

Innovative approaches to census-taking: overview of the 2011 census round in Europe

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Abstract

In the course of the year 2011, almost all European countries have conducted the population and housing census. About half of the countries in Europe conducted the 2011 census using an alternative methodology to the traditional census, in most cases for the first time. In general, the alternative methodologies adopted are based on the use of data from registers, either as the only source of census data, or in combination with other data sources. There are also innovative methods that do not make use of registers, like the French “rolling census”. This paper discusses the reasons that pushed many countries to consider alternative census methodologies. An overview of the different alternative approaches to census-taking developed in Europe is presented, with an attempt to evaluate the implications in terms of data quality, costs and organization.

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1 Introduction

The population and housing census can be considered as one of the “pillars” of national statistical systems. In fact, the census provides the benchmark for the population count at national and local levels, and yields information on the characteristics of the population at fine levels of territorial detail and for small population groups on which data cannot be collected using sample surveys. Furthermore, the census allows the creation of a solid frame that can be used to draw samples for all surveys conducted by the National Statistical Institutes and other relevant statistical institutions (UNECE, 2006).

The population census plays a key role in all countries, but it is particularly important in countries where vital statistics are not complete and accurate, as the census is the only statistical source providing in these countries accurate and detailed estimates of the population size and structure.

In July 2005 the United Nations Economic and Social Council (ECOSOC) adopted a resolution on the 2010 World Population and Housing Census Programme (UN-ECOSOC, 2005), in which Member States were urged to carry out a population and housing census at least once in the period 2005-2014, and to disseminate the census results in a timely manner. Similar resolutions were adopted by ECOSOC in connection with previous census rounds.

At the global level, the situation for the 2010 census round seems to be better compared to the 2000 round. The United Nations Statistics Division (UNSD), which is responsible at the global level for the 2010 World Population and Housing Census Programme, released in March 2011 a report (UNSD, 2011) according to which it was expected that by the end of the census round in 2014 at least 227 countries and areas (covering approximately 99 per cent of the world’s population) would have conducted at least one census. Only 6 countries or areas had not indicated a planned date for their 2010 round census. This is a significant improvement compared to the 2000 census round (covering the period 1995-2004) when 26 countries or areas – mainly in Africa - did not carry out a census.

According to the report by UNSD, in Europe it was expected that virtually all countries would conduct at least one population census by 2014. The large majority of countries in Europe have conducted the census in 2011, which is the reference year for the European census programme (which means that EU member states were expected to conduct their census in 2011). The report also shows that, compared to other continents, Europe stands out for the high number of countries that conducted the census using data from registers or adopting other methods alternative to the traditional census.

This paper presents an overview of the 2010 census round in Europe, focusing on the census methods used in the different countries. In the next sections, the main census methods are presented, starting with the “traditional census” and the problems that countries

may face using this approach. The main alternative census methods are presented in the following sections. For each of them, relative advantages and disadvantages are discussed, together with some implications on census organization, costs, data quality and coverage. Finally, information is presented on which census methods have been adopted by the various countries across Europe for the census of the 2010 round, together with a comparison with the methods used for the previous (2000) census round.

2 The traditional census approach

For many centuries, since the censuses taken in ancient Egypt, the methodology used for the census has been basically the same, consisting of the direct count of all individuals and their characteristics through the completion of population lists or – more recently - census forms. This information is collected in the field across the whole country in a relatively short period of time, normally lasting a few weeks.

In the traditional census there are two alternative methods of enumeration. In the first method the census enumerators are responsible for collecting the information from the households during an interview and completing the forms. This approach is usually adopted in countries where a relatively high proportion of the population has minimal education or is illiterate. This method is particularly expensive because enumerators have to conduct interviews in addition to delivering and collecting the forms.

In the second method, the enumerators deliver the forms to the households and collect them some days later when they have been completed. The forms are filled in by the members of the household, normally by a designated member called the reference person (indicated in some countries as “head of the household”). In some countries where this method is adopted, the postal system is used instead of the enumerators for the delivery and/or collection of the forms.

2.1 Problems associated with the traditional census

Although the concept of the traditional census is relatively simple, its implementation is a huge and very complex operation that requires significant financial resources, the participation of various administrations at the central and local levels, and the recruitment and training of a large work force to be employed on a temporary basis as census field staff (enumerators, supervisors, etc.).

