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The Swiss Census 2010: Moving towards a comprehensive system of household and person statistics

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Abstract: This paper provides a brief overview of the ongoing conception of the Swiss Census 2010 and the setup of a new integrated system of household and person statistics. The Swiss Census that was held (almost) every 10 years from 1850 until 2000 will be modernized. It will be based on an annual register survey, an annual structural survey of a large sample and five topic-based sample surveys alternating every year and a small annual omnibus survey. The process design will be organized along the EDIMBUS process model.

Keywords: census, register, survey, sample, data collection, data integration, integrated system, EDIMBUS, process model

1 The basic principles of the 2010 census

1.1 The 2010 census

On June 22, 2007 the Swiss parliament passed a completely revised version of the act concerning the federal census. The act came into force on January 1, 2008. The intention of the Swiss Federal Council and parliament in passing this new act was to modernise official statistics. The new census represents a comprehensive change of the system. The traditional census, which was previously carried out every ten years with the entire population, will be replaced by an integrated statistical system. This combines the use of existing person data registers with sample surveys which are carried out and evaluated in an annual cycle.

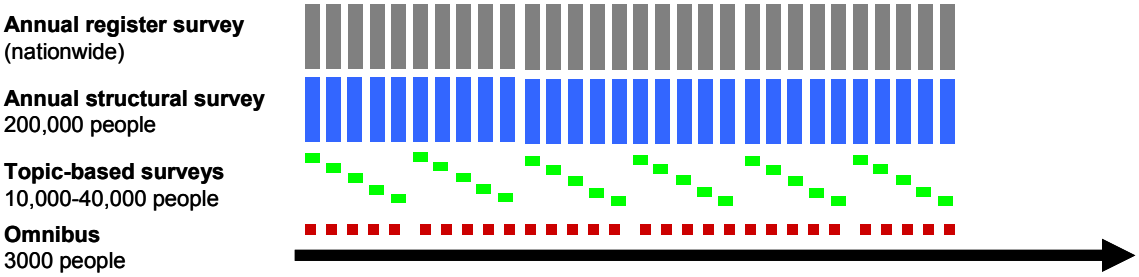
The new system offers a wide range of benefits. The information will be available more frequently, on a wider range of topics and within a very short period of time. The availability of the latest data on an annual basis will improve the ability to monitor important, politically relevant, sociocultural topics on a regular and systematic basis. The new system can also be constantly updated and developed. Impor-

tantly, it also offers an excellent cost/benefit ratio. Improved coordination and the increased use of synergies will result in a significant reduction in costs and administrative work, while at the same time lightening the burden on the interviewees and the municipalities.

1.2 Key elements of the census

The Census Act specifies the requirements for the new system. Data concerning the population structure and societal development in Switzerland are to be collected every year. The relevant topics are described in article 1 of the act. The broad range of topics is covered by four different surveys which will be carried out annually: the register survey, the structural survey, also called Swiss Population Survey, one topic-based survey and the CH omnibus (Figure 1).

Figure 1: *Survey time line*



The annual register survey is based on the population registers of the municipalities and cantons, the most important federal person data registers and the National Register of Buildings and Dwellings. Therefore, the survey provides basic information annually about the population and about buildings and dwellings at the smallest spatial resolution. The act concerning the harmonisation of official person data registers, which came into force on January 1, 2008, has fulfilled one of the central requirements for the easy and efficient use of the register data. The act specifies the identifiers and the attributes which the registers must include, determines the content and form of the registers and controls the exchange of data between them.

The structural survey is an annual sample survey of 200,000 people. As it is a population survey, it includes important attributes which are not currently available in the registers. The survey covers people living in private households who are aged 15 or over. The interviewees provide information about themselves and their households. An annual sample survey of 200,000 people allows statistical analyses to be carried out for all the cantons and for groups of 15,000 people with a sufficient accuracy. After five years it will be possible to make assertions about groups of 3,000 people using data pooling, by combining five consecutive annual structural surveys. Such a method is used for example in the American Community Sample. Within these groups, units of 140 people can be identified after one year and of 28 people after five years. The cantons can supplement the survey within their own area at their own expense to improve the results further.

