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## Conference of European Statisticians

**Group of Experts on Population and Housing Censuses****Twenty-sixth Meeting**

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**Revising the Conference of European Statisticians Recommendations  
for Population and Housing Censuses for the 2030 round:****Quality Assessment and Quality Management****Developing the Recommendations on Quality Assessment and  
Quality Management: part 1 (chapter on Quality  
management)****Note by the Conference of European Statisticians Task Force on  
Quality Assessment and Quality Management\*\*\****Summary*

This document discusses the content on quality management and quality assessment for the Conference of European Statisticians (CES) Recommendations for the 2030 round of population and housing censuses. It gives a summary of the changes introduced in comparison to the Recommendations for the previous, 2020 round.

The proposals of the task force that undertook this work pertain both to the chapter in the 2020 edition entitled Quality management, and to the Annex entitled Quality management programme implementation. The current document contains the draft text for the former,

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- \*\* This document was submitted to the conference services for processing after the deadline for technical reasons beyond the control of the submitting office.



while document ECE/CES/GE.41/2024/16 contains the draft text for the latter. The two documents are therefore intended to be read in conjunction with one-another.

The main purpose of the two documents is to elicit comments and suggestions from national census experts on the proposed draft text, to ensure that it reflects the needs and priorities of national statistical offices and the latest methodological developments.

## **I. Introduction**

1. Every ten years the Conference of European Statisticians (CES) issues Recommendations to guide countries in conducting their population and housing censuses. The Recommendations are developed by expert task forces overseen by the CES Steering Group on Population and Housing Censuses.
2. Section II of this document summarizes the changes introduced in the content pertaining to quality assessment and quality management, in comparison with the Recommendations for the previous, 2020 round.
3. Section III presents the draft chapter on Quality Management for the CES Recommendations for the 2030 round of population and housing censuses. The content on quality management continues in document ECE/CES/GE.41/2024/16, which contains the draft annex on Quality management programme implementation.
4. The main purpose of the two documents is to elicit comments and suggestions from national census experts on the proposed draft text, to ensure that it reflects the needs and priorities of national statistical offices and the latest methodological developments.

## **II. Summary of changes from the 2020 Recommendations**

5. The next round of censuses will need to build on the 2020 round's experiences and lessons learned around quality in order to improve the approach and measures. The quality management programme for National Statistical Offices (NSOs) must become more robust as stakeholders will continue to request more transparency about the quality of census data.
6. As the Task Force discussed the changing future of census work, the members agreed that the demand for data quality-related methods, processes and metrics will just continue to increase.
7. Data quality became a major concern regarding censuses conducted during the Covid-19 pandemic. Countries made modifications to census procedures and operations, such as introducing data collection approaches that would limit direct contact with respondents or extending the enumeration period to mitigate the risk of under-coverage. Stakeholders required an increased understanding and additional access to information about the methods, approaches and metrics that were being used to assess data quality.
8. The necessary quality metrics will continue to evolve as many countries move from the 'traditional' field enumeration of all individuals to a census that is based on data coming from statistical registers, whether in a combined or in a fully register-based approach.
9. For this reason, the Task Force members agreed that CES Recommendations should be more tailored towards the different census methods and on how quality metrics might differ for direct enumeration-based censuses, register-based censuses and those censuses that are a combination of both.
10. The revision has been informed both by the responses to the Quality and coverage section of the 2020 census round UNECE survey and by the relevant scientific literature and international guidance on quality, such as the one specifically addressed to the management and measurement of quality of administrative sources in censuses (CES Guidelines on the use of registers and administrative data for population and housing censuses and CES Guidelines for Assessing the Quality of Administrative Sources for Use in Censuses) and,

more generally, the Handbook on the Management of Population and Housing Censuses, Revision 2 and the revised (currently under revision) UNSD Principles and Recommendations.

11. After agreeing on keeping the same structure of the current Quality chapters (a chapter on Quality management an Annex on Quality management programme implementation), the introduction to the Quality management chapter has been slightly edited, putting additional emphasis on the importance of establishing a quality management programme and setting quality standards at the planning stage and a reference to the well-known Quality assurance circle has been included (in the figure). Reference to additional sources of non-sampling errors (i.e. representation and measurement errors) traditionally described in terms of variance and bias has been added to the section ‘Defining information quality’, as well as to the additional quality dimensions usually considered when assessing the quality of administrative sources for use in censuses (such as the institutional environment, linkability, accuracy of record linkage, accuracy of conflict resolution).

