010 World Programme. The report also describes the preparatory activities for the 2020 World Population and Housing Census Programme.

49. The Statistics Division established an international expert group in 2013, comprising census experts from countries in both developed and developing regions, UN regional commissions and relevant international and regional organizations to review the text of the *Principles and Recommendations for Population and Housing Censuses, Revision 2* and propose changes and updates.

50. Through the international expert group, the Statistics Division has prepared a draft version of the *Principles and Recommendations for Population and Housing Censuses: the 2020 Round, Revision 3*.

51. The Statistics Division is planning to prepare or update international census guidelines for the 2020 round as had been done for the previous census round. The *Handbook on Census Management for Population and Housing Censuses*, the *Handbook on Population and Housing Census Editing, Revision 1* and *Measuring the Economically Active in Population Censuses: A Handbook* will be updated or revised by the UNSD.

52. The Statistics Division, in collaboration with the UN regional commissions and other relevant regional and international organizations, *plans to organize regional technical training workshops, to provide direct technical assistance to countries and to organize study visits (South-South cooperation) for countries to learn from one another* in order to strengthen the capacities of countries to undertake census operations .

53. For the 2020 census round, the Statistics Division will maintain the World Population and Housing Census Programme website as a resource for countries to exchange their experiences and share their knowledge and information on census-taking.

54. The Division will take on the role as part of its responsibilities for an international organization with the responsibility of collecting and making accessible census microdata samples from countries for the 2020 World Population and Housing Census Programme.

55. The Division prepared a draft resolution on the 2020 World Population and Housing Census Programme that was approved by the UN Statistical Commission in March 2015 and endorsed by the Economic and Social Council in June 2015.

56. The United Nations Statistics Division collects from all the National Statistical Offices several population censuses' datasets. The data are collected via the *Demographic Yearbook* census questionnaires. Data have been collected since 1948 through a set of questionnaires dispatched annually to over 230 national statistical offices and have been published in the Demographic Yearbook collection. The Demographic Yearbook disseminates statistics on population size and composition, births, deaths, marriage and divorce, as well as respective rates, on an annual basis. The Demographic Yearbook census datasets cover a wide range of additional topics including economic activity, educational

⁵ The report prepared by UNSD for the 2015 UN Statistical Commission: <http://unstats.un.org/unsd/statcom/doc15/2015-6-Censuses-E.pdf>

attainment, household characteristics, housing characteristics, ethnicity, and language, foreign-born and foreign population. The available Population and Housing Censuses' datasets reported to UNSD for the censuses conducted worldwide since 1995 are now available in *UNdata*⁶.

B. United Nations Economic Commission for Europe (UNECE)

57. Population and Housing Census is one of the main areas of work of the UNECE Statistical Division. The activities in the period 2005-2015 were aimed at promoting the implementation of the *Conference of European Statisticians (CES) Recommendations for the 2010 Round of Population and Housing Censuses*, and the preparation of the CES Recommendations for the 2020 Census Round. UNECE also supports member countries in the preparation for their next population and housing census. The activities include the organization of annual expert meetings and training workshops at regional and sub-regional levels to discuss emerging issues in census methodology and management, the preparation of publications and training material on censuses, and the collection and dissemination of information about censuses in UNECE countries.

58. In May-June 2012, a work plan was drafted at the UNECE-Eurostat Meeting on Population and Housing Censuses and endorsed by the CES, in order to review the 2010 round of censuses in the UNECE region and to prepare new Recommendations for the 2020 Censuses. According to this work plan, nine task forces were constituted as⁷:

- Census methodology;
- Census technology;
- Census costs and benefits;
- Census coverage and quality;
- Population to be enumerated and geographic characteristics;
- Economic and educational characteristics;
- Migration and ethno-cultural characteristics;
- Demographic, household and family characteristics;
- Housing topics.

59. Between 2012 and the end of 2014 the task forces reviewed the 2010 round of censuses in the UNECE region and prepared the draft CES Recommendations for the 2020 round of censuses.

60. The work of the Task Forces, coordinated by the UNECE Steering Group on Censuses, was based on the results of a comprehensive online survey carried out by UNECE in early 2013. The results of the work of the Task Forces were used to prepare the volume *Measuring Population and Housing: Practices of UNECE Countries in the 2010 Round of Censuses*⁸, published by UNECE in 2014 in English and Russian.

⁶ <http://unstats.un.org/unsd/demographic/products/dyb/dybcensusdata.htm>

⁷ Terms of Reference (ToR) of Steering Group on Censuses(ECE/CES/BUR/2012/NOV/7) (4th November 2012):

<http://www.unece.org/fileadmin/DAM/stats/documents/ece/ces/bur/2012/november/7.pdf>

⁸ http://www.unece.org/fileadmin/DAM/stats/publications/2013/Measuring_population_and_housing_2010.pdf

61. In January 2015, the Steering Group and all of the task forces completed the final draft of the *CES Recommendations for the 2020 Censuses of Population and Housing*⁹ which were reviewed by the CES members through an electronic consultation in March 2015, and then adopted by the CES at its 63rd plenary session in June 2015.

62. The main objectives of the Conference of European Statisticians Recommendations for the 2020 Round of Population and Housing Censuses are to provide guidance and assistance to countries in the planning and execution of their population and housing censuses; and to facilitate and improve the international comparability of census results through the identification of a core set of census topics and the harmonization of concepts, definitions and classifications.

63. The UNECE Statistical Division coordinated the preparation of the CES Recommendations in close collaboration with Eurostat and in conjunction with the revision of the global Principles and recommendations for population and housing censuses for the 2020 round by the UN Statistics Division in New York. The new recommendations on labour force statistics that emerged from the 19th International Conference of Labour Statisticians held in Geneva on 2-11 October 2013¹⁰ were also taken into account.

64. The UNECE Census Wiki¹¹ platform is used to share work material, develop documents and organize discussion forums. A lot of material and links to various articles, papers, and publications are presented on various pages of the UNECE Census Wiki¹². Publications and papers on census methodology and related issues are presented. Comparisons and sorting countries by selected indicators about census methodology in 2010 Round is available. Papers on transitions to new census methods from countries are presented. Challenges, experiences and lessons learnt are shared within the countries.

C. Eurostat^{13,14}

65. Through the 2011 Population and Housing Census, for the first time, the European legislation defined in detail a set of harmonized high-quality data from the population and housing censuses conducted in the EU Member States.

66. As a result, the data from the 2011 round of censuses:

- is a collective work of the European Statistical System (ESS)
- provide accession to a richness of harmonized and comparable information
- provide exceptional flexibility to cross-tabulate different variables
- provide geographically detailed data.