Since the new Swiss Federal Census Act foresees a duty to give information for the Swiss Population Survey, the response rate is expected to be very high. The anticipated accuracy of the Swiss Population Survey has been analyzed in Eichenberger, Hulliger and Potterat (2007). The concepts of estimation of the size of a group, the resolution of a survey, i.e. the smallest estimable size, and the comparison of proportions are introduced and discussed in that paper.

Topic-based sample surveys will also be carried out annually using a sample size of 10,000 to 40,000 people. The following topics will alternate on a five-yearly cycle: "mobility", "education", "health", "families" and "language, religion and culture". The existing health survey and the transport micro-census will be incorporated into this system. Because of the size of the samples, the topic-based surveys

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allow conclusive results to be produced for the whole of Switzerland and the seven major regions. The micro-census on mobility and transport will also provide results for the large urban areas. The cantons can also supplement these surveys at their own expense.

The survey referred to as the CH omnibus is a new flexible tool which will provide rapid answers to current questions. This annual sample survey of around 3,000 people offers interested groups the opportunity to join in by asking specific questions. The survey produces results for the whole of Switzerland which can be rapidly processed and published.

1.3 The census as part of an integrated system

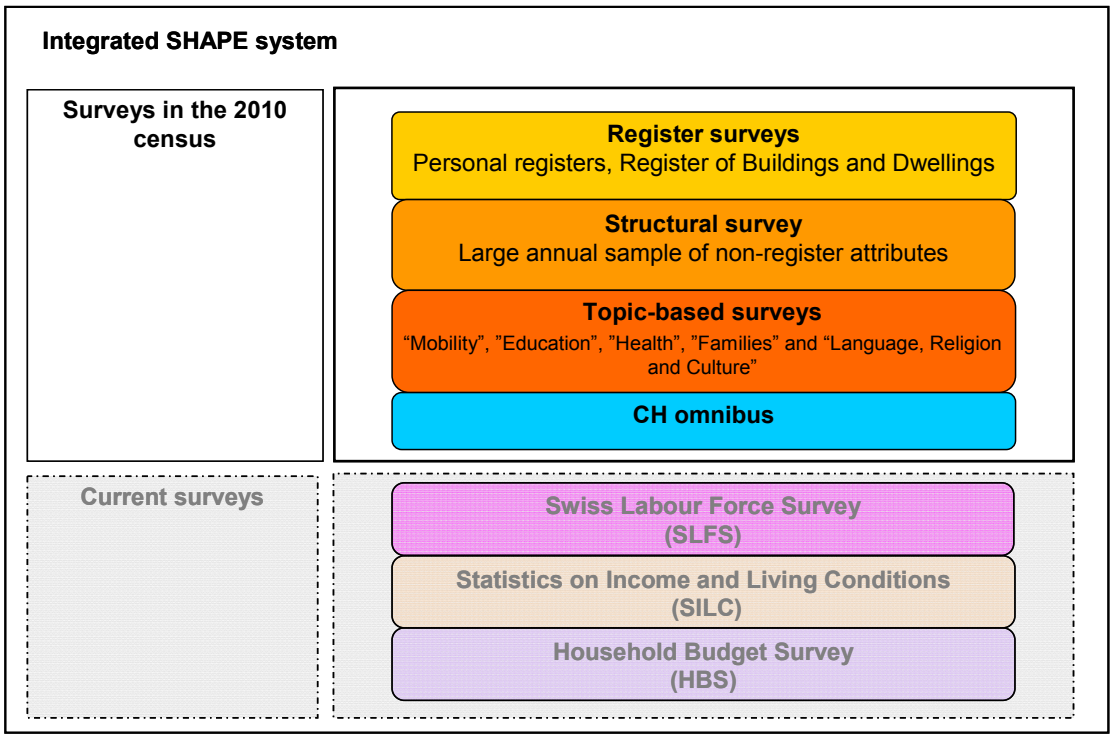
The new focus of the census has transformed it into the backbone of a new integrated system for household and person statistics (SHAPE). In the future it will be part of a system which combines the systematic use of existing administrative registers and sample surveys of people and households. The content, method and organisation of the various surveys will be linked and coordinated with one another. In particular in the long term, the integrated system provides added value which makes it much more than the sum of its parts.