From the point of view of the **census management**, there are a number of problems and issues to be faced when the traditional approach is adopted, including the following:

i) Very high cost: the census conducted in a traditional way is very expensive. The main cost item is for the temporary work force (enumerators, supervisors, etc.) that has to be recruited and trained, and has to work for a few weeks or longer periods. Considering that an enumerator is needed on average for about 100 households (this is a rough estimate, as the real number depends on the characteristics of the census, the territory and other factors), it is clear that the number of persons to be recruited is very high, and so is the cost. Apart from the cost for census field staff, the cost of printing, distributing, collecting a huge number of census forms, entering the data (manually or using scanners) and processing them is also very high. An analysis of data from the 2000 round of censuses conducted by UNECE showed that a traditional census could cost as much as about 20 US dollars per capita in purchasing power parity (ppp) units (United Nations, 2008, pages 39-41).

ii) Not only the very high costs, but also the cost distribution over time and in particular the peak around the period of the fieldwork can create problems for the management of the traditional census.

iii) In many countries, it is difficult to recruit a large number of temporary census staff for the fieldwork operations, taking into account that they must have the necessary skills but can be employed only for a short period.

iv) In many National Statistical Institutes, once the census operations have been completed, it is not possible to retain the staff that worked for the census; they are often reallocated to other services or released. In this case, the knowledge accumulated while planning and conducting the census is lost unless the same staff can be re-employed for the next census.

From the point of view of the **organization of the fieldwork operation**, there are also problems associated with the traditional census, including:

i) The cooperation of various administrations at the national and local level is normally necessary to conduct an operation as complex as the traditional census; this may pose problems in some countries, especially if the budget does not fully cover the census expenses, or if the respective tasks and responsibilities of the various administrations involved are not clearly specified.

ii) There are increasing difficulties to enumerate certain population groups, particularly those characterized by high mobility and multiple residences (including young professionals, students, workers, retired people or other categories who commute regularly between two or more places). In general, it can be difficult to find these persons at home in order to fill in the census forms. Moreover, identifying the place of usual residence for these people is often complicated. A partial solution to this problem is the possibility for the respondents

to complete the census forms on the Internet, which is offered as an option by an increasing number of countries.

ii) In many countries, an increasing reluctance of the population to participate in the census has been observed over the last years. This can be due to various reasons, including: reluctance to open the door for security reasons, in particular by old people or in areas with security problems; distrust towards the statistical institutes or more in general the public authorities; fear that the information collected could be used for purposes other than the statistical use; reluctance to provide information that is already available in registers or other administrative sources.

Finally, there are also some problems with the **outputs** produced by the traditional census, including:

i) The timeliness of the census results is often an issue at least for certain categories of users of the traditional census, because the results are normally available a relatively long time after the data collection, due to the need to process a huge amount of material and information.

ii) The frequency of the results may also not be sufficient for certain categories of users who need “fresh” data regularly updated: for these users, updates only every ten years are not sufficient.

iii) The information content is limited by the characteristics of the enumeration, in particular 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.

2.2 A variation of the traditional census: the use of long and short forms

In order to address some of the shortcomings of the traditional census, a possible solution consists of using two different forms: a long form is used to collect detailed information from a sample of the population, while a short form is used for the majority of the population, to collect only very general information used for the population count. This approach has been used for instance in the United States and Canada since the 1970s.

This method has the advantage of providing extensive information on the characteristics of the population (from the long form), and at the same time reducing substantially the amount of information collected and processed, and limiting the complexity and costs of the census operations. On the other hand, the information present in the long form is avail-

able only for a sample of the population, and therefore the information detail is limited both for small areas and for small population groups.

For the 2010 US census, the long form has been replaced by a large household sample survey (the American Community Survey, or ACS) that is conducted every year and provides detailed demographic, social and economic data about households. As a result, the new US census model is based on a decennial traditional enumeration – conducted in 2010 using only a short form – with yearly updates of the population characteristics on a sample basis provided by the ACS.