⁹ http://www.unece.org/fileadmin/DAM/stats/documents/ece/ces/bur/2015/February/18-Cover_note_on_Population_and_Housing_Censuses.pdf

¹⁰ Economic Commission for Europe Conference of European Statisticians Sixty-third plenary session Geneva, 15-17 June 2015 Item 5 (c) of the provisional agenda Recommendations for the 2020 Round of Population and Housing Censuses

¹¹ UNECE Census Wiki Main Site:

<http://www1.unece.org/stat/platform/display/censuses/UNECE+Census+Wiki>

¹² UNECE Census Wiki Page for Sources:

<http://www1.unece.org/stat/platform/display/censuses/UNECE+publications+and+papers+on+census+methodology+and+related+issues>

¹³ Eurostat materials are on the website: <http://ec.europa.eu/eurostat/web/population-and-housing-census/>

¹⁴ Meeting documents of Working Group on Population and Housing Censuses and Task Force on the future EU censuses of population and housing

67. Data from the 2011 population and housing census were collected by Eurostat in accordance with Regulation EC No 763/2008 on population and housing census and the three implementing Commission regulations (Regulations No 1201/2009, No 519/2010 and 1151/2010) are **only valid for the 2011 exercise**. A set of new Commission implementing regulations specific to the 2021 census round will therefore need to be developed. The *CES recommendations for the 2020 census round* (adopted by the CES in June 2015) will also be taken into account. In order to achieve this goal a Task Force has been created by Eurostat and is currently working.

68. The Task Force is expected to review the technical requirements set by the framework regulation (Regulation EC No 763/2008), as well as the results of the quality assessment exercise on the 2011 data and metadata, and provide Eurostat with appropriate advice and assistance.

69. In particular, the Task Force is expected to:

- review practical difficulties encountered by Member States when implementing the different aspects of the 2011 Census exercise, and propose possible measures to overcome these difficulties;
- review the CES Recommendations for the 2011 and 2020 census rounds in order to see where technical advice may be necessary to help implement these as part of the 2021 EU census data requirements
- facilitate as far as possible the use of administrative data in those countries that wish to do so
- identify emerging user needs for data and incorporate them if appropriate into planned 2021 Census outputs
- identify and document instances of good practice in overcoming data source problems and in applying statistical definitions to meet the essential features of censuses to the highest possible extent
- suggest the best ways of introducing the geo-referencing (1km² grid) to the regulations
- make comments and suggestions to assist with the drafting of technical aspects of the Commission implementing legislation

70. The work and recommendations of the Task Force will have to reflect as much as possible with the ongoing changes at national level in the approaches, methods and data sources used for census-type statistics; and ongoing work on the modernisation of European social statistics. The work of other organizations and task forces will need to be taken into account, including the work organised by:

- UN Statistical Division and Economic Commission for Europe on recommendations for the 2020 census round,
- the Eurostat Task Force on Integration of Statistics and Geospatial Information.

1. The Census Hub^{15,16}

71. The richness and the volume of data collected by the NSIs demanded new means of data transmission. To handle this challenge, the Census Hub has been developed as a modern and innovative technical solution for the transmission and dissemination.

¹⁵The Census Hub: <http://ec.europa.eu/eurostat/web/population-and-housing-census/census-data/2011-census>

¹⁶The Census Hub (Compact Guide): <http://ec.europa.eu/eurostat/documents/4031688/6285607/KS-02-14-480-EN-N.pdf/05b4ca91-1f72-4dbb-ae2c-d3a07f56d795>

72. The 2011 Census database is the result of work by the European Statistical System (ESS) to better disseminate the results of the Population and Housing Censuses in Europe. It provides easy access to detailed census data that are structured in the same way and methodologically comparable between countries. It is a data sharing platform, where NSIs provide access to their data according to standard processes, formats and technologies. Eurostat provides the IT structure for quickly accessible, flexible, easily compilation and extraction of data stored in the different national census databases.

73. The data disseminated by the Census Hub are not microdata. They are aggregated data that are structured according to the tables agreed by Member States and defined in the legal implementing rules¹⁷.

2. Databases¹⁸

74. Eurostat disseminates various levels of detailed data for 1990/91, 2001 and 2011 rounds, at regional and national levels. All tables have metadata documents both for national and European level. Under the title “3. Statistical Presentation”, including:

- Data descriptions (relevant regulations and definitions etc.)
- Classification systems
- Coverage and sector
- Statistical concepts and definitions
- Statistical unit
- Statistical population
- Reference area
- Coverage and time
- Base period

3. Legislation¹⁹

75. Eurostat also disseminates the relevant legislation on the website:

- **Regulation on population and housing censuses (EC-763/2008 of 9 July 2008):**
This Regulation establishes common rules for the decennial provision of comprehensive data on population and housing. Diversity of data sources is mentioned in “Article 4- Data Sources”. These are:
 - conventional censuses
 - register-based censuses
 - a combination of conventional censuses and sample surveys
 - a combination of register-based censuses and sample surveys
 - a combination of register-based censuses and conventional censuses
 - a combination of register-based censuses, sample surveys and conventional censuses
 - appropriate surveys with rotating samples (rolling censuses)

76. Topics to be covered in Population and Housing Censuses are also mentioned.

¹⁷ To access the new 2011 Census database:

<https://ec.europa.eu/CensusHub2/query.do?step=selectHyperCube&qhc=false>

¹⁸ EuroStat Database for Population and Housing Census:

<http://ec.europa.eu/eurostat/web/population-and-housing-census/census-data/database>

¹⁹ EuroStat Legislations: <http://ec.europa.eu/eurostat/web/population-and-housing-census/legislation>

- **Regulation on population and housing censuses as regards the technical specifications of the topics and of their breakdowns (*EC-1201/2009 of 30 November 2009*):** The main aim of the regulation is to ensure that data from the population and housing censuses conducted in the Member States are comparable, and to allow reliable Community-wide overviews to be drawn up, the census topics as required by Regulation (EC) No 763/2008 must be defined and broken down in the same way in all Member States. It lays down the technical specifications for the census topics and their breakdowns required implementing Regulation (EC) No 763/2008.
- **Regulation adopting the programme of the statistical data and of the metadata for population and housing censuses provided for by Regulation (EC-763/2008) (*EU-519/2010 of 16 June 2010*):** This Regulation establishes the programme of the statistical data and the metadata for the population and housing censuses to be transmitted to the Commission (Eurostat) for the reference year 2011. It mentions about the requirement of hypercubes.
- **Regulation implementing Regulation EC-763/2008 on population and housing censuses, as regards the modalities and structure of the quality reports and the technical format for data transmission (*EU-1151/2010 of 8 December 2010*):** This Regulation lays down the modalities and structure of the quality reports to be submitted by Member States on the quality of the data they transmit to the Commission (Eurostat) from their population and housing censuses for the reference year 2011, as well as the technical format for data transmission, to fulfil the requirements of Regulation (EC) No 763/2008.