The different areas which make up the census supplement existing surveys in order to create a comprehensive picture of socioeconomic statistics (Figure 2). Three annual surveys are already carried out on the topics of "work" and "income, consumption and living conditions".

- The Swiss Labour Force Survey (SLFS) provides data about the labour market and about working life in general. In order to coordinate with European statistics, the results will in future be produced quarterly.
- The Household Budget Survey (HBS) provides regular information about the consumption habits and income of private households in Switzerland.
- The new survey on income and living conditions introduced in 2007 (SILC: Statistics on Income and Living Conditions) covers a wide area including income, education, work, childcare, the composition of households, the housing situation and health.

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Figure 2: *Integrated system for household and person statistics (SHAPE)*



2 The new census: The information provided and the survey programme

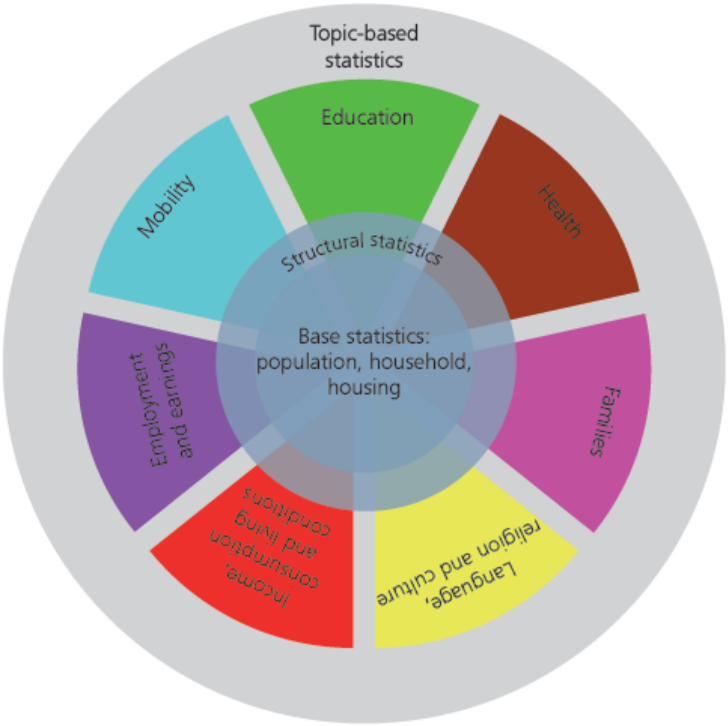
2.1 Statistics and surveys

At the heart of the new statistical information system is the resident population of Switzerland, in other words, the people and their households. For every person, a link with the dwellings and residential buildings is formed. The new census system allows four different surveys and their resulting data to be brought together. In future, this integrated system will make four types of statistics available with a different topic-based and spatial depth of focus.

- Basic annual statistics on the population, households and housing on the basis of the nationwide register survey.
- Annual structural statistics based on the structural survey. These also include the traditional topics of the census. They provide additional information to the basic statistics and form the basis for the analysis of the topics at canton level.
- Detailed annual statistics on the topics of "labour" and "income, consumption and living conditions" using the topic-based surveys.
- Detailed annual statistics on one of the other topics.
- Annual statistics on current issues on the basis of the CH omnibus.

