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Reports, guidelines and recommendations prepared under the umbrella of the Conference:**Assessing the quality of administrative sources for use in censuses****Guidelines for assessing the quality of administrative sources
for use in censuses****Prepared by the Task Force on assessing the quality of administrative
sources for use in censuses***Summary*

This document is an abridged version of the “Guidelines for assessing the quality of administrative sources for use in censuses”. The purpose of the Guidelines is to provide census producers with a practical guide for assessing the quality of administrative data, through a series of stages of assessment: source, data, process and output, with the first of these two stages being the principal focus of the Guidelines.

The Guidelines were prepared by the Task Force on assessing the quality of administrative sources for use in censuses, consisting of the United Kingdom (chair), Austria, Canada, France, Germany, Ireland, Israel, Italy, Montenegro, Netherlands, New Zealand, Poland, Portugal, Republic of Moldova, Spain, Turkey, United States of America, United Nations Population Fund, Eurostat and an independent expert.

This abridged version of the Guidelines has been prepared for translation purposes. It includes most of the introduction, the chapters on the quality framework and the Source Stage, and the full chapter of conclusions and recommendations. Please note that the numbering of the sections in this shortened version does not correspond to the numbering of chapters and sections in the full Guidelines.

The remaining sections can all be found in the full version of the Guidelines in English, which was sent to all members of the Conference of European Statisticians (CES) for consultation in March-April 2021 and is also available on the Conference webpage at <https://unece.org/statistics/events/CES2021>. Summary of the feedback form the consultation will be provided in document ECE/CES/2021/3/Add.1.

Subject to a positive outcome of the consultation, the CES plenary session will be invited to endorse the Guidelines.



I. Introduction

A. Background

1. In 2017, the UNECE Task Force on register-based and combined censuses prepared the Guidelines on the use of registers and administrative data for population and housing censuses¹. The Guidelines included a section on “data sources and their quality” with a general discussion of this topic. Experts at the UNECE-Eurostat Expert Meeting on Population and Housing Censuses (Geneva, 4–6 October 2017) identified the quality of administrative sources as a topic of primary importance for many countries. As a consequence, the Expert Meeting called for the establishment of a new UNECE Task Force on measuring the quality of administrative sources for use in censuses, building on the work of the previous Task Force.

2. The Task Force was established in 2018, with its Terms of Reference² approved at the February 2018 meeting of the Bureau of the Conference of European Statisticians (CES) in Helsinki (14–15 February 2018). The Task Force reported to the UNECE Steering Group on population and housing censuses, which in turn reports to the CES and its Bureau.

3. The objective of the Task Force was to develop guidance on the measurement of the quality of administrative sources for use in censuses³. The terms of reference stipulated that guidance should be developed that is relevant to all UNECE countries, and that it should build on the work of Eurostat’s ESS.VIP ADMIN project⁴ on the use of administrative sources in the production of official statistics.

4. These Guidelines serve as a practical toolkit for the assessment and measurement of the quality of administrative sources for population and housing censuses.

B. Use of administrative data in censuses

5. Administrative data sources are data holdings that contain information collected primarily for administrative purposes. This includes data collected by government departments, public bodies and other organizations for purposes of registration, transaction and record-keeping, usually during the delivery of a service. They include administrative registers (with a unique identifier) such as a country’s population, business, address, education, health, employment and tax registers, as well as other administrative sources (without a unique identifier). Administrative registers and/or other administrative sources are used to create statistical registers, which are specifically used for statistical purposes, including for the census.

6. The use of administrative data sources in censuses varies across countries. Such sources may be used to enhance or to supplement a traditional census, to conduct a combined census, or in the construction of a fully register-based census. There has been a clear trend towards increased use of administrative data in censuses. This has been motivated by the benefits administrative data can bring, including reduced cost and respondent burden, improved timeliness and frequency of results, improvements to quality, and greater flexibility to respond to user needs (see, for example, section 4.1 of UNECE 2018). Furthermore, the conditions within many countries have changed to support and facilitate the use of administrative data throughout national statistical systems (c.f. section 4.2 of UNECE 2018).

¹ Available from <http://www.unece.org/index.php?id=50794>

² Available from http://www.unece.org/fileadmin/DAM/stats/documents/ece/ces/bur/2018/February/06Add.1-TF_on_quality_of_admin_data_for_censuses_ToR_apr.pdf

³ The Task Force subsequently decided to adjust its title and the corresponding objective to ‘assessing’ rather than ‘measuring’ the quality of administrative sources for use in censuses.

⁴ More information on this project can be found at https://ec.europa.eu/Eurostat/cros/content/ess-vision-2020-admin-administrative-data-sources_en

This includes through changes in legislation, public and stakeholder acceptability, and through developments in technology and statistical methodologies.

7. The importance of administrative data has been further highlighted by the challenges that National Statistical Offices (NSOs) are now facing when it comes to collecting data directly from the population, whether due to a reluctance of the public to engage with the census, or their ability to do so. This challenge was emphasized at the onset of the Covid-19 crisis in 2020, where both the public's ability to engage with NSOs and at the same time NSOs' ability to engage with the public were affected significantly.

C. Key risks to quality

8. For all the benefits that administrative data can bring, there are a number of key quality considerations that must be assessed and evaluated before incorporating an administrative source into a census. First, the NSO will have only limited control over the way the data are collected and processed. There is therefore a significant dependency on the authorities holding the administrative data. For example, if the administrative authority is unable to meet the NSO's requirements with respect to providing the right data at the right time, this will impact the timeliness of the census results. Similarly, if the administrative authority does not adequately engage with the NSO on any potential changes to the source, this could impact coherence and comparability.

9. Second, the use of administrative data by the NSO for purposes other than those for which the data were originally collected raises privacy, security and legal concerns. The NSO must therefore assess public acceptability, seeing that the required assurances are in place and that they are communicated to the public (and to the administrative authority). The use must also be lawful. Without acceptance or agreement both from the public and from the data supplier, or a credible legal basis for the use of the administrative source, there would be significant risk to the reputation of the NSO and its ability to deliver a high-quality census. This can arise if the public changes their behaviour in the way they interact with the administrative authority or the NSO, due to concerns over the way the NSO is using their data.