3 The register-based census

Starting in the 1970s, some Nordic countries began working on a totally different approach to the census, where the traditional enumeration was replaced by the use of administrative data coming from various registers (population register, cadastre, social security, etc.) through a matching process, making use of a personal identification number. This approach, adopted for the first time in Denmark in 1981, permits the production of census data at a limited cost and with relatively limited work, once a good quality system of statistical registers has been set up. This approach has the advantage of placing no burden on individuals, and data are potentially available every year. Moreover, there is no cyclic distribution in the costs and census staff, as they are distributed relatively evenly across time. It should be noted, however, that setting up and maintaining a statistical system based on registers requires important initial investments and a very long development time (UNECE, 2007). Moreover, this approach requires good cooperation between the statistical institute and the authorities responsible for the registers, legislation which allows using register data for statistical purposes and matching records across registers, and finally the acceptance by the public of such a system. All these conditions are met in all the Nordic countries, which adopted this approach in 2011.

A disadvantage of this approach is that the characteristics to be collected are limited to those available in the registers, and the quality of the data produced is dependent on the coverage and quality of the registers themselves. Statistical agencies, however, can combine data from different registers to assess and increase quality and derive new variables. Statistical agencies are also dependent on register authorities (see the requirements listed above), but in the Nordic countries in general there is good cooperation. Establishing and maintaining a high quality register-based statistical system requires significant resources and societal will. However, once such a system is set up, it can be used to efficiently produce a wide range of statistics in addition to census data.

4 The “combined census”, based on data from registers and other sources

Many countries have population and other registers that potentially could be used for the census, but the coverage and data quality are not sufficient for complete reliance on these registers to produce census data, or some key census variables are not available. Some of these countries in the last years decided that they can still use register data and integrate them with data from other sources in order to produce the census results. Different approaches to this “combined census” exist, depending on what other data sources are used, and how they are used in combination with the register data. Some of these approaches are presented in this section.

4.1 Combining data from registers and existing surveys

A first approach to the combined census consists in using the results from existing household surveys in combination with register data. An example is the so-called “Virtual census” conducted in the Netherlands in 2001 and 2011, where register data are integrated with results from the labour force survey (LFS) in order to produce census data. The Netherlands decided to develop this method because they could not obtain from the registers all the necessary information for some of the economic characteristics. Therefore, information on these characteristics is derived based on results from the LFS.

A necessary prerequisite for implementation of this approach, as for the register-based census, is the capacity to link information from different sources at the unit record level. As this method does not require a field data collection, there is no respondent burden on households, and the costs are relatively limited. Moreover, census results are consistent with survey results for common variables. However, the processes to successfully link information on individuals from registers and surveys, and to produce information on households are quite complex.

4.2 Combining data from registers and an ad-hoc survey

A variation of the previous approach is to combine data from the registers with data from a sample survey conducted ad-hoc for the census. The survey is conducted to evaluate the accuracy of the population or address registers and to collect information on topics that may not be covered in registers, or for which the coverage and quality of registers is not sufficient. The method has the advantage of testing the accuracy of the population register and consequently being able to adjust population counts derived from it. This method was adopted in 2008 by Israel, and in 2011 by other countries including Belgium, Turkey and Switzerland.

4.3 *Combining data from registers and full enumeration*

Some countries decided to conduct a census in which the enumeration is based on data from registers, but there is still a full field collection of characteristics on all individuals. This enables variables not available in registers to be obtained in the field as well as providing information about the accuracy of the population count based on registers. This approach is more expensive than the previous ones (presented in section 4.1 and 4.2) because of the full field enumeration. But it is in general less expensive than a traditional census, because of efficiencies in field operations made possible by the use of register data. Compared to a register-based census, this method is clearly much more expensive and poses response burden on the public, but on the other hand it provides improved precision of the results and may help improve the coverage and quality of the registers. For this reason, this approach is often selected for the transition period from a traditional to a register-based census. A significant number of countries in the European Union used this approach for the 2011 census (see section 6).

