THE MODERN CENSUS

CENSUS DATA GATHERING BY MULTIPLE SOURCES:
POLAND CENSUS 2011

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President of European Forum for Geography and Statistics EFGS
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Central Statistical Office of Poland

Second Meeting - Task Force on Population and Housing Censuses Round 2020
Cairo, 22-23 January 2017
The project timetable

National Population and Housing Census 2011

2007
Start of preparation

IV-V.2010
Trial census
NSP 2011

IV-VI.2011
NSP 2011

IX-X.2009
Trial Census
PSR 2010

IX-X.2010
PSR 2010

Agriculture Census 2010

2013
End of project
Census organisation
Organization NSP 2011

Over 10 external companies providing ongoing support

- 16 central controllers
- 32 managers of the WCZS and the WCC
- 571 voivodship controllers
- 642 statistical interviewers
- Around 2800 gmina leaders
- Around 18000 census enumerators
Mixed Model for Population and Housing Census

Combining Census - a combination of data from administrative sources (full survey covering basic demographic variables) with data acquired from ad-hoc 20% sample survey.
Data collection channels in 2011 Census Round

- **Administrative Sources**: Including spatial data reference registers
- **Self-enumeration by Internet**: CAII (CAWI) – Computer Assisted Internet Interview
- **Telephone Interview**: CATI - Computer Assisted Telephone Interview (Call Center)
- **Face-to-face Interview with respondents executed by the census enumerators**: Registered on hand-held terminals with usage GPS and GIS service. CAPI - Computer Assisted Personal Interview
NSP 2011 – full scale survey (15 questions)

Full-scale survey:

1) Data from administrative register – Master Record
2) Data acquired using the CAII method
3) Data supplemented using CATI and CAPI method
NSP 2011 – sample survey (about 100 questions)

1) Data from administrative register – Master Record
2) Data acquired using:
   - The CAII method
   - The CAPI method
3) Data supplemented using CATI method
CAxI

- CAII - Computer Assisted Internet Interview,
- CAPI - Computer Assisted Personal Interview,
- CATI - Computer Assisted Telephone Interviewing.
# Registers - data acquisition

## Data Owners:

- Ministry of Finance,
- Ministry of Interior and Administration,
- Ministry of Justice,
- Agricultural Social Insurance Fund,
- National Health Fund,
- Agency for Restructuring and Modernisation of Agriculture,
- Agricultural and Food Quality Inspection,
- Agency for Geodesy and Cartography,
- State Fund for Rehabilitation of Disabled Persons,
- County Offices,
- Commune Offices,
- Regional Offices,
- Telcoms,
- Energy Suppliers,
- Office For Foreigners,
- Social Insurance Institution,
- Housing Managers,
The use of administrative sources in censuses

• The usage of administrative sources during the census:
  – direct source of research data,
  – source of information to create a list of entities covered by the census frame (address-housing survey),
  – in addition, a source of information for:
    • imputation,
    • data estimation,
    • comparison the quality of the data.
On-line channels for data collection
System Architecture

Map Server

CAPI

Census Completeness Management

Operational Microdata Base

CATI

CAII
CAII method system
Self-enumeration by Internet
filling the questionnaire by the respondent

• Identification

Used to confirm the identity of the respondent.

• Entering identification data in a questionnaire (f.ex.: PIN, NIP, first name, last name) or additional authentication qualities (f.ex. a place of birth, mother’s maiden name)

• Establishing a password which jointly with PIN was the basis of authentication within 14 days
Self-enumeration by internet course of action in completing the survey by person

In case of full scope survey person fulfilled his/her questionnaire, and could also specify adults who lived in the same apartment.

In case of sample survey the dwellings questionnaires were completed in the first place. Later were fulfilled personal questionnaires.

After completion of the authorization process the census form was available for 14 days.
Self enumeration trend
Typical person using selfenumeration

- A man
- Age: about 24 years old
- A city inhabitant
- Secondary degree

'Dzienny' Graf w ciągu (5 Minut/y - Średnio)

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'Tygodniowy' Graf w ciągu (30 minut - Średnio)

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CATI – Computer Assisted Telephone Interview

• scheduled as the first or the second (following CAII) channel of collecting data;
• working posts of telephone interviewers - located in separated Call Center studies;
• telephone interviewers - provided with professional equipment.
CATI in National Census 2011

- 16 distributed Call Centers
- 320 SIP Stations
- 642 telephone interviewers/consultants
- technology Interactive Intelligence
- utility applications prepared by CSO in Poland