12. In the Quality evaluation and reporting section, two main additions are being proposed:

(a) Specific mention of operational assessment documents and evaluation for administrative sources used in censuses;

(b) Reinforcing the importance of ensuring transparency about data quality, through the thorough documentation of quality assessments performed by NSOs, including assessment of completeness and accuracy and methodologies and extent of adjustment counts (if any).

13. Furthermore, a dedicated section has been added (Ensuring quality in register-based and combined censuses), devoted to quality assessment of administrative sources, with specific reference to the four quality assessment stages (Source, Data, Process and Output) identified as relevant for administrative sources.

14. The following changes are proposed to the Quality Annex (see document ECE/CES/GE.41/2024/16 for the proposed text):

(a) Linked to the increasing use of administrative sources for censuses and the increasing number of data sources used for census compilation is the proposed addition of a section on the measurement of record-linkage quality, as the increasing diversification of population census sources increases the need for quality measures of data linkage. The section includes a case-study on the use of quality measures for record-linkage from Germany;

(b) The introduction of a short section on ‘Measuring imputation quality in register-based censuses’ is proposed, including a case study on the use of imputation for missing values in a register (The imputation of educational attainment in the Dutch register-based census). Indeed, the need for data editing and imputation does not decrease when administrative sources are used, as the existence of multiple data sources can be in itself a source of inconsistencies. Undercoverage of data sources, data linkage problems and the use of sample data can lead to missing values that might require specific solutions. Improper imputation methods can lead to erroneous results. Therefore, an increasing need arises to assess the quality of data editing and imputation procedures;

(c) Updated guidance in relation to the use of Computer-assisted web interviewing (CAWI) and other electronic modes (Computer-assisted personal interviewing, CAPI, and computer-assisted telephone interviewing, CATI) has been added to the sections on ‘Questionnaire design’ and ‘Systems development’, while the section on ‘Operational quality control methods’ has been lightened, keeping just basic information on quality control, while moving some of the previous detailed text to a footnote, and of course maintaining the reference to essential literature to be consulted for a complete examination of the topic;

(d) A third case study has been included in the content evaluation section, providing a detailed insight of the United Kingdom’s Census Quality Survey, in order to provide an example of assessment of content error (which in international guidance is usually much less dealt with than coverage error);

(e) Furthermore, both in the Chapter and in the Annex, some footnotes have been added, in order not to add too much text but at the same provide the reader with useful references to actual cases and/or relevant literature for a number of topics, namely:

(i) The importance of setting quality targets (footnote 3 in relation to early setting and declaration of accuracy targets and footnote 4 in relation to users' consultation programmes for process-related relevance targets);

(ii) Coverage adjustment as an integral part of the census process (footnote 6);

(iii) The importance of designing a comprehensive evaluation programme (footnote 7);

(iv) Changes to coverage estimation processes based on quality assurance processes (footnote 8)<sup>1</sup>;

(f) Finally, other noteworthy integrations made to the text include some suggested cross-references, namely to the new Chapter on Emergency preparedness and contingency planning, especially with reference to the development of a risk management plan as an integral part of the operational quality control system.

### **III. Draft text for the chapter on Quality management for the Recommendations for the 2030 round of population and housing censuses**

#### **A. The need for a quality management programme**

15. The product of any census of population and housing is information, and confidence in the quality of that information is critical. The management of quality must therefore play a central role within any country's census.

16. A quality management programme is an essential element in the overall census programme, regardless of whether it is a traditional, register-based or combined census, and should touch on all activities during planning, the development period, operational activities such as data collection and processing, through to evaluation and dissemination of results.

17. The focus of any quality management programme is to prevent errors from occurring or reoccurring, to detect errors easily and early enough to allow taking corrective actions. Without such a programme, the census data, when finally produced, may contain errors, which might severely diminish the usefulness of the results. If data are of poor quality, then decisions based on these data can lead to costly mistakes. Eventually the credibility of the entire census may be called into question.