77. Eurostat disseminated “*EU legislation on the 2011 Population and Housing Censuses - Explanatory Notes*”²⁰. It is a guide on the EU legislation on the 2011 population and housing censuses. The objective is to disseminate more detailed data in a user-friendly way, and to make the data more comparable. The European Union’s legislation on population and housing censuses aims to achieve comprehensive and flexible dissemination of census data, plus transparency about their quality. At the same time, it respects the diversity of traditions and methods in the Member States. This publication describes and explains the current legislation.

4. Recent progress

78. In September 2014, meeting of the Census Working Group, launching the Task Force to develop the 2021 census data collection was proposed. The Directors of Social Statistics asked to combine the new 2021 Task Force with the existing Task Force on the post-2021 census strategy. New combined Task Force created met for first time in December 2014.

²⁰EU legislation on the 2011 Population and Housing Censuses - Explanatory Notes:
<http://ec.europa.eu/eurostat/documents/3859598/5916677/KS-RA-11-006-EN.PDF/5bec0655-4a55-466d-9a00-fabe83d54649?version=1.0>

V. Issues and challenges

A. Measurement issues

79. When more and more countries are collecting the census data with different types of collection methods and data sources, there will be challenges to ensure that the collection method does not affect the **comparability of the results**. Even with traditional censuses, when the form is exactly the same in the web and paper questionnaire, the respondents sometimes do not give the same answers. When we discuss different types of collection methods, like the register-based census, the combined census or the rolling census, the issue will be more problematic.

80. A related big challenge in the future is **how to measure the different dimensions of census quality** (in particular, accuracy and coverage) between countries/years when the census is carried out with different methods. Clearly, possible significant differences in census quality may affect also the comparability of the census results.

81. On the other hand, if we try to keep the data content comparable over time, how we are going to react to the changes of the world?

82. An additional challenge is brought by fact that the **data content is limited by the characteristics of the enumeration**. For instance, when the forms are completed by the respondents the number of questions and the time necessary to complete the forms must be limited, and questions that may be complex or potentially sensitive for the respondents have to be avoided. On the other hand, in a register-based census obviously information is available only on topics that are included in the registers.

B. Managerial issues

83. From the point of view of census managers the **cost of the census** is a very important issue – often the most important – especially in the current period of financial crisis. Many countries have identified census cost as a major challenge in the planning and conducting of their censuses for the 2010 round. This was the number one challenge in all regions of the world, in particular in the countries where the census was conducted using the traditional approach, which requires huge financial resources, in particular to pay the large number of fieldwork staff.

84. A possible long-term solution to reduce the cost of the census is to move towards the use of registers. In fact, the cost of a register-based census – once a high quality register-based statistical system is in place - is much lower than the cost of a traditional census. However, in order to create such system important initial investments are required and a long development process is normally necessary. Therefore, many countries are confronted with the dilemma whether it is worth or not investing resources to develop their registers (or create new ones if necessary) for possible use in future censuses. An accurate and detailed review of the content and status of the existing registers and administrative sources is necessary to assess their potential use for a population and housing census, and take a decision. Consideration should also be given to legal aspects and the acceptance by the public of the use of registers for the censuses. For these purposes, the experience and advice of countries that developed a register-based census – especially those having a similar social, administrative, and institutional context – would be particularly useful.

85. Another important managerial issue is recruiting and retaining skilled **census staff**. Population and housing censuses – regardless of the methodology used - need experienced,

high-skilled and particularly permanent team. Permanency of the staff is necessary for passing along experiences between census decades as well as following the recent improvements and professionalism. In addition, having experts within the NSOs census team who have skills related especially to using innovative technologies to adopt it in census methodology, to analyze data in timely and accurately, to be familiar with GIS technologies etc. will be a good advantage. Otherwise, outsourcing which is another important issue for NSOs is being used to take support mostly on IT related areas. For the field collection (except for register-based censuses) or editing process, enumerator pool can provide easiness in finding too many enumerators with expected skills.

86. The organization of census team can be discussed due to process' complex and unique structure. How a census expert should be defined related to a chosen method? Or what kind of experts should be included in a census team? Census operation may require wide knowledge of areas such as sampling, questionnaire design, data analysis, definitions of variables, field organization, IT solutions, GIS applications, etc. While being proficient in each area is difficult, census experts should have an idea or general knowledge of each area to shape the methodology, to be able to make connections on different dimensions of censuses and to find solutions on specific issues. The composition of the census team and the areas of knowledge of the staff clearly depend on the census methodology used. This should be taken into consideration in countries that consider possibly changes in the methodology.

87. For countries conducting the census in the traditional way, normally a certain number of staff members are recruited and trained to work for the census for a relatively short period of the 10 year census cycle. However, often it is not possible to retain this staff after the census. As a result, unfortunately, the knowledge accumulated while planning and conducting the census is lost. When other census methodologies are used, this is less of a problem. For instance, the register-based census and the rolling census require a number of census staff more or less constant over time, possibly with limited fluctuations.

C. Conceptual issues

88. There are a number of conceptual issues that emerged from the review of the national experiences in the 2010 census round and the work for the preparation of the new recommendations for the 2020 round. Even though work was done recently on these issues in the framework of the new recommendations, some of them may still require further work either in the short-medium term (to help countries planning their next census and implementing the new recommendations) or in the long term, when the new recommendations for the following (2030) census round will be prepared. This section of the report presents briefly some of these issues.

89. ***Undercounting and overcounting of specific population groups:*** Both traditional and register-based censuses – but also other census methods - have one common issue. It is the difficulty to measure exactly the number of people living in a particular area at a specific time. In a traditional census the population size is more likely to be underestimated, because some groups of people are not reached by the enumerators. On the contrary, in the register-based census the population registers tend to overestimate the population due to the fact that the emigration is not easy task to update in the population register. On the other hand, some population groups can also be missed by the register-based census, like illegal and undocumented migrants. Since this issue may affect the comparability of census results between countries using different census methods, work could be promoted in this field in the short-medium term (see Proposal 4 in the section “Conclusions and Recommendations”), so that some guidelines might possibly be agreed for consideration by countries in the next (2020) census round.