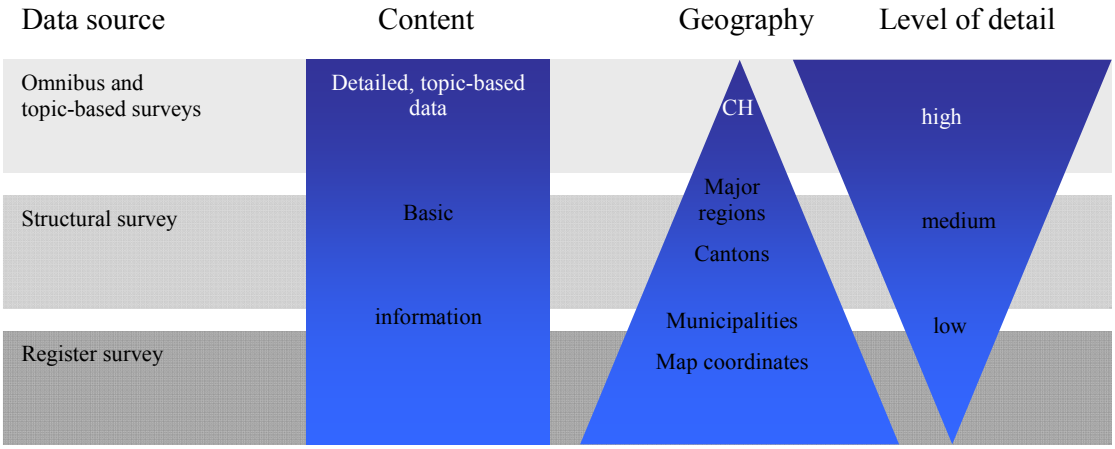
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Figure 3: *Integrated system: Statistics and topics*



The system includes all the information about persons, households and housing from the basic statistics, structural statistics and detailed topic-based statistics (see Figure 3). These cross-sectional perspectives and the integration of the results from the various surveys allow the seven topic areas to be covered comprehensively. The principles of the data integration in simplified form are as follows:

Figure 4: *Integrating the statistics*



2.1.1 Embedding into the European statistics systems

When the bilateral agreement on statistics with the EU came into force on January 1, 2007, one important institutional and legal condition changed. Switzerland is now responsible for ensuring on a systematic basis that Swiss statistics are comparable with those of the EU and EFTA countries. For this purpose, Switzerland has adopted the corresponding legal instruments of the EU. The United Nations Economic Commission for Europe (UNECE) and the Statistical Office of the European Communities (Eurostat) have issued joint recommendations for population and housing censuses in 2010. These

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describe the attributes to be included in the survey, the recommended additional attributes and the classifications and definitions which ensure that the data can be subjected to international comparisons. Switzerland will follow the UNECE/Eurostat recommendations concerning the key area of the census results and consider the Regulation on Population and Housing Censuses in the EU Member States.

2.1.2 A new sample survey system supported by register data

From 2010 onwards, samples can be drawn using auxiliary information collected in the population registers and the National Register of Buildings and Dwellings. The population statistics play a central role in providing reference figures for estimations based on the sample surveys. The information on the overall population, on population groups and on residential buildings and dwellings is very important for the purpose of planning, weighting and calibration procedures of the sample surveys.

2.1.3 Basic statistics on population, households and housing based on register data

The basic statistics on population, households and housing form the core of the new statistics system. The main source of these statistics is the register survey. Demographic evaluations of the entire population are carried out annually. These cover the entire resident population living in private and collective households. The basic information on population and households is combined with data on residential buildings and dwellings from the National Register of Buildings and Dwellings. This link provides annual, geocoded information on the population, households, dwellings and living conditions. It also allows annual, small-scale evaluations at the level of the municipalities or below to be carried out. Alongside cross-sectional statistics of this kind, the sources of basic demographic statistics can also be analysed from a chronological perspective.

Indicators for the basic output on population and households

The basic statistics on the population and households provide classic demographic indicators, such as population structure, size and evolution. They cover the entire resident population living in private and collective households and provide annual results on the following indicators:

- Size and structure of the population
- Population balances
- Change of status: Status of the resident foreign population
- Acquisition of Swiss citizenship
- Migration: Internal and international migration
- Private and collective households
- Marriages and civil partnerships
- Divorces and dissolutions of civil partnerships
- Widowhood
- Recognition of paternity
- Adoptions
- Live births and stillbirths
- Deaths
- Population scenarios

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Indicators for the basic output on housing

The basic statistics on housing provide information about the building and housing stock and its structure, together with living conditions. They cover all the residential buildings and dwellings in Switzerland and provide annual results on the following indicators:

- Building and housing stock
- Age of buildings and dwellings and the date of the most recent renovation
- Housing supply
- Residential moving behaviour
- Heating and energy sources
- Occupied or unoccupied dwellings

2.1.4 Structural statistics based on the structural survey

The structural statistics combine the results of the structural survey and the register survey and therefore provide information which goes beyond the restricted scope of the basic statistics. They complement the basic annual statistics with a large-scale sample survey of attributes not included in the registers. They also forge a link between the basic statistics generated from register data and the detailed information of the individual topic-based statistics, by creating general overviews of the most important population structures. The fact that the statistics are available annually also allows important changes in the population structure to be monitored regularly at a detailed level. The main source of structural statistics is the link between the newly introduced annual structural survey of 200,000 people and the register survey described above.