10. Third, administrative data have (in general) not been collected for statistical purposes. As a consequence, the data sources may have adopted different concepts and definitions from those required by the census; they may refer to different reference periods; and they may have limited coverage of the census population. In addition, the accuracy and completeness of the data will be highly dependent on the importance of the data to the administrative authority's function. The administrative sources may also be subject to changes over time and inconsistencies in the way the data are collected across units of the population.

11. Finally, the complexity of the administrative data and the availability and completeness of the associated metadata will impact the ability of an NSO to understand, access and use an administrative source. For example, administrative data can be held in large, complex data structures, posing significant technical challenges for the NSO to consider and overcome. The complexity of administrative data may also impact the accessibility and clarity output quality dimension from a user's perspective. That is, users of the census may find it difficult to understand the use of administrative data in the census and the impact this use has on the quality of the census outputs.

12. These key quality considerations will inform decisions about the use of administrative data in a census. The Guidelines address each of the considerations in detail.

II. Quality framework

13. The quality of statistics depends on whether the statistical output satisfies its intended use. For example, the ESS definition of quality is derived from the ISO 9000 family of standards, "the degree to which a set of inherent characteristics of an object fulfils requirements" (ISO 2015). In official statistics, the object may include "a statistical product, service, process, system, methodology, organisation, resource, or [data] input" (Eurostat

2020, p.17). In a census context, the quality of administrative data used should therefore be considered in relation to the ways data are collected and processed by suppliers and NSOs, through to the final census outputs.

A. Quality and error in censuses

14. Where official statistics are produced using a sample survey methodology, survey questions are designed and tested to reduce measurement errors, thus ensuring maximum accuracy and reliability. Thus, the error of the estimates produced are assumed to be caused by deficient sampling and are typically measured and communicated using the Mean Squared Error (MSE) framework and/or through confidence intervals. However, such measurements do not capture non-sampling errors and these are particularly important in the context of censuses, where the aim is to capture the full population. As such, similarly to statistics produced with administrative data more generally, the key sources of error in the context of censuses are not sampling errors, but representation (coverage) and measurement errors (Zhang 2012). A common practice is thus to adjust census estimates based on the results of a post-enumeration survey – although this can lead to controversy as complex dual estimation methods are ill-understood by the public.⁵

15. Where administrative data and other alternative data sources such as big data are used in censuses, the range of possible errors is greater than in a traditional census, because data collection processes are not controlled by NSOs. Zhang (2012), drawing on Groves et al. 2004, distinguishes between two broad types of error in statistics produced using administrative data: measurement and representation errors. The first relates to errors in the measurement of characteristics (e.g. age, gender etc), while the second to errors in the representation of population units or objects (e.g. individuals or households in a census).⁶ Zhang also distinguishes between the quality of single sources as provided by data suppliers and the quality of transformed and/or integrated sources, after processing by the NSO. This approach is mirrored in the Guidelines which assess the quality of single administrative sources and of integrated sources, with a particular emphasis on identifying measurement and representation errors.

16. Furthermore, the total survey error (TSE) framework has also been adapted to assess the quality of administrative data. In contrast to MSE, TSE identifies a wider range of errors including validity, frame/coverage, nonresponse, measurement, processing and model errors. As such, TSE frameworks have sought to capture how a variety of errors accumulate throughout the statistical design and methodology, resulting in the final error of any given estimate. This approach has been adapted to report the quality of statistics which integrate administrative data (e.g. Reid, Zabala and Holmberg 2017, Rogers and Blackwell 2020). At the same time, the quality of statistics cannot be reduced to assessing error alone. When considering the integration of data from an administrative source into the census design, the impact of such integration on quality should be assessed in terms of the extent to which it adds error or uncertainty to the outputs, vis-à-vis the advantages of integration e.g. reducing response burden, increasing timeliness, reducing costs. As such, these Guidelines identify additional dimensions which can affect the overall quality of census outputs including the

⁵ For example, the adjustments based on the post-enumeration survey carried out after the 1990 U.S. Census were subject to court proceedings and rejected by the U.S. Supreme Court and the 2000 adjustments were also subject to litigation (United States Census Bureau 2009).

⁶ Based on Zhang (2012), In relation to input data, measurement errors relate to differences between supplied and target characteristics (e.g. gender, sex, age, ethnicity, occupation etc.) and include several types of error within variables including relevance (definition misalignment), mapping (errors in the re-classified measures due to poor equivalence between supplied and target classifications which may therefore require adjustments, e.g. through imputation) and comparability errors (errors between the re-classified and adjusted measures). Representation errors relate to the difference between the units supplied and the target units. They include errors relating to over and under-coverage (lack of alignment with target population), identification (errors in classifying a unit based on inconsistencies across multiple sources) and unit errors (errors in the statistical creation of statistical units of interest where they do not exist in any available data source).

institutional environment and the need to balance quality dimensions in order to meet user needs.

17. Following these Guidelines will help ensure that census estimates are based on the most appropriate sources and methods and are not misleading. At the same time, consideration should also be given to the way administrative sources are intended to be used in the census design. Given the variety of possible uses, this framework should be used flexibly and adapted to the level of quality required by different uses of administrative data by the NSO and different statistical requirements from the users of census statistics including the generally public, organizations, local and national governments. Inevitably therefore, quality assessment relies on skilled professional judgement throughout the entire statistical production process, from collection to publication, in order to meet the needs of users.

B. Measuring quality

18. The quality of census estimates produced using administrative sources is particularly difficult to assess and/or measure due to the complexity and multi-dimensionality of the data used. As noted above, many factors affecting quality are not quantitatively measurable. Moreover, what constitutes ‘fitness for purpose’ and high-quality statistics will necessarily vary from one user to another e.g. some users may prioritize timeliness over accuracy. As such, it is important to assess/measure administrative data quality across the key dimensions which will be of interest to statistics producers and users. As such, what is meant by assessment and measurement needs further clarification.