The system worked from 8.04 to 30.06 (84 days) in hours 8.00 – 20.00/2 shifts

Hotline 0 800 800 800 or (22) 44 44 777
The most significant functionality of Call Center

- Hotline
- Interviewing
- Arranging visits by census enumerators
- Confirming the identity of the interviewer/census enumerator
CAPI – Computer Assisted Personal Interview

• the third channel of data collection in the case of failure to obtain a complete set of data via CAII and CATI channels

• direct interviews in households (first or second channel)

- where such a way of proceeding results from adopted methodology or

- whose members has not expressed consent for a telephone survey
CAPI method system
Field enumeration management
Supervisor – Regional (NUTS2) level

Responsibilities:

• Address Point and Census Area management
• Enumerator monitoring
  – Census Progress
  – Localization and trail
• Emergency situation management
  – Providing help for enumerators
• Providing necessary information to enumerators
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Enumerator

- Map module - GIS
  - Ortophotomap
  - Cadastral Data
  - Assigned Tasks
  - Started Tasks
  - Completed Tasks
HH - Mobile terminal of enumerator with GPS

- HTC Touch Pro2
- Screen
  - touch-screen
  - size 3,6”
  - resolution 480 x 800 pixels
  - sliding, tilting - convenient usage
- sliding, 5-rows QWERTY keyboard
- GSM/GPRS/EDGE/UMTS/HSPA
- GPS module
- camera - 3,2 MP
- Windows Mobile® 6.5
Enumerator

- Visiting all assigned holdings
  - Filling electronic questionnaires
- Daily synchronisation
- Contact with the supervisor in terms of task scheduling
- Adding newly identified holdings
Enumerator
L10.1a. Jaka jest Pana(i) narodowość? Przez narodowość należy rozumieć przynależność narodową lub etniczną - nie należy jej mylić z obywatelstwem

1. polska
2. białoruska
3. czeska
4. karaimska
5. litewska
6. łemkowska
7. niemiecka
8. ormiańska
9. romska
10. rosyjska
11. słowacka
12. tatarska
13. ukraińska
14. inna

- Brak mieszkania
- Mieszkanie niezamieszkanne
- Nieobecność respondenta
- Odmowa spisu
- Odwołanie umówionego spotkania
- Spis w CAII
- Zaplanowanie spotkania w innym terminie
• Alarm procedure
  – In emergency situations, enumerators have a possibility of sending an alarm signal to their supervisors
  – Alarm notice is sent to the supervisor application and via SMS to the supervisor

Enumerator
CENSUS
Data Processing Infrastructure
The IT Census System
Census architecture

For the purposes of census design and conduction, the Central Statistical Office of Poland implemented the IT Census System (ICS)

The ICS integrated various technologies (from applications installed on mobile terminals, through applications managing and assisting in telephone interviews, to specialist bases, data warehouses and analytical and reporting tools)
ICS – main elements

Stage I – Preparatory Work:

- Metadata System
- Building Register
- Application for updating the statement of houses, flats and people
- Map servers (ESRI)
- Enumerators Registration System
- The notification System and Knowledge Base
Stage II – Data acquisition:

- The platform for data acquisition TransGUS
- Operational Microdata Base (OMB)
- Self Enumeration online system
- Metadata System (MS)
- Mobile and dispatch application – ASPIS
- Call Center
ICS - main elements

Stage III – Results compilation:

- Operational Microdata Base (OMB)
- Metadata System (MS)
- Analytical Microdata Base (AMB)
- Geostatistics Portal

Some of these systems were created by more than 10 commercial companies, but development and integration of whole system was conducted by CSO.
Architecture solution

Stage I – Preparatory works

Stage II – Data acquisition

Stage III – Results compilation
Administrative sources

- The process of data processing started from collecting administrative sources from data administrators’ registers in the field defined by the appropriate legal Acts.
- The Polish statistics has the right to access all unit data stored in information sources of the public and commercial sectors.
- The obtained data include necessary identifiers and personal data supporting the process of merging (linking) unit data from different sources.
Data quality -measures-

1. Measuring the quality of administrative registers
   - timeliness of data
   - methodological compatibility
   - completeness
   - identification standards used in the registry
   - usefulness
   - compatibility of data in administrative sources to data obtained in the study/survey

2. Measuring the quality in processing of data registers
   excessive coverage error rate
   incomplete coverage error rate – subjective indicator of completeness
   objective indicator of completeness
   imputation rate
   data correction index
   integration data from various sources index
Transform data

Data processing in the production environment consisting of:

- profiling – create a report on the data quality,
- unification/standardization of data,
- parsing (separation) or combining variables,
- standardization with schemes,
- conversion,
- validation,
- deduplication,
- data integration.
Operational Microdata Base

• The basic structure of data in the OMB is a layer. It is a set of records, each of which relates to one census unit (a person, a dwelling, a household). The records include the values of census attributes derived from source data collected from respondents or defined in a different way (e.g. in the process of imputation). Layer can differ between one another with a set of attributes whose values are presented in a given layer.