90. The following other conceptual issues would possibly require modifications to the international recommendations, that have been adopted recently. Therefore, these issues could be considered for work in the long term, when the new recommendations for the following (2030) census round will be prepared:

91. ***Concept of usual residence and one year criterion:*** Globalization poses new challenges for the data collection. People move often for work or leisure between and within countries, and may have more than one place of residence during the census year. It becomes increasingly common that people live in different places for shorter periods and even live in several countries at the same time. The one year residence criterion as a base definition of the usual residence will become not only harder to define but may become more or less irrelevant as an analysis variable. Problematic groups to be counted are also nomads, migrant workers, illegal and undocumented migrants, refugees and other populations groups outside the ordinary citizens groups.

92. ***Different concepts of population base in traditional and register-based censuses:*** With regard to the definition of the population, there are differences between the countries depending on the census method and the source of the data used. While for the countries using registers the population is defined by the criteria governing the inclusion in the registers (set by the authorities that maintain them), for countries which conduct field collection the population is based on 12 months criterion. International recommendations and EU regulations accept both, because this is directly related to country circumstances.

93. ***Other conceptual issues:*** Besides globalization, changes in society and in population life style will cause problems from the point of view of concepts or definitions. For instance an increasing number of people work from home, they do not have fixed workplace where they go every morning. How should the lifelong learning to be handled in the data collection?

94. Concept of work and the definition of employment status are constantly changing and will be even more difficult to define in the future. People are having multiple sources of livelihood at same time and there may not be any main employment for a significant part of the employed.

95. Family concept is changing when families become more diverse. Not only families with same sex couples, but also shared custody and other mixed types of families are no longer exceptions. For example children having a residence with both parents are becoming increasingly common. Many individuals will also have more than one family or one, two or maybe four parents.

D. Methodological issues

96. In many countries, an increasing reluctance of the population to participate in the census has been observed over the last few years. Also, the costs of the traditional censuses are so high that alternative approaches to conduct the census are planned by many countries.

97. At the moment, a significant number of countries with traditional census also have registers that could potentially be used for census purposes. Anyway, there can be problems of utilising the register data, because of the poor quality and the coverage. Other barriers to the use of registers are the lack of standardisation among different data sources, technical and legal problems, the limited data content of registers and political or public opposition. For these reasons it can be expected that in the 2020 census round some countries will start using registers, while other will continue using the traditional approach (see also paragraphs 83-84).

98. Anyway, more and more register data will be available and used in the future for statistical purposes. In many countries, also among those with the register-based approach, there is a huge interest to the possible use of Big Data in the statistics production. Thus, it seems clear that approaches of different kind to conduct the census will be the future.

99. Moreover, the timeliness and frequency of updating census data becomes divergent between countries. While some of the countries are able to present annual figures on population characteristics, others continue to take decennial population censuses for obtaining and presenting the data in required detail. In scope of globalization, more recent data also become important for international organizations to compare countries. For instance, in the European Union as part of long-term post 2020 census strategies, some options are being considered that include annual data collections, either extensive or limited to restricted sets of variables. Work could be possibly promoted at UNECE level to discuss whether a similar approach could be extended also to countries outside the EU. This activity could possibly build on the work being conducted in the EU, and benefit from the experience of the countries that can already produce annual data, with or without registers.

100. One question is how to adapt the international recommendations (after the 2020 round) so that they are relevant to the different census methodologies?

E. Technological issues

101. Technology directly affects and makes possible the use of different methodology and different data sources. From the planning to the dissemination all stages of the census are conducted in parallel with available IT solutions and capacity of the NSO in the means of both IT staff and infrastructure.

102. IT related activities such as combining huge data sets, testing and analyzing sources/collected data, monitoring/ reporting/ supporting field collection, capturing data, editing, presenting and disseminating results, etc.: these are all crucial points which add a lot in the way of having accurate, timely, qualified data with less effort. Also, related to collecting data a variety of methods are used during the 2010 round censuses. Usage of internet for self-completion of the census questionnaire or using a device (laptop, mobile/cellular phones, tablet and hand held devices) in enumeration process are common examples of IT usage.

103. The success of internet usage for self-completion of the census questionnaire is not only related to NSOs' IT capacity, but also related to public ability of access to internet and usability of internet. Sometimes, local circumstances act as a barrier to technological improvements in methodology.

104. For common methods which are planned to be used for next census round, best country practices can be determined and method-specific guidelines can be prepared with the coordination of international organizations.

F. Other issues

105. A key dimension of statistical quality is *relevance*, which is usually defined as the degree to which the statistical information meets the needs of users (*CES Recommendations for the 2020 round of censuses*, para. 351). In case of the census, the consultations with users are particularly important because in the ten years that normally span between two consecutive censuses the users' needs and priorities may change even significantly, reflecting also the societal changes. Apart from the census content, in many countries a key issue for users is the frequency of the censuses. Having results only every ten years may not be sufficient in the future for an increasing number of users. The *user needs* will add

pressure to conduct censuses or other surveys to satisfy the need of “fresh” data more often than every ten years.

106. *Legal frameworks* are normally constructed at the national level through specific census legislation or as part of the generic statistical legislation, and are specific to national sources and circumstances. It has a very important role for planning the use of the register data for statistical purposes. For EU countries there is a Council Regulation on the free access to administrative data sources for statistical purposes. Anyway, even if there is also a national statistics law, which should give an access to the existing administrative sources, in practice it does not realise.

107. *Participation of public or public approval* is another discussion topic. The publicity campaigns may directly influence the public perception on population and housing censuses and increase participation, reassuring respondents about the confidentiality of personal data, safety of data collection and protection and respect of citizen rights. In recent years, non-response rates in censuses and the social surveys have increased in many countries. Register-based censuses from this point of view have the advantage that the population do not have to provide data. However, there must be public acceptance of this approach.

108. *The cooperation at international level* is becoming even more important in the means of obtaining comparable data and sharing the experiences. UNSD, UNECE and Eurostat are the main bodies which contribute to NSOs in their census activities. Determination of countries’ needs, defining standards, bringing out solutions, creating discussion/ sharing platforms can be counted among the key roles of these organizations. When the rapid change of the world is taken into account, activities on the census should be continuous rather than decennial to be able to cope with variation of methods and sources.

VI. Conclusions and recommendations

109. During the last census round, many countries in the UNECE region have improved efficiency by using new census methodologies and advanced technology. However, some countries still face challenges including the rising cost of censuses, keeping abreast of ever-changing technology and rapidly changing lifestyles accompanied by the reluctance of respondents to participate and provide their personal information, and the increasing difficulty to enumerate certain population groups.