19. These Guidelines distinguish between *assessing quality*, meaning a qualitative evaluation, and *measuring quality* – meaning attaching a quantitative metric to this evaluation of quality. Where it is not possible to produce indicators for quantitative measurement, or where they have not yet been developed, these Guidelines recommend a qualitative assessment of their impact on quality. In addition to these, there are several additional principles which guide the production of official statistics (UNECE 1992) and which are applicable throughout the full statistical process and the wider NSO environment (e.g. commitment to quality, independence, data protection, statistical confidentiality etc.). These themes are relevant for all statistical processes and are not fully covered within the scope of the present Guidelines. However, it must be acknowledged that a census that uses administrative sources relies on data that were produced outside of the statistical system, in a different organization over which the NSO usually has no control.⁷ For this reason, the impact of using these outside sources on these principles, must be considered carefully.

C. Stages of quality assessment

20. To ensure these Guidelines are easy to follow, the quality assessment of administrative sources is considered across four broad stages of the census lifecycle. These are applicable regardless of census type. While statistical design is never entirely linear, thinking of how to carry out quality assessment in this way should enable statistical producers to quickly identify the key quality considerations which are most relevant to their own circumstances. The Stages are:

- *Source Stage:* A metadata-based quality assessment of new or re-supplied administrative sources to be used in the census. This Stage does not require NSOs to be in possession of the actual data, but it is crucial for the Stages that follow;
- *Data Stage:* The quality assessment of the raw administrative data supplied to NSOs by administrative authorities. This will require NSOs to validate the data supplied against the learning from the Source Stage. As well as basic validation, this Stage

⁷ In some cases, the NSO has some control over the register. In Switzerland for example, the Federal Register of Buildings and Dwellings or the Enterprise Register are sections within the Federal Statistical Office. Therefore, it might be feasible in a long-term perspective to integrate certain suitable registers within NSOs.

includes any processing required to establish the quality of the data supplied vis-à-vis what was expected, as well as comparisons with alternative sources;

- *Process Stage:* The processes often carried out on administrative data sources, in the context of censuses to transform the data for use in the census and/or to improve quality. The processes identified include data linkage; constructing statistical registers and the ‘signs-of-life’ methodology; enumeration using administrative data; methods for comparing the quality of variables across sources; and editing and imputation;
- *Output Stage:* The overall quality assessment of the census outputs produced using administrative data. While this is not conceptually that different from the assessment of the outputs of a traditional census, these Guidelines attempt to identify where this may differ.

D. Quality dimensions

21. As previously noted, the quality of statistics and of administrative data is understood to encompass multiple dimensions which are not reducible to representation or measurement errors e.g. statistics which are accurate but out of date, are of limited use. The quality dimensions identified by ESS include 1) relevance, 2) accuracy and reliability, 3) timeliness and punctuality, 4) accessibility and clarity, and 5) coherence and comparability.⁸ However, for assessment of administrative data these “standard quality dimensions are not always applicable” (Daas et al 2008, p.2). On the other hand, they do capture all of the relevant aspects of administrative data quality. The following tables set out the dimensions for assessment of administrative sources used in these Guidelines, for each of the above-mentioned Stages.

Table 1
Quality dimensions at Source Stage

<i>QUALITY DIMENSION</i>	<i>DEFINITION</i>
Relevance and accuracy	The degree to which the administrative data source meets the needs of the census. Covering the overlap between the census target population, concepts and definitions (relevance). The degree to which the data correctly describe the phenomenon they were designed to measure (accuracy).
Timeliness	The lapse between the end of the reference period to which the information pertains and the date on which the information becomes available to the NSO.
Coherence and comparability	The degree to which the administrative source can be successfully combined with other sources used in the census, including linkability.
Accessibility	The ease in which the NSO can obtain the administrative data, covering the impact of any restrictions, public acceptability of the use, the ease of data transfer and receipt, and the availability of metadata.
The institutional environment	Organizational factors affecting the data supplier’s capacity to supply data to the quality expected. Covering the strength of the relationship, previous experience, existence of formal agreements, risks associated with the status of the supplier and the supplier’s quality standards.

⁸ Alternative dimensions are used by various NSOs (e.g. Statistics Canada 2017, Australian Bureau of Statistics 2009). On the whole, these alternative frameworks cover approximately the same content albeit using different terminology or classifications.

Table 2
Quality dimensions at Data Stage

<i>QUALITY DIMENSION</i>	<i>DEFINITION</i>
Validation and Harmonization	The data files provided to the NSO are in a readable format. Further data validation and harmonization arrangements are in place upon data transfer to NSO, to confirm that the expected variables/units/reference period have been supplied and ensure data processing by the NSO is consistent across census use cases.
Accuracy and Reliability	The accuracy, completeness (for variables and population coverage) and coherence of the data supplied matches the requirements of the specific census use-case for which it will be used. Comparisons with alternative sources reveal acceptable levels measurement or representative errors.
Timeliness and Punctuality	The timeliness and punctuality of the data supplied matches the requirements of the specific census use-case for which it will be used.
Linkability	Adequate linkage variables are available (i.e. either common unique identifiers or a combination of variables which enable identification) and these are of sufficient quality to enable data linkage.

Table 3
Quality dimensions at Process Stage

<i>QUALITY DIMENSION</i>	<i>DEFINITION</i>
Accuracy of record linkage	Where multiple sources are linked (to each other or census responses), the linkage is accurate and unbiased, thereby improving the overall quality of the census methodology and/or dataset.
Coverage and coherence of statistical registers and admin-based enumerations	Where census (sub-)population registers are constructed, or when admin data are used to supplement census collection, they adequately cover the target population/variables, thereby improving the overall quality of the census methodology and/or dataset.
Accuracy of conflict resolution	Where different sources are linked and the same attributes are available in them, methods for deciding between sources are improving the overall quality of the census methodology and/or dataset.
Accuracy of editing and imputation	Where census variables/units are derived/constructed through imputation or modelling techniques, this derivation is accurate and unbiased, thereby improving the overall quality of the census methodology and/or dataset.