5 The rolling census

Some countries do not have population registers, and therefore cannot adopt the methods presented above. Some of these countries, however, developed alternative approaches to the traditional census without making use of registers. An original and very innovative approach was developed in France and it is known as the “rolling census”. As the name suggests, under this approach the census is conducted as a cumulative continuous (or “rolling”) survey over a long period of time rather than on a relatively short time period. In France a five-year cycle was adopted for the rolling census, and two different strategies are used for small municipalities (population under 10,000) and large municipalities. Small municipalities are divided into five groups, and a full census is conducted each year in one of the groups. In large municipalities, a sample survey covering 8% of dwellings is conducted each year. At the end of the five-year cycle, all the population in small municipalities (amounting in France to about half the total population) is enumerated, and about 40% of the population in the large municipalities. In total, about 70% of the country’s population is enumerated. This is enough to guarantee robust information at the level of municipality and neighborhoods, according to the French statistical institute INSEE that developed this method.

The census results are based on rolling averages calculated over the five-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 five-year period 2004-2008 and were referred to 2006, which was the central year of the period. This method provides for improved frequency of the data, and spreads out across time the financial and human burden associated with the census. On the negative side, the method can be complex to implement. Complications may arise from the movements of persons

across municipalities over the various years. These movements could potentially lead to double counting or to missing certain individuals, although specific mechanisms have been put in place to deal with these cases.

6 Overview of census methods used in Europe

In the previous sections, various methodological approaches to the census were presented². In this section information is presented on the methods that were used by European countries for the census of the 2010 round, based on a survey conducted in 2010 jointly by UNSD and the United Nations Economic Commission for Europe (UNECE). The information is presented separately for the countries that are members of the European Union or the European Free Trade Association (EFTA) and for the other European countries that participated in the survey.

6.1 *Census methods in European Union and EFTA countries*

The data for the 27 EU countries and three EFTA countries (table 1) show that only 11 countries conducted a traditional census in 2011. The remaining 19 countries (over 60% per cent) adopted an alternative census methodology. As the table shows, 13 countries adopted a combined approach, where data from registers were used in combination with a full field enumeration, or with the results of a sample survey (see section 4 above). Among these countries, the most popular approach is using register data in combination with a full enumeration (6 countries). As mentioned above, this approach is often adopted by countries that are moving from the traditional census to a register-based census. Among the other countries with a combined census, data from existing surveys have been used together with register data in the Netherlands (where this approach was already adopted in 2001), Iceland and Slovenia. An ad-hoc sample survey was used together with data from registers in Belgium and Switzerland. Finally, two countries (Germany and Poland) combined data from multiple sources, including registers, a full field enumeration and sample surveys.

Five countries (the Scandinavian countries plus Austria and Denmark) conducted a register-based census, while France used the rolling census.

² A more detailed description of the different census methods is described in more detail in (UNECE, 2006), Ch. I and Appendix II. Some examples of implementations of innovative census methods are available on the UNECE website at: <http://www.unece.org/stats/documents/2004.11.censussem.htm>

Table 1: Census methods and reference dates for EU and EFTA countries - 2010 Census round

<i>Country</i>	<i>Census method</i>	<i>Reference date</i>
Austria	Register-based	31 October 2011
Belgium	Combined (registers + survey)	1 January 2011
Bulgaria	Traditional	10 March 2011
Cyprus	Traditional	1 October 2011
Czech Republic	Combined (registers + enumeration)	26 March 2011
Denmark	Register-based	1 January 2011
Estonia	Combined (registers + enumeration)	31 December 2011
Finland	Register-based	31 December 2010
France	Rolling census	1 January 2011
Germany	Combined (registers + enum. + survey)	9 May 2011
Greece	Traditional	16 March 2011
Hungary	Traditional	1 October 2011
Iceland (EFTA)	Combined (registers + survey data)	31 December 2011
Ireland	Traditional	10 April 2011
Italy	Combined (registers + enumeration)	23 October 2011
Latvia	Combined (registers + enumeration)	1 March 2011
Lithuania	Combined (registers + enumeration)	1 March 2011
Luxembourg	Traditional	1 February 2011
Malta	Traditional	20 November 2011
Netherlands	Combined (registers + survey data)	1 January 2011
Norway (EFTA)	Register-based	19 November 2011
Poland	Combined (registers + enum. + survey)	31 March 2011
Portugal	Traditional	21 March 2011
Romania	Traditional	22 October 2011
Slovakia	Traditional	21 May 2011
Slovenia	Combined (registers + survey data)	1 January 2011
Spain	Combined (registers + enumeration)	1 November 2011
Sweden	Register-based	31 December 2011
Switzerland (EFTA)	Combined (registers + survey)	31 December 2010
United Kingdom	Traditional	27 March 2011

Source: Survey conducted by UNSD and UNECE in 2010 and additional information from UNECE.