110. Even if the traditional approach will still be the most popular in the 2020 census round at global level, many countries in the UNECE region have plans to move totally or partly towards the use of registers in their censuses. Also there is the interest to use new technologies in the data collection. For the adoption of new methods for conducting the census, countries will need support in different areas. In occasion of the recent consultation on the new CES Recommendations, various countries indicated that they would like activities to receive technical support in the following areas:

- providing internet response option and designing electronic questionnaires
- using GIS technology, mobile devices, and other IT solutions
- methods of data protection in the delivering the small area data
- methods to give an access to the census micro data for researches
- assessing quality of administrative sources, for possible use in combined or register-based census

Proposals for future work:

In order to support countries in the planning of the censuses of the 2020 round, and in implementing the new CES Recommendations, it is proposed that UNECE promotes the following activities, in addition to the regular annual expert meetings:

1. Regional **training workshops** in the areas listed in paragraph 113 above, to be organized in the period 2016-2017;
2. **Study tours** for experts of interested countries, in the same areas and in the same period. The tours would take place in countries with extensive experience in the implementation of the specific methodologies/technologies;
3. Preparation of **guidelines on the use of registers for censuses**, covering also the **assessment of the quality of administrative sources**. The new guidelines should build on the 2007 UNECE publication *Register-based Statistics in the Nordic Countries - Review of Best Practices with Focus on Population and Social Statistics*²¹ (prepared by the Nordic countries) and cover also some forms of combined censuses. The guidelines could be prepared by a small task force of experts from countries with register-based or combined census, coordinated by UNECE and reporting to the existing UNECE Steering Group on Censuses.

111. In future census rounds, it is expected that the diversity of methodologies among the countries and continents will increase further. That means that the harmonization of datasets for international comparability will be more difficult. An important question is therefore to what extent the diversification of census methodology affects the comparability of census outputs between countries (see also para. 89).

Proposal for future work:

4. In addition and to complement the activities proposed above, it is also proposed that UNECE promotes a **study on the impact of the census methodology on the comparability of census results** across countries. The study could include a general assessment of **the different dimensions of census quality** (in particular, accuracy and coverage) for the main census methods. The study could be prepared by a small task force of experts representing countries that adopt the main census methodologies, coordinated by UNECE and reporting to the existing UNECE Steering Group on Censuses.

Other areas to be considered for possible future work

112. More work must be promoted to **integrate censuses with various statistical surveys and new data sources such as big data and mobile data**.

113. The transition from traditional censuses towards a comprehensive or partly use of registers can be a complex and long process for many countries. A fully register-based census is not an alternative for most of the countries in the next census round. The **use of sample surveys** in a combined method that could be recommended to take into practice both in traditional and register-based countries as well. UNECE could organise a meeting

²¹ http://www.unecce.org/fileadmin/DAM/stats/publications/Register_based_statistics_in_Nordic_countries.pdf

or promote other activities for countries interested in developing their census to be able to use sample surveys in estimation of some census variables.

114. Since the timeliness of population figures has become more important, some **new guidelines about providing annual data** with reduced numbers of indicators and reduced detail could be possibly developed for the countries that cannot provide regularly annual census data. This work could build on similar work currently being carried out at the EU level by the Eurostat Task Force on Future Censuses. A UNECE task force could be established on this subject and in particular experiences could be shared by the countries that can disseminate annual census data. In addition, rolling census or virtual census methods could be taken into account for the relevant countries which can meet the necessary conditions.

Appendix I.

Country practices

1. Approaches and objectives of the census vary from country to country and change over time. There are important differences between countries with regard to methodology and mode of implementation of the census, depending on factors such as: information needs, cost considerations, quality, existing possibilities, attitudes and expectations of the society with data confidentiality and other issues.
2. Conducting the census in the traditional way has various disadvantages: it is very costly, it provides information only for the enumeration year (and there are increasing data needs for the interim years), implies respondent burden to fill the census questionnaire, it requires technical improvements and innovation, raises concerns about data privacy etc. In response to these issues many countries developed new approaches and practices in terms of data sources and data collection methods to be used in the census. In this context, countries which have reliable and updated administrative records suitable for producing statistics began to use them for census purposes. Other countries tried to develop administrative register systems which can also be utilized for official statistics. Besides, countries with adequate technical facilities and social consciousness tended to collect data remotely via mail and Internet instead of collecting data by interviewers or enumerators. In addition, use of geographic information systems to plan and manage the census areas and also replacing paper-based questionnaires with hand held devices or laptop/netbook computers can be considered as present improvements.
3. According to UNECE's report²² on practices of countries in the 2010 round of censuses, 35 countries used traditional method among 56 countries in the UNECE region, while 10 countries preferred the combined method (data registers plus field collection) and 9 countries used register based approach (2 countries had not conducted the census). Although the traditional approach seems to be the method used by the majority, 8 countries passed from traditional to combined or register-based methods compared to 2000 census round. In addition 3 countries changed the census methodology from combined to register-based at that period. These changes indicate that there is a significant tendency or requirement to leave traditional method and move to combined or to register-based census. Likewise, according to country papers on 2011 census experiences, it is seen that NSOs are trying to make use of new data collection methods, especially Internet response and take advantage of field technologies (GIS, GPS, hand held devices, tablet etc.). For instance, as stated in the UNECE's mentioned report, 8 out of 10 countries with combined census benefited from Internet for self-completion of the census questionnaire. Similarly, 19 countries used GIS technologies and 24 countries used a device (laptop, mobile/cellular phones, tablet and hand held devices) in enumeration process.
4. In this regard some country practices in the 2010 round of censuses are mentioned below as examples of different methods. It can be seen that the countries which used traditional method also try to maximise register usage for different stages of field collection even though not for the purpose of population count.

²² United Nations Economic Commission for Europe, *Measuring population and housing: Practices of UNECE countries in the 2010 round of censuses*, United Nations, New York and Geneva, 2014

1. Italy^{23,24}

5. The National Institute of Statistics of Italy (ISTAT) conducted the 15th Italian General Population and Housing Census in 2011 with traditional method. Main goals of the census were:

- determining the legal population
- collecting information on the main demographic and socio-economic characteristics of the population usually resident
- updating of the Municipal Population Registers (Anagrafi) on the basis of the comparison between census data and population register data, as required by the law on population registers (Regolamento Anagrafico).

6. Twenty-five million private households and more than 50,000 residential institutions, accounting for a total of approximately 60 million people, were to be enumerated by about 70,000 enumerators and 10,000 coordinators, organised in a network of 8,094 Municipal Census Offices (MCOs) and 110 Provincial Census Offices (PCOs). The Italian National Institute on Statistics (ISTAT) is responsible for the census and carries out design and coordination tasks directly, whereas the actual fieldwork is the responsibility of the municipalities.