Table 4
Quality dimensions at Output Stage

<i>QUALITY DIMENSION</i>	<i>DEFINITION</i>
Relevance	The degree to which statistical outputs meet current and potential user needs
Accuracy and Reliability	The closeness between an estimated result and the unknown true value – and how reliable these are over time and geographies.
Timeliness and Punctuality	The lapse of time between publication and the period to which the data refer, and the time lag between actual and planned publication dates.
Accessibility and Clarity	Accessibility and clarity refer to the actions taken in order to help the user find and understand the data he or she is interested in
Coherence and Comparability	The degree to which data can be compared over time and domain. The degree to which data that are derived from different sources or methods, but which refer to the same phenomenon, are similar.

Source: Eurostat 2013 and 2018.

III. Source Stage

22. This chapter provides a guide to the key quality dimensions, the process of assessment, and associated tools and indicators for evaluating the quality of administrative data sources to be used in the census production – both at first acquisition and when they are regularly re-supplied to the NSO. Normally, no data are accessible during this stage. However, the search for information about the administrative data sources begins, most likely through communications and exploratory meetings between the NSO and the administrative data source supplier.

23. The evaluation in this stage should lead to a recommendation on whether to proceed with the acquisition initiative (or continue the re-supplying of the data source). If the decision is to go ahead, the administrative data supplied will undergo a more detailed evaluation at the Data Stage.

24. It is necessary to assess source quality both at the first acquisition of an administrative data source and in each instance when it is re-supplied to the NSO. This is because the characteristics of any data set that has previously been supplied might have suffered changes in terms of concepts, classification, collection methods etc.

A. Source quality dimensions

25. The data quality dimensions to be considered at this stage of quality assessment are Relevance; Timeliness; Coherence and Comparability; Accessibility and Interpretability; and the Institutional Environment. The dimensions are described below, with the processes, tools and indicators for assessment provided in the sections that follow. It should be noted that failure to reach minimum acceptable quality against any of the dimensions cannot be compensated by success in the other dimensions.

1. Relevance and Accuracy

26. Relevance reflects the degree to which an administrative data source meets the needs of the NSO with respect to the intended use. To be deemed relevant, the administrative data source must, for example, fulfil the reasons for its acquisition. This could be with respect to reduced costs or respondent burden; improvements to the quality of census outputs; or through the delivery of enhanced or new census outputs. To achieve this, the administrative source should be representative of the population of interest for the census (the target

population) and the measurements from the population should align with the needs of the census. A key part of the assessment of relevance is understanding the context in which the administrative data have been collected.

27. As part of the assessment of relevance, the accuracy of the administrative data is also considered. Accuracy refers to the degree to which the data correctly describe the phenomenon they were designed to measure. It is important to understand how the collection, processing and quality assurance carried out by the administrative organization might affect the accuracy of the resulting data and their usefulness.

2. Timeliness

28. Timeliness refers to the period between the date to which the information pertains and the date on which the information becomes available to the NSO. The timeliness of the information will affect its relevance.

3. Coherence and Comparability

29. Coherence reflects the degree to which the administrative data can be successfully combined with data from other sources used by the NSO, i.e. census data, within a broad analytical framework, over time. The use of standard concepts, classifications and target populations promotes coherence within and between censuses. Therefore, a clear understanding of the operational definitions used by the administrative supplier, the purpose of data collection and the impact on comparability of changes in an administrative source over time and across domains factors in assessing coherence.

30. It is often a requirement to link an administrative source at the level of the census statistical unit to integrate the data into the census design. The comparability of identifiers across the different data sources to be linked is therefore a consideration under coherence.

4. Accessibility and Interpretability

31. Accessibility refers to the ease with which the NSO can obtain (and understand) the relevant administrative data items in their entirety. This includes an understanding of any restrictions (legal and those imposed by the supplier); public acceptability; the ease of data transfer and receipt (suitability of the form or medium for transferring data and costs); and the availability and clarity of documentation and metadata. It is crucial that the use of the administrative data source is based on a legal framework that gives the NSO the unequivocal right to access and use the data and the metadata for statistical purposes.

5. The Institutional Environment

32. The Institutional Environment refers to the organizational or institutional factors that may have an impact on the data supplier's capacity to supply data to the quality expected and to the agreed timetable (punctuality). This includes the strength of the relationship with the data supplier, including the effectiveness of communication channels and how responsive the supplier is to the NSO's requests. It includes the existence (or potential for) formal agreements and risks associated with the status and complexity of the supplier organization. It also includes the quality standards and procedures adopted by the administrative organization(s).

B. Tools and indicators

33. The quality of an administrative source should be assessed against the quality dimensions outlined in the section above. The following provides guidance on the process of assessment, including tools and indicators for evaluating an administrative source for use in the census.

1. Relevance and Accuracy

34. An understanding of the differences between the administrative population and the required census population, and between the measures/variables in the administrative source

and the required census characteristics is important to assess relevance and accuracy. The error arising from these differences is referred to as representation and measurement error respectively (Zhang, 2012). At the Source Stage of assessment, it is possible to gain some understanding of these errors and their impact on relevance based on metadata about the supplier's purpose and methods of data collection. The impact of representation and measurement errors on accuracy and reliability are also considered at the Data and Process Stages.