6.2 *Census methods in Eastern Europe*

If the majority of countries in the European Union adopted an alternative census methodology for the 2010 census round, the situation is different in Eastern and South-Eastern Europe, where all countries choose the traditional census approach (table 2). The reason could be that some of the problems associated with the traditional census (see section 2.1 above) do not apply to these countries. For instance, recruiting a large number of temporary census staff could be easier in these countries - compared to countries in Western Europe - thanks to relatively high unemployment, or relatively low labour costs. But there could be also other reasons that make difficult or impossible adopting an alternative census

methodology in these countries, like the limited availability of technical or financial resources needed to develop the new census methodology, or the absence of administrative registers of sufficient quality to use the data for census purposes.

Table 2: Census methods and reference dates for countries in Eastern and South-Eastern Europe

<i>Country</i>	<i>Census method</i>	<i>Reference date</i>
Albania	Traditional	1 October 2011
Belarus	Traditional	14 October 2009
Bosnia and Herzegovina	Traditional	n.a.
Croatia	Traditional	31 March 2011
Montenegro	Traditional	31 March 2011
Republic of Moldova	Traditional	2013 (to be confirmed)
Russian Federation	Traditional	14 October 2010
Serbia	Traditional	31 September 2011
The Former Yugoslav Republic of Macedonia	Traditional	31 September 2011
Ukraine	Traditional	2012 (to be confirmed)

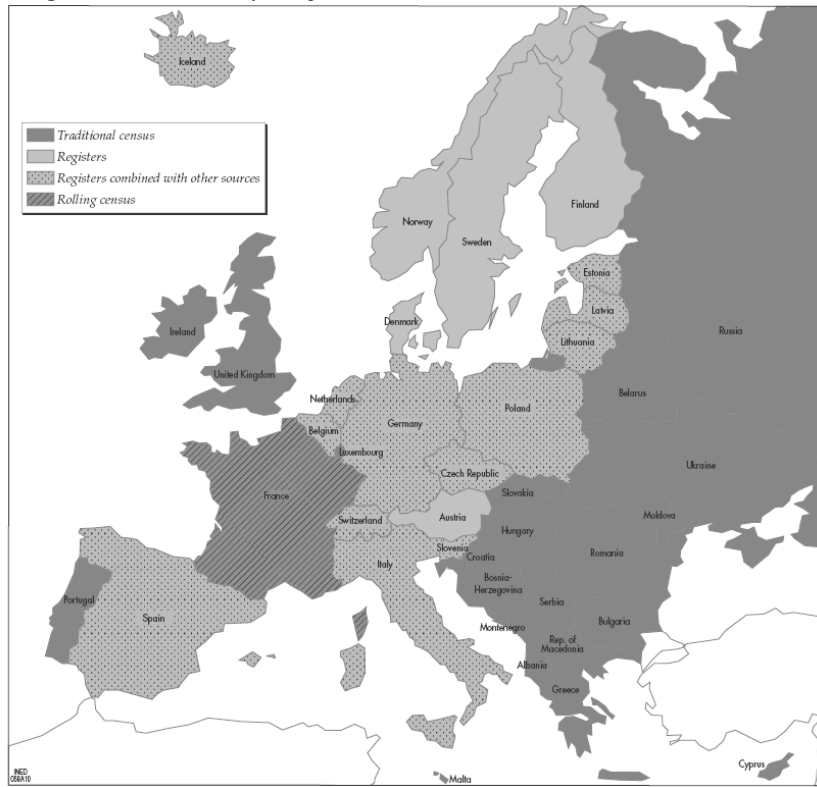
Source: Survey conducted by UNSD and UNECE in 2010 and additional information from UNECE.

6.3 The evolution of census methodology in Europe

Based on the information presented above, it emerges that in Europe almost half of the countries (19 out of 40 for which information is available) conducted the census of the 2010 round using an alternative methodology to the traditional census. The majority of them (13 countries) conducted a combined census using data from registers and other sources, five countries conducted a full register-based census, and France used its original rolling census.