• In the first step of processing, before beginning the census, on the basis of source sets and the census frame the layer referred to as a Master Record was created, consisting of the initial value of the selected subset of census attributes. The values from this layer were transferred to the CAPI, CATI and CAII processes for personalization electronics questionnaires.
Operational Microdata Base

• After completing the census with the use of the CAPI, CATI and CAII processes, on the basis of information collected in the processes proper layers in the database are created. The layer which have already been saved in the system can serve as the basis for creating new, internal layer in which new attributes (derived from the existing ones) can be added.

• Collection and processing of data was done in the OMB, which contained personalized data on the census unit, together with the value of characteristics obtained from administrative sources and from other channels (CAII, CATI, CAPI)
Operational Microdata Base

• The Operational MicroData Base (OMB) - system included hardware-system-tool infrastructure (computer hardware, system software, tool software) and application software (computer programs that are the result of programming work). This base enabled the inclusion of data transmitted in electronic form through four informational channels by entities and to conduct further data processing. In the OMB processes connected with the control, correction, and linking of data, up to their complete cleansing took place. Next, depersonalized data (as the Golden Records) were transferred to the Analytical Microdata Base (AMB).
GOLDEN RECORD
Golden Record generation

Integration with Census Frame and CAxI data,
Validation,
Correction,
Operational Imputation,
Transfer proper values to Golden Record,

Registers 1..n
CAxI
Golden Record

OMB Layers
AMB
The main objectives of AMB

Preparation and dissemination census data for statistical analysis

Dissemination of analytical and reporting platform for development of census data collected and preparation of statistical products for national and international users.

Supporting for process of creation and dissemination statistical products
Analytical Microdata Base cont.

In the Analytical Microdata Base took place the following processes: data integration, validation, automatic correction, imputation, calibration, creation a new secondary variables and new statistical units (i.e. families and households).

ETL processes in OMB and AMB were repeatedly executed until the approval by the methodologists.

In the next step, processes concerning creation multidimensional objects - OLAP Cubes (domestic needs), and Hypercube (60 HC) and Quality Hypercube (in accordance with international requirements - Eurostat) were made.
Concept solution

ETL
- transfer to base
- validation
- correction
- imputation
- weighting
- calibration
- transformation
- quality indicators,
- calculation of the secondary variables,

ANALYTICAL MODEL

MULTIDIMENSIONAL STRUCTURES

REPORTS, ANALYSES

DISSEMINATION DATA

APPLICATION OF INTERNAL USERS

APPLICATION OF EXTERNAL USERS

GOLDEN RECORD NSP’2011

REPOSITORY OF DATA AND METADATA

STATISTICAL PRODUCTS FILES TO EUROSTAT

SDMX
Data processing in AMB

In order to realize the process of "Data Processing", a series of ETL jobs were divided into the following steps (using the SAS Data Integration Studio tools):

- S00: load source data from Golden Record NSP’2011 (8 tables: Buildings, Dwellings, Collective living quarters, Persons, Emigrants after 2002, Homeless, Households, Families),
- S01: copy the relevant objects, Households, Families,
- S02: execution of the automatic data correction,
- S03: Validation tables of Golden Record,
- S04: execution of manual data correction,
- S05: weighing data
- S06: data calibration and imputation
Data processing in AMB

- S07: control reports
- S08: calculation of derived variables
- S09: calculating rules on the basis of dictionaries
- S09a: adding the secondary variables
- S10: transformation data to the analytical model (facts tables and dimension tables, cubs for national purposes)
- S11: creation and loading hypercubes for Eurostat
- S12: validation of hypercubes and creation quality hypercubes for Eurostat
- S13: transformation of operational metadata
- S14: enumeration of quality indicators
- S15: preparation aggregates for the Geostatistics Portal
The Metainformation System