(a) The Census target population (representation)

35. To assess relevance, the NSO must determine whether the set of objects in an administrative data source align with the population units of interest for the census (the target population). An object is the basic element of the population on which information is collected, this could be a person, household, dwelling, event or transactions, etc. The following indicators are proposed for establishing relevance, with respect to representation. Against each indicator is a series of questions to help guide the assessment:

- Alignment (of the objects) with the census target units:
 - (i) How comparable are the administrative objects with the census target units?
 - (ii) What definitions, methods and processes are used to identify and include an object in the source?
 - (iii) Are there any laws or regulations that define the objects?
 - (iv) Are any checks carried out by the data holder to ensure the definitions hold?
 - (v) In the case of misalignment with the census units, is a transformation possible that could meet the census needs?
- Coverage (of the set of objects) against the census target population:
 - (i) Does the coverage of the objects meet the needs of the census?
 - (ii) Is there evidence of under-coverage (objects that are missing from the source, but are part of the census target population) and over-coverage (objects that are in the source, but are not part of the census target population) that would impact the usefulness of the source?
 - (iii) Are there any differences across geographical areas due to differences in practices by the data holder or due to legislation that need to be considered?
 - (iv) Are there any rules, legislative or regulatory requirements, including penalties for non-compliance that may impact on the inclusion and exclusion of objects on the source?
 - (v) What methods and processes are adopted by the data holder to include new objects that meet the required inclusion criteria / definitions (e.g. registration procedures) and to remove objects that no longer align with the target population for the administrative source (e.g. deregistration procedures)?
 - (vi) In the case of coverage errors, are there other data sources that could be used in combination with the source to overcome, for example, under or over-coverage in the source?

(b) The census variables/Characteristics (measurement)

36. To assess relevance, the NSO must also determine whether the information collected from the objects on an administrative data source meets the needs of the census, with respect to the target concepts (e.g. ethnicity, employment status, household size, tenure status, etc.). The following indicators are proposed for establishing relevance, with respect to measurement:

- Availability of the target variables/characteristics:
 - (i) Does the administrative source include the variables needed against the intended use for the census?

- (ii) Do the variables / characteristics broadly cover the relevant census reference period?
- Alignment of variable concepts, definitions and classification with the census needs:
 - (i) Are the administrative concepts, definitions and classifications comparable with the census needs?
 - (ii) Is there a difference between the data holder's ideal target concepts and what is actually achieved through their operational target measure used in the collection?
 - (iii) In the case of misalignment with the census concepts, definitions and classifications, is a transformation possible to meet the census needs?
- Alignment/measurement error against the census reference period:
 - (i) What is the frequency of collection for a variable / characteristic?
 - (ii) Are there known delays between an event or phenomenon occurring and being captured in the administrative source (e.g. parents may not have to register a birth for several weeks on a country's birth register)?
 - (iii) Are there time stamps recorded on the data source to indicate what period a data item relates to?
 - (iv) Are there any incentives or disincentives for a data subject to update their information as and when their circumstances / information changes on the administrative source (e.g. benefits or penalties for not doing so / or doing so)?
- Quality of collection and potential for measurement error against the census concepts:
 - (i) What is the data holder's purpose for collecting the data and how might this influence the quality of the data?
 - (ii) Are there any legal obligations, targets or incentives (or lack of incentives) that could influence the quality of the data collection?
 - (iii) Does the data holder's collection process raise any concerns about the quality of the variables, including the potential for any biases? This could include whether data are recorded by proxy and therefore not reported directly by the data subject (increasing the potential for misreporting);
 - (iv) What procedures are in place to validate and check data on entry by the data holder?
 - (v) Are there any incentives or disincentives on the data subjects to provide complete and accurate information to the data holder?
- Quality of data processing and potential for processing error by the data holder:
 - (i) Does the processing carried out by the data holder suggest the quality of the resulting data will meet census needs?
 - (ii) What checks are carried out by the data holder to assure quality?
 - (iii) Are data edited or imputed? If so, when and how, and is there an indicator on the data source to identify when an edit and imputation has taken place?
 - (iv) Are there any rules, regulations or incentives on the data holder that may impact on the way data are processed?

37. At the Source Stage of assessment, the evaluation against the indicators is usually based on a qualitative assessment (e.g. indicating whether the need is fully met, partially met or not met against each indicator, with an explanation of why, based on the answers to the question set). A quantitative assessment of representation and measurement error is carried out in the Data Stage (based on analysis of the data) under the dimension of accuracy and reliability.

38. The assessment against the indicators should inform a decision (often based on experience and expert judgement) on the use (or continued use) of a source in the census.

The decision should take account of whether or not the data source can meet the needs of the census (e.g. reductions in costs and respondent burden, improvement and enhancements to the census outputs), set against any costs or risks (referenced under the Institutional Environment and Accessibility dimensions below).

39. There are various quality frameworks described in the literature that provide similar indicators as in this chapter against the different dimensions of quality, along with question sets and scoring systems for informing the assessment (e.g. Daas et. al. 2009; SN-MAID, 2014; Iwig et. al. 2013; Statistics Canada's Administrative Data Evaluation Guide (Lavigne & Nadeau 2014); Statistics Austria's Quality Assessment of Administrative Data, Documentation of Methods Framework (Statistics Austria 2019)).

2. Timeliness

40. An administrative source may cover the relevant time period for the census, but to be useful it will also need to be available in time, against the schedule for the census. The following indicator is proposed to assess timeliness:

- Timeliness and frequency of supply against census needs:
 - (i) What is the lag between an event or phenomenon occurring and being captured in the administrative source?
 - (ii) What is the lag between the end of the reference period for the administrative data and the date the data can be made available to the NSO?
 - (iii) How frequently can the data be supplied to the NSO, set against the needs of the census?
 - (iv) Are there any requirements, in terms of the delivery method and required formats and data structures the NSO uses that could impact on the data supplier's timeline?
 - (v) Can the NSO structure and process the data in time for the needs of the Census, from when the data becomes available?

41. In instances where the data are unlikely to be available in time, the NSO may wish to establish whether a provisional version of the dataset can be made available ahead of schedule. In such cases, the dataset may be incomplete and subject to higher levels of error. There may therefore be a trade-off to consider between the timeliness of the data and accuracy.

42. As referenced against the dimension of Institutional Environment below, it is important to include the delivery dates against the data reference periods within formal agreements with the data supplier. Although the data may be available on time to meet the requirements of the data owner, they may not necessarily be delivered to the NSO in time, while the latter carries formal responsibility for timely delivery of the census.

3. Coherence and Comparability

43. It is important to assess the degree to which an administrative source can be successfully combined with other data sources for use in the census. The information gathered under the indicators provided to assess relevance can be used to assess coherence. This includes information about the differences between the underlying concepts, definitions, classifications and methods between the administrative data source and the other data sources for combined use within the census.