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Indicators for the basic output of structural statistics

The structural statistics provide additional information on the basic statistics, together with base information for the analysis of the topic areas. The corresponding person statistics cover the resident population, excluding those people who live in collective households. The information on dwellings relates to occupied dwellings. The structural statistics provide annual results on the following topic areas and indicators:

Basic statistics on population, households and housing

- Migration
- Housing rents
- Home ownership ratio and rate
- Housing situation

Introduction to the topic areas:

Work

- Employment and participation in the labour market
- Unemployment

Mobility

- Commuting
- Means of transport
- Traffic volume

Education

- Highest level of education obtained
- Current education
- Education and the labour market
- Original training and current occupation

Language, religion and culture

- Languages
- Religions

Families

- Household structures, family types and living arrangements
- Life/work balance

2.1.5 Detailed statistics on the topic areas

The annual structural statistics cover seven topic areas in a regular cycle. The topics of "work" and "income, consumption and living conditions" are based on the existing SILC, SLFS and HBS surveys and are surveyed and analysed annually. They already allow analyses to be carried out at the level of the major regions and meet the political requirements of the Swiss Confederation.

New surveys on the five topics of "mobility", "education", "health", "families" and "language, religion and culture" will be introduced and integrated into the 2010 census. The intention is to cover these topics in a five year rhythm. This level of frequency is adequate because the annual information from

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the structural survey gives a general overview of the most important changes, which usually take place more slowly and continuously than those in the labour market or in household incomes. The geographical depth of the analyses will depend on the requirements and on their political relevance for Switzerland. The evaluations cover the permanent resident population, but generally exclude those people living in collective households.

The output is based on the detailed topic-based surveys and modules which supplement the existing surveys in the integrated SHAPE system. The indicators for the topic areas will be defined as part of the design process of the individual surveys in cooperation with the cantons and other interested groups.

2.2 Consolidation into an integrated system

The new census can only exploit its full potential if it takes the form of an integrated system. It is more than the sum of the various individual statistics. In order to create an integrated system, integration components are needed which will bring together surveys based on different data sources. The four integration components are as follows:

- The basic populations shared by all the surveys.
- The new social security number which as a person identifier uniquely identifies a person in different data sources.
- The building and dwelling identifiers which allow the formation of households to be identified and the attribution of people and households to buildings and dwellings.
- The core variables which ensure that the results in different surveys are comparable and that the population groups and basic populations are uniformly defined.

2.2.1 Common basic populations

The different surveys can only be consolidated on a common foundation consisting of the same basic populations which are uniformly defined and harmonised. They determine the framework of the person, household and housing statistics using the statistical units which are being monitored.

The following three basic populations form the common foundation of all the statistics in the SHAPE system:

- The permanent resident population, without people living in collective households, which are defined in the Register Harmonisation Ordinance (e.g. homes for elderly people, prisons, etc.).
- All private households, in other words, all groups of people living under one roof in the same dwelling. Collective households are excluded.
- The third common basic population consists of the occupied residential buildings and dwellings.

2.2.2 Personal identification number

As part of the process of harmonising the official population registers, the new social security number will be included in the registers listed in the Register Harmonisation Act. The number can be used as a personal identification number (PIN) for statistical purposes. The introduction of the thirteen-digit PIN into the registers specifically referred to in the act is a central element of the process of linking data for statistical purposes. Data with the new social security number are regarded as non anonymised data. For this reason, measures will be needed to guarantee the protection and the confidentiality of the data. The use of one or more statistical identification numbers (pseudonymised numbers) which are specific to each area and other technical protection measures will be investigated.