Although a large number of countries in Europe have adopted an alternative methodology, the traditional census is still the most common method in the region, adopted by 21 countries located mainly in Eastern and South-Eastern Europe.

Figure 1 presents the map of Europe by census methodology adopted by countries for the 2010 census round. This figure shows the geographical patterns that were already described above in this article. The traditional census is the favorite method in all countries in

Figure 1: Methods used by European countries for the 2010 round of censuses

Source: Valente (2010), published by INED.

Eastern and South-Eastern Europe, but also in selected EU countries like Ireland, the UK, Portugal, and Luxembourg. The register-based approach is adopted in the Nordic countries and in Austria. The combined approach is adopted in many countries in Central Europe, and also in Italy and Spain. Finally, France is the only European country where the rolling census is adopted for the 2010 census round.

It is important to note that Europe is the only continent in the world where a significant number of countries conduct the census adopting an alternative methodology to the traditional census. In the rest of the world, virtually all countries use the traditional approach with only a few exceptions, mainly in Asia (registers are used in Bahrain, Israel, Singapore and Turkey).

The trend that sees many European countries moving away from the traditional census and adopting an alternative method started already in the 1970s, as mentioned above, but there was a clear acceleration in the last years. In order to see how many countries changed census method in the last years, table 3 presents the distribution of European countries by census method adopted in the 2000 and 2010 census rounds.

Table 3: Distribution of European countries by census method used in 2000 and 2010 census rounds

<i>Census method</i>					
<i>2010 round</i>	<i>Traditional</i>	<i>Combined</i>	<i>Register-based</i>	<i>Rolling</i>	<i>Total</i>
<i>2000 round</i>					
<i>Traditional</i>	20	5	1	1	27
<i>Combined</i>		6			6
<i>Register-based</i>			3		3
<i>No census</i>	1	2	1		4
<i>Total</i>	21	13	5	1	40

The cells with grey background along the main diagonal show that the majority of countries adopted for the 2010 round the same census method as in the 2000 round: the traditional census in 20 countries, the combined census in six and the register-based census in three countries. The fact that the six countries that adopted the combined approach in the 2000 census round have still adopted this approach in the 2010 round and have not moved to a register-based census can be explained by the long development time necessary for a register-based statistical system to be used for the census.

Out of the 27 countries that conducted a traditional census in the 2000 round, seven moved for the 2010 round to an alternative method: it's the combined census for five countries (Czech Republic, Estonia, Italy, Lithuania and Poland), the register-based census for Austria and the rolling census for France. Austria passed directly from a traditional census in the 2000 round to a register-based census in the 2010. This can be considered as a relatively unusual change, but in fact Austria has been working towards the register-based census since long before the census of the 2000 round.

The data presented in table 3 also show that four countries that had not conducted the census in the 2000 round have actually conducted a census in the 2010 round. Two of them (Germany and Iceland) conducted a combined census, and one (Sweden) a register-based census.

Conclusions

With regard to census methodology, Europe can be considered as the world's laboratory, since it is the only continent where a significant number of countries have developed and adopted alternative methods to the traditional census. In the last years, in particular, there was a clear increase in the number of European countries adopting alternative census methods: from 9 in the 2000 census round to 19 in the 2010 round. This trend can be explained by the various shortcomings associated with the traditional census, in terms of costs, management, organization and characteristics of the census outputs. In most cases the alternative census methods make use of data from registers, as unique source of data or in combination with other sources. But innovative approaches have also been developed that do not make use of data from registers, like the French rolling census.

Notwithstanding the trend towards alternative methods, the traditional census was still the most common approach in Europe for the 2010 census round. Probably the traditional census will continue to be the best method for many countries in the years to come, in particular in Eastern and South-Eastern Europe. In fact, although many countries are moving from the traditional census to alternative methods, this is not necessarily the way to follow for all countries. In fact, every method has its strengths and its weaknesses and there is no perfect solution that fits all countries.

Each country needs to decide what will work best in its own context, considering all relevant factors. The most important issue is the quality of the output and its relevance for the uses to which it is put. It is also important that each country clearly documents the method used, evaluates the quality of the census results through established methodologies, and informs the users in a transparent way of possible weaknesses in the data.

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