44. For a full register-based census, it is important to analyze the census characteristics and administrative data source; mapping and ascertaining the extent to which the information in the administrative data source facilitates the derivation of the relevant census characteristics. In particular, the NSO should establish whether or not the data recorded in the registers conform to the definition of the census characteristics. In the case of partial or no conformity, the NSO should examine the causes of non-conformity between the census characteristics and the information available in the administrative data source.

(a) Comparability

45. Administrative data are subject to changes and difference over time and across domains due to changes in legislation, regulation and procedures, which can affect the concepts, definitions, classifications and coverage of a source. More generally, the changes can impact on all of the indicators under representation and measurement, as outlined under the dimension of relevance. This is of particular importance for the census, where stability over time can be a key concern. The following indicator is proposed to assess comparability:

- Comparability over time and domains:
Are there any changes across time or differences across domains (e.g. geographical areas) affecting the:
 - (i) The definition of an object and coverage of the objects on the administrative source relevant to the census?
 - (ii) The concepts, definitions and classifications associated with the variables on the administrative source of relevance to census?
 - (iii) The data collection, processing and quality assurance procedures that could impact on the quality of source for census purposes?

(b) Linkability

46. A consideration under coherence and comparability is the ease with which an administrative data source can be linked with other relevant datasets for the census. The following indicators are proposed to assess the linkability of a source:

- Presence of a unique key for linkage:
 - (i) Does the source include a unique identifier that is common with the unique keys required for the census linkage?
 - (ii) Is the identifier available for all of the relevant objects on the source?
- Presence of a unique combination of variables for linkage:
 - (i) Does the source include a unique combination of variables (e.g. name, age and address), which could be used for the census linkage?
 - (ii) Are the unique combination of variables present for every object on the source?

47. The quality of linkage variables is also assessed at the Data Stage and the quality of the linkage process is covered as part of the Process Stage.

4. Accessibility

48. The following indicators are proposed for the assessment against the accessibility dimension:

- Restrictions on data access and use;
- Public acceptability;
- Easy of data transfer and receipts;
- Interpretability of the source – clear and comprehensive metadata.

49. The sections below provide details of the relevant information for assessment against each of the indicators.

(a) Restrictions on data access and use

50. It is important to identify any restrictions that may impact on the NSO's ability to access and use an administrative source. For example, existing data protection restrictions embedded in legal acts can impose certain limitations on the data acquisition and processing (especially when data are protected with extra security measures or laws at state level). Such legal acts may be specific to particular data sources or may be more generic allowing the NSO access to such data sources as and when required, subject to the agreement of the data

owner. The data owner may also impose further restrictions on the supply of data and the permitted use. These can include:

- Suppression of records or variables;
- Disclosure treatments (pre-delivery), such as encryption of identifiers, perturbation, banding or top-coding of the supplied data;
- Restrictions on how the data can be used;
- Restrictions on the retention of data and rules on deletion / disposal;
- Rules on disclosure methods that must be applied by the NSO, affecting the census outputs.

51. The NSO should establish and describe any restrictions that apply, on which an assessment can be made as to the impact (and risks) of the restrictions on the use of an administrative source in the census. As part of the assessment, the NSO should also consider whether it has the capability to abide by the restrictions. This could include the technical and procedural safeguards the NSO must adopt. The safeguards would generally form part of a Memorandum of Understanding (MoU) or Data Security Agreement with the data owner / supplier. In particular, the MOU may describe how Personally Identifiable Information (PII) will be protected.

(b) Public acceptability

52. Whether an NSO can access a data source for use in the census may also depend on public acceptance. The public must understand and be supportive of, or at least not hostile to new approaches and uses of their information. If the public are opposed to the use of an administrative data source, there is a risk to quality. For example, this could change the way the public interact with the census or an administrative source used in the census. The NSO should therefore be transparent about the use of administrative sources in the census, highlighting the benefits to the public, whilst providing assurance against privacy and security.

53. To assess public acceptability, the following tools or processes can be used:

- Public consultation or engagement;
- A Privacy Impact Assessment (PIA);
- A Data Ethics Assessment.

54. A Public Consultation or Engagement exercise may be carried out by the NSO on the use of administrative data in the census (or for other statistical research or outputs). This can take various forms, including formal consultations, questionnaires (through surveys or via the NSO inviting feedback via its website), qualitative research into public attitudes, or the use of Citizens' Panels. Citizens' Panels aim to bring together members of the public (to be representative of the population, or to reflect different population groups of interest) to assess their views and opinions.

55. A Privacy Impact Assessment (PIA) is a formal process resulting in a document that describes the process, findings and results that helps the NSO to consider the effects of a new programme or service (or proposed policies and plans) on the privacy of individuals. As a risk management tool, used in the planning phase of a programme or service initiative, PIAs assist organizations to more fully consider the privacy implications of a given proposal. PIAs are also used to ensure data controllers can meet their obligations under the General Data Protection Regulation (under European Law). A PIA can be applied to the various usages an NSO may wish to make of a data source in the design of the census.

56. A Data Ethics Assessment is carried out to establish whether the access, use and sharing of public data, for research and statistical purposes, is ethical and for the public good. NSOs may use an ethics self-assessment tool (e.g. UKSA 2020), but may also use a formal

body to provide expert advice or endorsement, such as a Data Ethics Advisory Committee (e.g. the UK National Statistician's Data Ethics Advisory Committee⁹).

57. The findings from public consultation and engagement, PIA and ethics assessments, can help an NSO assess public acceptability of the use of administrative sources in the census (and for other NSO statistics).

(c) Ease of data transfer and receipt

58. The Data Supplier might use very different data models, formats, schemas, software and hardware to what the NSO is familiar with. This includes how data are held and transmitted, (including the security arrangements for transmission). The data structures could also be complex and file sizes extremely large (particularly for transaction data). It is important that the NSO understands such differences and complexities, in order to assess whether it is feasible to receive and ingest the datasets into the NSO's systems. This process can also include negotiations with the supplier on the development of processes and systems to facilitate the transmission of datasets in a format that meets the needs of the NSO. However, this can be a time consuming and costly process.