The Metainformation System gathered indispensable metainformation describing data and census processes, including the processes indispensable to drawing up quality reports. The task of the Metainformation System was to ensure the coherent definition of statistical objects for the Operational Microdata Base (OMB) and Analytical Microdata Base (AMB).
Conceptual model of metadata

• Methodological metadata
  ➢ Describe the data and processes in the context of existing inventories
  ➢ Are the basis for the implementation of technical objects executive systems (eg. OMB, AMB)
  ➢ Examples: concepts, rules, processes definition, dimension, measures definition, quality indicators definition
Conceptual model of metadata

• Operational metadata
  - Are collected in executive systems
  - Are collected for the purpose of reporting
  - Describe the data processing
  - Examples: information about the collection of data, information on the source of the features, the values of quality indicators

• Technical metadata
  - Implementation of methodological metadata in specific technical environments, for example, SAS
Instead of a conclusion

Census in 2002

- 180 thousands of census enumerators
- 120 mln of questionnaire
- 1 000 tons of papers
- At the end shredding census questionnaires

Census 2011

- 18 thousands of census enumerators
- 0 questionnaires
- 0 tons of papers
- ca. 50 mln € less
- better data
- the more reliable results
- statistical surveys in the future
Census data dissemination
GEO.STAT.GOV.PL

START: JULY 2013

Census results: Choropleth maps, Diagram maps

Local Data Bank

Other statistical databases
The main objectives of the Portal

• The spatial presentation of collected data, in particular:
  • **Agricultural Census 2010**
  • **Population and Housing Census 2011**
  • **Local Data Bank** – a huge database with statistical data for years 2009-2012
• The spatial presentation of the geostatistical analysis results
• Completing tasks associated with **INSPIRE** Directive guidelines implementation
The portal allows statistical data presentation in form of any spatial unit:

- 5’ grid
- 1 km² grid
- administrative division
- urban division
- statistical division
- any other polygon
Default view
Statistical division
Object identification
One phenomenon – various presentation levels
Bar chart
Publishing statistical data on grids

GEOSTAT project
Merging statistical data and geospatial information

Total population in 1km² grid (persons)
- 0 - 20
- 20 - 80
- 80 - 160
- 160 - 2000
- >2000

Total population in 1km² grid (persons)
- 0 - 10
- 10 - 40
- >40

Map showing population distribution in 1km² grids.
High-level, generic framework that consists of five principles that are considered essential for integrating geospatial and statistical information.

Five principles of the Global Statistical Spatial Framework

1. Use of fundamental geospatial infrastructure and geocoding
2. Geocoded unit record data in a data management environment
3. Common geographies for dissemination of statistics
4. Interoperable data and metadata standards
5. Accessible & Usable

GSGF prepared by Australian Bureau of Statistics and approved by UN-GGIM on August 2016
"The 10 Level Model"

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| unique identifiers system |

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AIMS AND OBJECTIVES

• The United Nations initiative on Global Geospatial Information Management (UN-GGIM) aims at playing a leading role in setting the agenda for the development of global geospatial information and to promote its use to address key global challenges. It provides a forum to liaise and coordinate among Member States, and between Member States and international organizations.
1. Integrating **geospatial statistics** and other information
2. Development of a global map for sustainable development
3. Geospatial information supporting Sustainable Development and the post 2015 development agenda
4. Adoption and implementation of standards by the global geospatial information community
5. Development of a knowledge base for geospatial information
6. Identification of trends in national institutional arrangements in geospatial information management
UN-GGIM Arab States

• **Countries**
  - Algeria, Bahrain, Comores, Djibouti, Egypt, Iraq, Jordan, Kuwait, Lebanon, Libya, Mauritania, Morocco, Oman, State of Palestine, Qatar, Saudi Arabia, Somalia, Sudan, Syrian Arab Republic, Tunisia, United Arab Emirates and Yemen.

• **Executive Body**
  - **Chair:** H.E. Dr. Abdulaziz Alsaab, Saudi Arabia
  - **Vice Chair:** Mr. Hamid Oukaci, Algeria
  - **Vice-Chair:** Mr. Awni Al-Khasawneh, Jordan
  - **Secretary:** Mr. Saad M. Al Hamlan ([s.alhamlan@gcs.gov.sa](mailto:s.alhamlan@gcs.gov.sa))
  - **Website:** [http://www.un-ggim-as.org/](http://www.un-ggim-as.org/)

• **4th Meeting of the UN-GGIM Arab States** will be on 21-23 February 2017 in Qatar
Thank you for your attention

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