7. Municipal registers were used to generate list of persons to be enumerated. Questionnaires were sent to 25 million households based on these lists of names and addresses geo-coded to enumeration areas through national postal services. This took place over 6 weeks spanning the census reference date (8 October), beginning on 12 September and ending on 22 October (it was impossible to deliver such a huge amount of questionnaires in a shorter time). The filled questionnaires were collected with multiple modes as:

- online, using the password provided with the questionnaire;
- at any post office in Italy;
- at one of the Municipal Collection Centres (MCC), where specialized assistance was available;
- directly to a municipality enumerator.

8. One of the new features of the 2011 census was the use of sampling techniques for the measurement of some of the variables of interest. This was carried out using two versions of the questionnaire, the full form and a short form. Households received one questionnaire only; all questions in the reduced version were also contained in the full version. Random sampling was used only for municipalities forming the administrative seat of their province or with a population of at least 20,000 inhabitants as of 1 January 2008. Of these 486 municipalities, around one third of resident households received the full questionnaire and the remaining two thirds the short form. All households in all other municipalities received the full version of the questionnaire.

9. By 6 March 2012, 95.9 per cent of households had been enumerated, for a total of about 24.6 million questionnaires returned. Of these, 27.9 per cent were short versions. 34.2 per cent of respondents chose the Internet, 31.5 per cent the MCCs and 22.6 per cent the post offices. The remaining 11.7 per cent were collected directly by the enumerators.

²³

http://www.unece.org/fileadmin/DAM/stats/documents/ece/ces/ge.41/2015/mtg1/CES_GE.41_2015_7-istat_rev.pdf

²⁴ http://www.unece.org/fileadmin/DAM/stats/documents/ece/ces/2012/22-IP_Italy.pdf

10. Enumerators were required to categorize each of the addresses corresponding to non-enumerated households according to a detailed classification (wrong address, uninhabited dwelling, residents temporarily absent and so on). The aim of this operation was to classify uninhabited dwellings and to update Municipal Addresses' Registers. MCOs perform a comparison with Population Register data and revise population registers on the basis of the census results once the census has ended.

11. All phases of the census were managed through a Census management system, accessible online to all workers involved, with access authorised on the basis of position and geographic area. The system was designed to automate back-office work and enabled the status of every individual questionnaire to be followed in almost real time. It also permitted the production of census progress reports, allocation of areas to the enumerators and monitoring of their work, targeted recovery of non-responders and unregistered individuals, comparison of the census and local records, and production of relative accounts.

2. Czech Republic^{25,26}

12. The Czech Statistical Office (CZSO) used traditional method in 2011 census as in previous one. Some processes had been adjusted when compared to the 2001 census. Administrative data sources were extensively used. The main changes were: field operations provided by contractor; option to complete census forms online and multiple ways of collecting census forms.

13. The census was performed by traditional method of enumeration combined with the use of administrative data sources (used for pre-filling of the census forms and also in data processing). There were three types of forms used in census – for individual persons (SLO), for dwellings (BL) and for houses (DL). Where possible, the census forms were pre-filled by available identifiers – an address of place of enumeration from the Register of census districts (2.2 million DL and 4.3 million BL) and a name of a person from the Population register (almost 10 million SLO). Also, some of the data on the buildings census forms were pre-filled from administrative sources. Remaining census forms were not pre-filled and thus universally usable, so-called “bianco” forms.

14. One of crucial tasks of the Census preparatory phase was the printing of approximately twenty million census forms of all types. Each census form included a unique barcode, which allowed monitoring the life cycle of the form (from generating pre-filled records and files, printing, distribution and collection both paper and electronic forms, scanning, and storing records in database).

15. In the Czech Census, the distribution and collection of census forms were not provided directly by the Czech Statistical Office (CZSO), but the Czech Post realized the field work as the supplier (SFW). This meant that the SFW and the CZSO had to cooperate closely via an interconnection of two different information systems. The CZSO had to prepare numerous pieces of background information, which had to be consolidated, electronically processed, and prepared in appropriate technical form to be submitted to the SFW. Accordingly, form distribution was provided by the Czech Post service and the collection was done by several means: either by post deliverers, electronic protected on-line forms or data deposit boxes.

16. Consequently, at the end of the census in which participation was mandatory for all inhabitants, 17.3 million completed census forms entered data processing. The return rate of

²⁵ http://unstats.un.org/unsd/demographic/sources/census/2010_phc/Czech/2011CENSUS_CZE.pdf

²⁶ http://www.unecce.org/fileadmin/DAM/stats/documents/ece/ces/2012/31-SP_Czech_Republic.pdf

disseminated census forms was 97 per cent. 4.3 million of completed census forms were in electronic format (25.1 per cent) and 13.0 million were paper based forms (2.2 million forms collected by enumerators - 12.7 per cent and 10.8 million forms mailed back – 62.2 per cent). The major advantage of using electronic-based forms was in minimizing respondents' and enumerators' burden as well as from higher quality of collected data. The Internet application automatically notified unfilled answers and checked selected logical links between answers. To complete the form electronically, it was necessary to use the access codes found on the paper forms.

17. On the other hand, a special approach was used in collective living quarters (hotels, hospitals, hostels, homes for seniors etc.) where enumeration was carried out mostly by employees of these facilities. Special census districts were also defined in responsibility of the Ministry of Defence (e.g. members of the armed forces located abroad), Ministry of the Interior (police lodging houses, asylum facilities), Ministry of Justice (prisons and custody facilities) and Ministry of Foreign Affairs (Czech diplomatic personnel working abroad). There were about 12'000 census districts defined in the Czech Republic. Each enumerator was assigned to one census district with 300 – 400 households on average. The phase of the distribution and the collection of the census forms took place between 7 March and 19 April 2011. The data were recorded in the census forms as of the reference date on 26 March 2011. During May 19 – 30, the supplementary survey was performed. The enumerators visited households that did not return any completed forms.

18. The completed paper census forms (13.0 million) were scanned (scanning ended in mid-July 2011); entries were recognized by OCR method, then validated and saved in the database (4.3 million electronic census forms were entered the database directly). Next step was automatic coding of recognized items; in some cases manual coding had to be applied.

3. Poland²⁷

19. Poland used the “combined method” in conducting the 2011 Population and Housing Census (PHC). In other words, the Census was realized by using the registers combined with the information derived from the field. Preparation works was carried out in coordination with the 2010 Agriculture Census. In this process, coordinates for the addresses were determined and infrastructure of a Geographical Information System (GIS) was established.