2.2.3 Dwelling and building identification numbers

The process of register harmonisation involves assigning to each person in the population register the federal building identification number (EGID) and the federal dwelling identification number (EWID) of

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the dwelling in which they live, from the National Register of Buildings and Dwellings. This allows the composition of households to be determined on the basis of the register. The federal dwelling identification number is a three-digit identifier of the dwellings in the Federal Buildings and Dwellings Register. It is unique within each building and is always assigned in combination with the nine-digit federal building identification number.

2.2.4 Harmonised core variables

The definition of core variables is a further precondition for a harmonised structuring of the statistical information. The attributes should, in future, be used uniformly in all the surveys. They allow population groups to be defined and identified in a standardised way. The core variables also generate a lowest common denominator which guarantees that the results of the different statistics and the statistical monitoring of specific population groups are comparable.

The concept of the harmonised core variables allows assertions to be made about the statistical units in the different topic areas. For example, conclusions can be drawn about the mobility and travel behaviour, health prevention measures, use of cultural activities, language skills or religious practice of groups according to the "highest level of education attained". As a result, definable groups of people (for example, people with university degrees) can be described and analysed in the context of the topic areas.

3 Supplementing the structural survey

The structural survey, also called Swiss Population Survey, is a sample survey of persons. This means that the information obtained can be extrapolated to produce statistical results for the entire population. The results of these projections are estimates which are subject to certain random sampling errors.

The standard programme consists of a survey of 200,000 people aged 15 years or more who are living in private households. As a result, around 2.7% of the entire resident population is surveyed every year. This corresponds to approximately 3.5% of the people aged 15 years or over. The precision of the assertions made on the basis of a sample of this kind can be described in terms of two factors. The depth of focus indicates the smallest geographical unit for which reliable estimates can be made. In contrast, the resolution represents the smallest possible group which can be precisely estimated independently of the size of the geographical unit.

The standard programme allows statistical assertions relating to individual attributes to be made with a sufficient level of accuracy for groups of 15,000 people. These groups can correspond to regional or socioeconomic boundaries, for example, women with a university degree aged between 30 and 40 or single mothers. Using this depth of focus, sound results can be achieved for all the attributes in the structural statistics for all the cantons, larger municipalities and larger districts of large cities.

Estimates for small groups define the mesh size of the monitoring net. In the standard programme the size of a group for which estimates can be made is 140 people, regardless of the attribute being investigated. These people become trapped in the monitoring net, so to speak. Where attributes apply only to a smaller group of people, for example, if only 100 people in a municipality have a tertiary education, they cannot be identified with certainty in the analysis grid.

Pooling or combining the data from structural surveys over several years allows a correspondingly larger sample to be formed. As a result, the precision and significance of the results also increase. However, this information does not refer to a clearly defined survey date, but represents an average over the period being investigated. Data will be pooled over three and five years, resulting in sample sizes of 600,000 and 1,000,000 people. The depth of focus and the resolution change accordingly.

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Details about the anticipated accuracy of the Swiss Population Survey can be found in Eichenberger, Hulliger and Potterat (2008). The Swiss cantons have the possibility to increase the sample sizes for the structural survey and the topic-based surveys at their cost and reduce in this way the sample errors.