59. More generally, cost is a key factor to be considered when assessing ease of access. This can include costs imposed by the data supplier, or costs incurred by the NSO in developing its capability to receive an administrative dataset (for example, if new software or hardware needs to be purchased). It is important to assess any costs against the expected value a new administrative source will bring.

60. In practice, details of the arrangements for the transmission of data to the NSO, including the files structures and format (e.g. flat files, a relational database; SAS, Excel or text formats, etc), the variables, the frequency of supply and dates for delivery, data standards and agreed costs, would be included in Data Sharing or Delivery Agreements between the NSO and the supplier. Such agreements would be signed by authorized managers at each of the organizations.

(d) Interpretability of the source – clear and comprehensive metadata

61. An assessment of interpretability relates to the existence and availability of comprehensive and clear metadata and documentation about the administrative source. Without this, it is not possible to understand and assess the administrative source against the intended use. The metadata should include details about the:

- Administrative organization and the purpose of the collection;
- Concepts, definitions, classifications and protocols used;
- Collection, processing, validation and quality assurance methods and procedures;
- Reporting units and variables; including data dictionaries, file structures, formats and relationships within the data.

62. This information is important for the assessment against the other quality dimensions outlined in this chapter. It will often be the case that clear and complete metadata will not exist for all aspect of an administrative source in the initial phase of exploring the source for use by the NSO. It is therefore necessary to work with the data supplier to build the relevant metadata. This relies on good communication with the supplier and a willingness of the supplier to work with the NSO (see Institutional Environment below). Depending on the complexity of an administrative source, an NSO may decide to set up secondments for staff to work within the administrative organization to develop an in-depth understanding of a source.

⁹ For more information see <https://uksa.statisticsauthority.gov.uk/about-the-authority/committees/national-statisticians-data-ethics-advisory-committee/#:~:text=The%20National%20Statistician%E2%80%99s%20Data%20Ethics%20Advisory%20Committee%20%28NSDEC%29,advise%20the%20National%20Statistician%20on%20the%20ethical%20>

5. The institutional environment

63. The NSO is completely reliant on the data supplier to collect, process, and deliver the administrative data to the quality expected and to the agreed timetable. The NSO is also reliant on the quality of the information the supplier provides about the data and about any foreseen changes to the data. It is therefore important to assess confidence in the data supplier's ability to meet these needs. The following indicators are proposed for the assessment of the Institutional Environment:

- The strength of the relationship with the supplier;
- Previous experiences with the supplier;
- The existence of formal agreements;
- The risk posed by the status of the supplier;
- The supplier's quality standards.

64. *The strength of the relationship.* There should be processes in place for managing the relationship with the data supplier; ensuring there is a continuous dialogue. These should include mechanisms for:

- The communication of the NSO's requirements to the supplier;
- The timely communication (by the supplier) of any changes that might affect the data source (e.g. changes to the legal basis for the data, to concepts and classifications and to the processes and procedures for data collection, management and supply);
- Raising any questions with the supplier about the data source;
- Feeding back findings to the supplier that could result in improvements to the source.

65. *Previous experiences.* This includes how responsive a supplier has been to the NSO's requests, whether any issues have arisen with previous supplies of data (e.g. late delivery, unexpected errors), whether the supplier has provided accurate information in the past about a data source (this might have been established through checks at a later stage by the NSO).

66. *Formal agreements.* This includes whether written agreements (legal or otherwise) exist or can be developed, covering:

- Roles and responsibilities of the NSO and supplier. This could include whether the NSO has a role in the approval of any changes to an administrative source used (or to be used) in the census;
- The legal basis for the supply of data and any security/confidentiality requirements;
- The specification of requirements, as per the Data Sharing/Delivery Agreement referenced under the Ease of data transfer and receipt section above.

67. *The status of the supplier.* The risk associated with the status of a supplier should be assessed by the NSO, considering whether the supplier is an established, stable and reputable organization. This should consider whether there is any legal or regulatory basis to the administrative function the supplier carries out that would give confidence in the sustainability and quality of the source. Risks associated with the complexity of the supplier organization(s) involved in the collection, processing and delivery of the source should also be considered. For example, there could be multiple bodies or organizations involved, each impacting on the quality of the final data supply.

68. *Supplier's quality standards.* An assessment of whether the supplier can meet the quality expectations of the NSO should be made. This should consider the Information on the principles, standards and guidelines adopted by the supplier for assuring quality, including the procedure in place covering collection, processing and the supply of data to the NSO. Evidence of how the supplier checks whether the standards are being met is valuable, this could be through internal or external audits by regulators or professional bodies. The supplier may also produce quality reports, which should be reviewed by the NSO. A more detailed assessment based on key aspects of the administrative source is included under the relevance quality dimension above.

69. Following an assessment of the data supplier against the criteria outlined above, the NSO can evaluate the risks associated with the supplier delivering the administrative data on time, against the required quality criteria.

IV. Conclusions and recommendations

70. Administrative data can be used across the different census methodologies and to support all stages of the census process, including constructing an address frame, supporting field operations, enumerating the population, collecting census variables, quality assurance, editing and imputation, modelling and estimation. Their use can provide more frequent and timely statistics about the population; improvements in accuracy and reliability; and significant reductions in costs and respondent burden.

71. However, there are significant quality challenges to assess and overcome before an administrative source can be used in a census. Most significant among these is that administrative data have, in general, not been collected for the purpose of a census. As such, the NSO may have little control over the concepts and definitions used; the target population; the collection, processing and quality assurance procedures; and the data methods, structures and systems used.

72. The Guidelines have set out Stages of quality assessment, set against a number of quality dimensions, with associated tools and indicators to guide the user through the process of assessment. The application of the Guidelines should help readers to make decisions about the use of administrative data in the census, whilst supporting a process of continuous assessment and improvement. Throughout the Guidelines, a number of proposals and recommendations have been made, which are summarized below.