20. For census purposes, 28 different administrative registers were combined. On the other hand, for the address checks, results of 2002 PHC were used. Administrative registers were primarily evaluated in terms of completeness and quality. A hierarchy was determined between these registers before linkage. In the selection of registers to be used for census, priority was given to the national and centralized ones. For the GIS system, cadastral data, ortho-photo maps, other maps, boundary maps at different scales were used as infrastructure which was obtained from relevant government agencies. GIS data were corrected and updated by various field works (Agricultural Census, Pilot Census).

21. After the preparation of administrative registers for census purposes, 2011 PHC was implemented in two **simultaneous** (short and long form applications) stages.

22. At the first stage (short questionnaire application), the purpose was checking the accuracy of the census framework which was created using administrative registers with using a questionnaire including 15 basic questions about personal and address info. The questionnaire was conducted only through the Internet. However, for the requesting users CATI (telephone interview) support was provided. This support was also provided to the

²⁷ <http://stat.gov.pl/en/national-census/national-census-of-population-and-housing-2011/>

users who could not complete the questionnaire. In addition respondents had an opportunity to fill the questionnaire off-line and sent it by e-mail.

23. Respondents first checked and verified the information filled in the questionnaire. If there was an error, they were asked to make the changes. However, adjustment for gender and date of birth were not allowed. Although the scope of the study was entire population, response rate was about 10 per cent. 32 per cent of the returnees were made updates to some questions. For the people who did not respond, their information in the administrative registers was accepted as correct. Furthermore, the persons who were selected for the long form application had the opportunity to answer the other questions (continue to fill the form) via Internet.

24. At the second stage (long questionnaire application), the census was conducted on the persons who were selected from the census frame which was created by using administrative registers. Sample fraction was about 20 per cent of the total dwellings. Accordingly, 2.7 million dwellings were selected from approximately 13.5 million residential addresses. So sampling survey was done in order to compile information on six main topics which cannot be obtained from the records exactly.

25. In Poland, the participation in the census was mandatory. Those who refused participation could be fined up to 1,200 Euros. In data collection, CAII (Internet), CATI (computer assisted telephone interviewing) and CAPI (computer-assisted face-to-face interviews) were used as a combination. Majority of the application was realized with CAPI. 7.6 per cent of the dwelling questionnaires were filled over the internet with telephone support provided by CSO (GUS). Interviewers used handheld terminals (mobile phone / handheld computer) for all census operations. Thus, enumeration, monitoring the operation and GIS studies were made with these hand-held terminals. In addition, data transmitted to the center from handheld computers were automatically deleted from the device. Therefore, it was not possible to rectify the data after sending it to the central database. The census frame is mainly based on administrative registers. Administrative registers are also used for completion of missing data.

26. Per capita census cost was calculated at 3,5 \$. The same method is planned to be used in 2021 census. It is also planned to utilize the survey results such as those of Labour Force Survey (LFS) by harmonization with administrative registers.

4. Turkey

27. In Turkey, in order to determine the exact and correct population size, to obtain information about demographic and economic characteristics of the population and occupied dwellings by administrative division, a total of 14 traditional population censuses had been conducted between 1927 and 2000. All of them were carried out in one day by the application of national curfew according to the “de facto” population definition which means that persons were enumerated at localities where they were present on the census day.

28. Problems related to traditional censuses of Turkey can be listed as follows:

- No information on usual residence (de-jure)
- Over-counting (imaginary) population
- High cost
- Duration of data processing of around 3.5 years
- Restricted questions included in the census questionnaires because of the one-day collection
- Information on population size and their characteristics available within ten-year interval

- Target was set as establishing an address based population registration system and changing the census methodology from traditional to register based.

29. In 2007, Address Based Population Registration System (ABPRS) was established for obtaining up-to-date information on population size of localities and monitoring the population movements. After the establishment of the ABPRS, information on population size by administrative division and basic characteristics of population such as age, sex, educational attainment and marital status, etc. were announced to the public annually based on registers by Turkish Statistical Institute (TURKSTAT).

30. The 2011 Population and Housing Census (PHC) was conducted with combined method in order to compile information which cannot be derived from Address Based Population Registration System, such as; labour force, employment and unemployment, reason for migration, disability and building and dwelling characteristics etc. at province/district level. Population sizes by administrative units were calculated from the ABPRS for the reference date (October 2, 2011). After that, population size, age-sex structure and size of households were directly taken from the registers, and then other characteristics, obtained from the survey, were calibrated according to the full-scale information.

31. Field collection was conducted between October and December 2011. The collection had two stages: address control study and 2011 PHC field study. Both stages were planned separately for households and institutional places. With address control study, under coverage, changes in types of addresses and existence of the addresses were identified. In the 2011 PHC, interviewers collected information by face to face interview with CAPI and paper based questionnaires. Sampling size of the collection was about 2.4 million households (approximately 12,7 per cent of the total households). Complete enumeration was realized in institutional (university dormitories, nursing homes, prisons, orphanages, military barracks etc.) places. As a result, 9 million people (12 per cent) were interviewed in total.

32. The advantages of this new method are numerous. First of all, the number of field staff needed for data collection was much less than 2000 Population Census. This case provided advantage in terms of budget, quality of staff and controlling the field operation and logistics.

33. Netbook usage (CAPI) provided some cross checks between answers at the time of interview and these checks in the program improved the data quality. Netbook usage for data capture also provided time efficiency compared to other methods (ICR, manual data entry). By the online data transfer that allowed interviewers to transfer data to the main system, the field collection could be monitored daily through central web based system. Besides, data analysis studies could be executed simultaneously.

34. First results of the census were announced by a news release dated 31 January 2013. And detailed results for province level were published on 10 September 2013.

5. Austria²⁸

35. In 2001, the last traditional population census was carried out in Austria, accompanied by a building and housing census. The traditional census was a sophisticated and costly effort. However, Austria moved from traditional census to register-based census method in 2011, as processing of data which has already been recorded by administrative

²⁸http://www.unecce.org/fileadmin/DAM/stats/documents/ece/ces/2012/20-Census_paper_-_Austria.pdf

authorities' offers numerous advantages compared to survey data such as diminishing costs, removed burden for respondents and the prompt availability of the data. The importance of administrative data sources for statistical purposes has recently been rising. In this direction, in 2000, the Austrian council of ministers decided to establish the new method for the census 2011 and in 2006, the regulatory framework came in force by the juridical authorities.