4 Integration of sample survey and register data

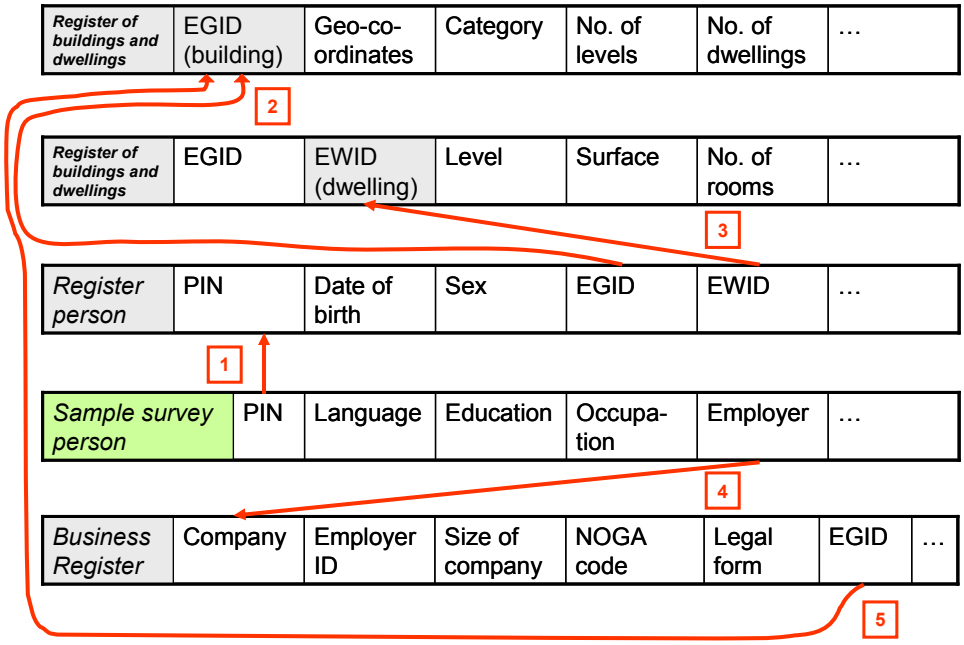
One of the main principles of the new integrated system is that in a sample survey, information that is available in a register will no longer be questioned. For example, information about sex, civil status and nationality will not be questioned in the Swiss Population Survey since this information is already present in the municipality registers. This procedure has the aim to reduce the burden of the survey respondents. This is also a preoccupation of the Swiss Constitution in which register harmonization is put forward to reduce census efforts (Article 65).

In the new integrated system of household and person statistics (SHAPE), several types of data integrations will be carried out:

- data from person registers – data from the National Register of Buildings and Dwellings (links 2 and 3 in Figure 5),
- person data from sample surveys – data from person registers (link 1 in Figure 5),
- person data from surveys – data from the business register (link 4 in Figure 5).

Figure 5 contains a schematic view of the combination of sample survey and register data in the new integrated system.

Figure 5: *Outline of the sample survey and register data combinations*



In what follows, we will briefly describe the expected benefits of this register data and sample survey data integration. Overall it is expected that the quality of the annual Swiss Population Statistic will be improved immensely.

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4.1 Register person – building in the Register of Buildings and Dwellings (link 2)

This link provides geo-coordinates (East and North coordinates) for every person. Thus the improved statistical information will be geo-encoded and can be made available for very small geographical areas. In the future it will be possible to produce basic demographic information down to the level of city neighbourhoods.

During the editing and imputation phase, this link may also help to increase – e.g. through automatic imputations – the quality of the building status (in project, in construction, existing, dismantled), category (one family home, several families home, etc.) and number of dwellings.

4.2 Register person – dwelling in the Register of Buildings and Dwellings (link 3)

The combination of EGID and EWID allows linking every person to a dwelling. Thus exhaustive information about housing conditions may be obtained. Since all persons who have been attributed the same EGID-EWID combination form a household, households are also linked to dwellings.

This link also allows defining the set of inhabited or temporarily inhabited dwellings. During the editing and imputation phase, this link may also help to increase – e.g. through automatic imputations – the quality of the dwelling attributes like status (in project, in construction, existing, cancelled), number of rooms and surface.

4.3 Survey person – register person (link 1)

This link allows the enrichment of sample survey data with demographic data from registers thus allowing numerous cross tabulations of sample survey data and register data on the person, building and dwelling level. The formation of population sub-groups based on sample survey and/or register attributes and comparison of results between sub-groups in the same survey or across surveys becomes also possible.

4.4 Survey person – business register (link 4)

Finally this link allows to couple sample survey person data with data of the business register. Thus information on NOGA classification, size and legal form etc. of a possible employer can be added to the sample survey data. The business register is maintained by the Federal Statistical Office.

The employer information in the business register also contains a building identifier (EGID) and thus the possible working place of a sample survey respondent can also be geo-encoded (link 5), thus allowing e.g. the computation of the commuting distance.

The same holds for a possible school or education site.