A. Recommendations

73. The following recommendations have been made:

i. The NSO should *identify the administrative sources* that may be relevant to their census, set against different use cases. It is important to *set out what the expected or required outcomes of using the source would be*, against which an assessment of relevance can be made. This could include improvements to the efficiency of the census operation in terms of reductions in cost and respondent burden; improvements to the quality of the census; or the delivery of new or enhanced census outputs. Central to such assessment is setting out what the administrative source needs to deliver in terms of the target population and the required measurements from this population for the census use case. The full Guidelines, including the case studies, provide examples of how administrative data have been used in several different countries.

ii. The *relationship between the NSO and the administrative data supplier* is of critical importance. This should be supported by robust mechanisms of communication, written agreements and an excellent understanding of the needs of both parties. There must also be an agreed legal basis for the supply and use of the data. To help build the relationship and secure a data supply, the NSO should identify areas of benefit to the supplier. This could be with respect to feedback mechanisms to help the supplier better understand their data, through collaborations on areas of common interest, or by helping the supplier (through the use of their data in the census) to support the wider good. Of course, feeding back on possible quality concerns with the data has the added benefit of facilitating ongoing quality improvements.

iii. *The NSO should engage with the supplier to gain an in-depth understanding of the data source.* This should translate into the creation of clear and comprehensive metadata about the administrative source. The metadata will provide a useful reference both for the census and for any other statistics that might benefit from use of the source. The full Guidelines provide details of the metadata that should be collected, along with various references to the relevant literature.

iv. Since administrative data are generally not collected for the needs of the census, it is important for the NSO *to understand and assess differences between the required populations, concepts, definitions and time-related dimensions*. More generally, a thorough assessment of the coherence and comparability of the administrative source, along with its limitations across the various quality dimensions, is essential. This includes the linkability of the source if this is a requirement for use in the census. This assessment will inform the processing stages, including mapping and derivation, editing and imputation, and the linkage and integration of sources (where decisions are made between and across sources based on their quality).

v. The NSO must *understand any restrictions and challenges to acquiring and integrating an administrative source into the census*. This could include resources and costs; risks associated with the Supplier's ability to deliver on time to the required quality; and whether the use of a source is acceptable to the public and users of census data. In this respect there are important trade-offs that the NSO must consider. Specifically, *the value of the administrative source must be assessed against its usefulness for the census, set against the effort and risks of acquiring and using the data*.

vi. The NSO has limited control over the collection and processing of the administrative data, which can be subject to changes in population coverage and the measurements from the population over time. This can be due, for example, to legal, policy, procedural or system changes affecting the data and/or their delivery. *The NSO must therefore assess and manage a level of risk*. The risk should be managed by working with the Data Supplier on potential or planned changes; by being flexible and responsive to change; and by reducing reliance on any single data source or item where possible, whether through the use of other data sources or by adapting processes/methodologies.

vii. *It is important that the public and data users understand how and why administrative data are being used in the census*. The NSO should, therefore, be transparent about the use; providing a clear justification of the benefits set against any risks and costs (i.e. a strong proportionality case exists). This can be achieved through *good communication, including the publication of the procedures and policies in place that support the effective use and protection of data*.

viii. The inclusion of administrative data sources in census production should be preceded by adequately resourced feasibility research which provides a 'proof of concept' for the planned integration of administrative data into the census production. It is advisable to carry out a number of test runs (using real data) well in advance of the main census to ensure any unforeseen issues are identified, allowing enough time to correct or adjust the methods, processes or systems.

ix. *Expert review* (working with data suppliers and subject experts) and *comparisons between sources and over time are important to identify any quality concerns* with a source or register. The use of well-designed surveys (linked to administrative data or registers) can be particularly important in identifying and adjusting for coverage and measurement errors.

x. *The NSO should record and publish the results of the quality assessment and assurance throughout the census production*, including the Data, Process and Output Stages. This will enable producers and users of the census to appraise and provide feedback, supporting an ongoing dialogue. This is important to ensure that users understand the strengths and limitations and can help determine whether the right balance has been achieved across the dimensions of quality.

xi. The NSO should *develop its own quality assurance framework and strategy*, supported by clear and comprehensive documentation and training procedures. These Guidelines provide a useful basis to support this, along with the reference material and case studies within the Guidelines. The strategy should build the continuous assessment and improvement of administrative data into the plans and procedures for the census. This should include the communication links between the NSO, users and the data suppliers.

B. Areas for further development

74. The Guidelines have focused on the assessment of the quality of administrative sources for use in censuses, while providing some information about the processes used to integrate and transform data to improve quality. The quality of census outputs that use administrative data is also covered briefly. However, the Guidelines do not provide a *wider total error framework* or a model for how the error from each source translates into the error in the final census estimates, taking account of the changes in quality due to processing (which can reduce or increase error).

75. The development of such a model that takes account of all sources of error is partly addressed by the total error framework adopted by Statistics New Zealand (Reid et al., 2017). The framework builds on Li-Chun Zhang's (Zhang 2012) extension of the Total Survey Error (TSE) paradigm (see Groves and Lyberg 2010; Biemer 2010). It has three phases covering: 1) an assessment of the single sources, 2) an integrated data set assessment; and 3) an estimation and output assessment. The work of the ESSnet KUMUSO on the quality of multisource statistics (WPI Quality, 2019) also provides a useful framework for assessing the quality of statistical outputs based on multiple sources (survey and administrative data).

76. This could be an area for further development and international collaboration with *a specific focus on how such a framework can be applied to censuses*. This could include examining how a total error framework or model can be developed and used to assess the quality of census outputs based on multiple sources. It could also include work to understand how the impact (and compounding impact) of various errors across the stages of the census can inform decisions about the best overall statistical design for the census.

77. Finally, the Guidelines have focused on the assessment of administrative data, but there are *other sources of commercial data that present opportunities for use to improve or enhance census statistics* (e.g. geospatial data, mobile phone data). The quality Stages, dimensions, tools and indicators within these Guidelines are to a great extent applicable to sources beyond administrative data. This too could be an area requiring further international work, with a specific focus on whether and how the tools and techniques for assessing the quality of such sources for use in the census differ from those identified here.