36. Prior to 2001, an interconnected network of population records did not exist in Austria. Each municipality administrated its own records and usually the data was not even entered into electronic systems. In this respect, the census in 2001 was the initial spark for the creation of some data sources, e.g. the Central Population Register (CPR), the Housing Register of Buildings and Dwellings (HR) or the Register of Educational Attainment (EAR). The Central Population Register (CPR) forms the backbone of the census. To assure the quality of the census results, the base registers are backed up by seven comparison registers. These seven fields of administrative units are provided by 35 data holders and are mainly used for cross checks as well as the supply with information that is not available or only partly available in the base registers.

37. Given the independence of the various registers as well as the autonomous process of data collection, the sources sometimes contain contradictory values for the same variable. Therefore, the principle of redundancy is used to ensure sufficient quality by acquiring information on sex, nationality or age from as many registers as possible. A particular method developed by Statistics Austria aims at identifying one particular base register to provide the information for a certain variable, whereas the comparison registers are used to confirm the values in the base registers.

38. Since the names and social security identification of individuals are not part of the data delivery, a unique identification number is needed for merging information from different data holders. To ensure data privacy the introduction of a branch-specific personal identification number for official statistics (bPIN OS) is required before delivering the data to Statistics Austria. Each administrative branch in Austria, like "social security", "taxes" or "social welfare", has its own bPIN. These 172-digit PINs, which should serve for privacy protected communication between public authorities via e-government, are derived by the Austrian Data Protection Commission (DPC) from the SourcePIN Register (Stammzahlregister).

39. In 2006, Statistics Austria conducted a test census with the scope of a full census of population, houses and dwellings as well as local units of employment to evaluate the transition from conventional to register-based census. For the first time, information from the various data holders was demanded for combined administrative statistics. Disregarding minor problems with the data sources, the test census was a general success. Particularly data on demographic issues, education and employment turned out to feature excellent quality and plausibility, while problems arose in identifying the job location for commuters and in associating individuals to dwellings. Statistics Austria has validated the quality of the results by comparing them with a sample survey for the same reference date. Besides ensuring the quality of the enhanced test census, detecting missing values, multiple records or measurement errors and eliminating them for counting purposes; Statistics Austria conducted a residence analysis. For example, individuals who are only covered by the CPR implicitly need clarification and these people were questioned by a letter which contains only one single question: "Did you have your main residence in Austria at the reference date?" For the register-based census of 2011, Statistics Austria applied the same procedure like in the test census of 2006.

40. The data flow of register-based census in Austria consists of three levels: raw data (i.e. the registers), combined dataset (Census Database, henceforth CDB) and imputed dataset (Final Data Pool, FDP). The information is connected via the unique key (bPIN OS)

and merged to data cubes in the CDB. Further, the CDB data are enriched with imputations of item non-response which complete the FDP containing real and estimated information.

6. Finland²⁹

41. In 1749 the first population census covering the whole country was conducted in the Kingdom of Sweden. In Sweden the interval between collections of census data was at first five years and from 1880 onwards ten years.

42. The Central Population Register and the Population Register Centre to maintain the register were founded in 1969. The establishment of the Central Population Centre and the introduction of the personal identity number into compilation of statistics were significant improvements that enabled combination of individual-level data.

43. Over the 1970s, several administrative registers were set up in the country and their coverage and quality level became so reliable that they could be utilised as source data for population censuses. In the 1980 population census, the majority of the data, that is, persons belonging to the population, all their demographic and qualification data were for the first time drawn from registers. The forms collected only missing information, such as concerning place of work and occupation.

44. In connection with the 1980 population and housing census, a register of buildings and dwellings was set up in the Population Register Centre. All basic information concerning buildings, dwellings and office premises was collected with population and housing census forms.

45. In the 1985 population and housing census the foundation pillars of a register-based census were included, that is, the person register, the register of buildings and dwellings, and the register of enterprises and establishments. Available was also a domicile code by means of which people could be combined to their dwellings. The household and family units necessary for censuses could be formed with the help of this information. Other additional data needed for a register-based census were taken from the Tax Administration's registers, pension register and student registers.

46. In 1990 the population census was already conducted totally on the basis of register data. Finland was the second country after Denmark to conduct the population and housing census using only data collected from registers and administrative records. Starting from 1990, data from over 30 registers have been used for population censuses.

47. Register-based population censuses have made it possible to produce now all population census data yearly. Annual population census data have been collected for over 20 years to the data warehouse, which opens new opportunities to statistics producers for the compilation of statistics and nearly inexhaustible study data for researchers. It is another important asset for register-based censuses that people need not be bothered at all by the census.

48. Register-based censuses are also considerably cheaper to carry out than form-based censuses even if made every year. The total costs of a conventional population census would be in Finland around EUR 50 million, while the additional costs for one register census are around EUR one million.

49. The year 2010 was an international census year: population and dwelling censuses are carried out globally in nearly all countries of the world between 2010 and 2011. In Finland the population census was carried out almost in the similar way as in other years,

²⁹ http://www.stat.fi/tup/vl2010/art_2011-03-18_001_en.html

but the new information needs specified in the EU regulation were taken into consideration in the collection of data.

7. France³⁰

50. In France, the first census of modern times was carried out in 1801, under Napoleon Bonaparte. Subsequent censuses took place every 5 years until World War II, and then at irregular intervals (every 6–9 years) between 1946 and 1999, using the traditional method. In 2004, the new rolling census was introduced for the first time, with the objectives to meet the expectations of census users (particularly in terms of frequent updates of the results), and facilitate census management in terms of constant budget over time.

51. The rolling census is based on a cumulative and continuous (or ‘rolling’) field data collection over long periods of time, rather than during a relatively short time period as in the traditional census. In France, a 5-year cycle is used, with two different strategies to collect data of small municipalities (population under 10 000) and large municipalities. Small municipalities are divided into five groups, and a full enumeration is conducted each year in one of the groups. In large municipalities, a sample survey covering 8 per cent of dwellings is conducted each year. At the end of the 5-year cycle, the population of small municipalities (which in France amounts up to about half of the total population) is fully enumerated, in addition to about 40 per cent of the population of large municipalities. In total, about 70 per cent of the country’s population is enumerated. This is considered to be sufficient to guarantee robust information at the municipal level.

52. The census results are based on rolling averages calculated over the 5-year cycle and are updated yearly. Since the data collection for the French rolling census started in 2004, the first results for the population at the national level were based on data collected in the 5-year period 2004–08, with 2006 used as reference year being the central year of the period.

³⁰ Valente, P., 2015. *Censuses: Current Approaches and Methods*. In: James D. Wright (editor-in-chief), *International Encyclopedia of the Social & Behavioral Sciences*, 2nd edition, Vol 3. Oxford: Elsevier. pp. 296–301.