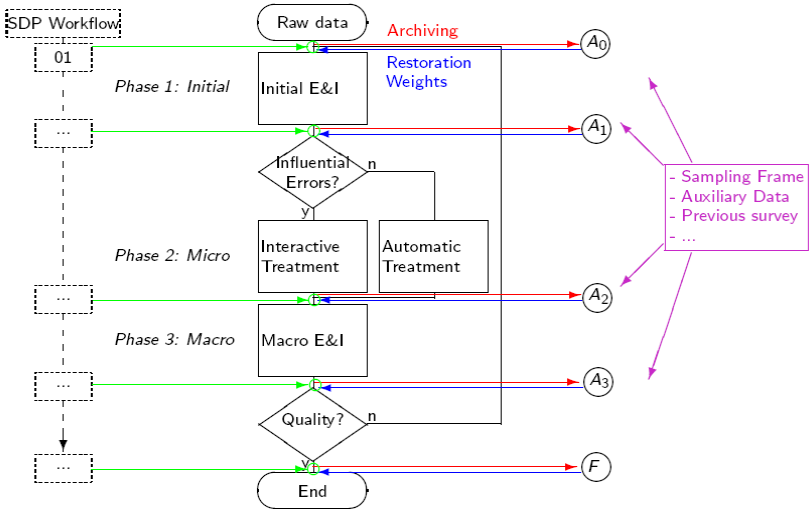
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5 Process design for the 2010 census

5.1 EDIMBUS process model

In the conception and process design phase of the integrated SHAPE system, the project team at the Federal Statistical Office used the EDIMBUS process model to design the data preparation phase. The applied statistical data preparation (SDP) process has been developed in the “Recommended Practices for Editing and Imputation in Cross-Sectional Business Surveys in the European Statistical System” (EDIMBUS) project carried out by the Italian Statistical Institute, Statistics Netherlands and the Swiss Federal Statistical Office. Although primarily designed for business surveys, its principles can be carried over to person, household, building and dwelling surveys.

Figure 6: *EDIMBUS model*



The data preparation process is subdivided into phases as can be seen in Figure 6. The first phase contains an initial data preparation where simple (e.g. systematic) errors are treated first. In a second phase, the data flow is separated in a critical and non-critical data stream with manual and automatic treatments respectively. In phase 3, data quality is checked on a macro level. At the end of each phase, a copy of the data is preserved for further possible iterations. We refer to the EDIMBUS web-site for more details.

The EDIMBUS process model has been applied to the three major types of surveys of the new integrated census system, namely the register survey, the structural survey and the topic-based surveys. If applicable, different data channels (registers, paper census form, Internet questionnaire and CATI) have been considered.

5.2 Implementation and next steps

The next steps in the setup of the integrated system are very briefly sketched out in the following:

- detailing of the process steps;
- specifications for the IT company in charge of the development of the system;
- decision for a combination of off-the-shelf solutions or a proprietary development;
- development and testing of the system.

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6 Further information

Further up-to-date information on the integrated system can be found at:
- www.bfs.admin.ch / Modernisation projects / 2010 census
- www.bfs.admin.ch / Modernisation projects / SHAPE
- www.bfs.admin.ch / Modernisation projects / Register harmonisation

Published information:
- Brochure "SHAPE: The New Statistical System on Households and Persons"
- Message for the fully revised version of the Act on the Federal Census of November 29, 2006 (06.093)
- Message for the harmonisation of official person data registers of November 23, 2005 (05.083)

The most important legal foundations of the 2010 census and SHAPE:
- Statistics Act (BStatG) of October 9, 1992 (SR 431.01)
- Act of June 22, 2007 concerning the Federal Census (Federal Census Act) (SR 431.112)
- Data Protection Act (DSG) of June 19, 1992 (SR 235.1)
- Act on the Harmonisation of Population Registers and Other Official Personal Data Registers (RHG) of June 23, 2006 (SR 431.02)

International requirements for the 2010 census:
- Recommendations for the 2010 round of population and housing censuses within the ECE region: The United Nations Economic Commission for Europe and the Statistical Office of the European Communities, New York and Geneva 2006 (only available in French and English).
- Regulation on Population and Housing Censuses in the EU Member States: Presidency Common Position, Working Group of Demography and Census, Luxemburg, 6-7 March 2008.

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- EDIMBUS website: http://edimbus.istat.it

Reference
Eichenberger Ph., Hulliger B., Potterat J. (2008) Anticipated Accuracy of the Swiss population Survey, submitted for publication.

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