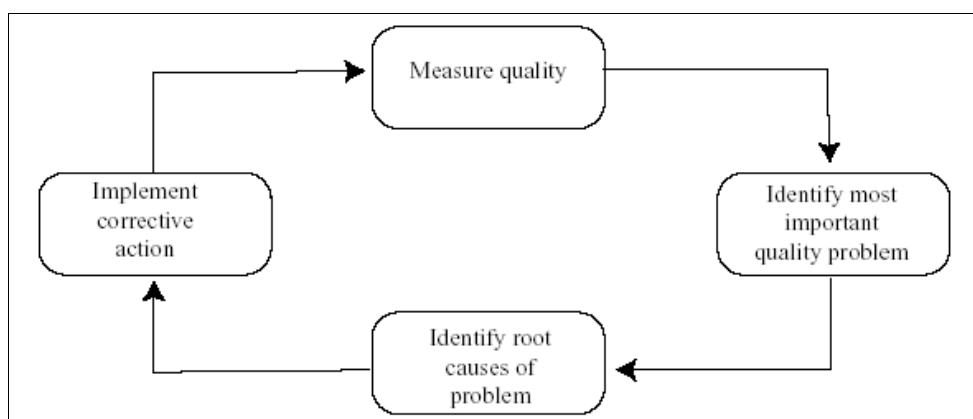
18. The quality management programme should be developed as part of the overall census project and integrated with other census plans, schedules and procedures. Establishing a quality management programme and setting quality standards at the planning stage is crucial to the success of the overall census operation.

19. A major goal of any quality management programme is to systematically build in quality from the beginning through the sound application of knowledge and expertise by employees at many levels, and through defined quality assurance processes and reviews. It will also include reactive components to detect errors so that remedial actions can be taken during census operations, as represented by the well-known Quality assurance circle (in the figure).

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<sup>1</sup> N.b. footnote numbers referred to here may not correspond to those appearing in the text of the document. It is understood that all footnote numbering and cross-references to numbered paragraphs will be revised when all chapters are combined into the final publication.

Figure  
Quality assurance circle



20. Lessons learned from previous censuses and experience learned by other NSIs are very useful to plan for a quality management programme for the current census. Therefore, a well-documented evaluation of previous experiences is of critical importance so that errors detected from previous censuses or similar activities are used as the basis for developing a quality management for the next census.<sup>2</sup>

21. Firstly, this chapter defines the different dimensions of ‘information quality’ and then describes a framework that can be used to manage quality across these dimensions through the full census lifecycle. Furthermore, it presents a paragraph devoted to quality management in register-based and combined censuses. Finally, it includes a short paragraph with some additional guidance concerning quality assurance in an outsourcing environment. Annex III provides further guidance about how the framework can be applied in practice to each dimension and additional detail on the following topics: operational quality control; questionnaire design; management of coverage error; systems development; methods of census evaluation (including a case study on content evaluation); measuring record-linkage quality; measuring editing and imputation quality.

## B. Defining information quality

22. It is generally accepted that there are six dimensions of statistical quality<sup>3</sup>:

### 1. Relevance

23. The relevance of statistical information reflects *the degree to which it meets the needs of users*. The challenge for a census programme is to balance conflicting user requirements so as to go as far as possible in satisfying the most important needs within resource constraints. This dimension of quality is particularly important in census content development and in dissemination.

### 2. Accuracy

24. The accuracy of statistical information is *the degree to which the information correctly describes the phenomena it was designed to measure*. It is usually characterized in terms of error in statistical estimates and is traditionally broken down into bias and variance. While bias refers to non-sampling errors, variance refers to sampling errors, therefore, in a census context, variance only applies in situations where a short form/long form strategy is used (i.e. a portion of the questionnaire is used for a sample of persons or households), or where only a sample of records is processed. Sampling errors are typically measured and

<sup>2</sup> Diagram taken from UNSD Principles and Recommendations [currently under revision, updated reference will be added prior to publication].

<sup>3</sup> E.g. see Handbook on the Management of Population and Housing Censuses, Revision 2, [https://unstats.un.org/unsd/publication/seriesf/series\\_f83rev2en.pdf](https://unstats.un.org/unsd/publication/seriesf/series_f83rev2en.pdf).

communicated using the Mean Squared Error (MSE) framework and/or through confidence intervals. However, such measurements do not cover non-sampling errors, which are particularly important in the context of censuses, where the aim is to capture the full population. Accuracy can also be described in terms of major sources of error (for example coverage, sampling, non-response, response, data capture, coding).

25. For statistics produced with administrative data as well, the key sources of error in the context of censuses are non-sampling errors, i.e. representation (coverage) and measurement errors (Zhang 2012)<sup>4</sup>.

26. Representation errors (errors relating to the target units, see 0) might occur if data are not reported correctly to the data supplier resulting, for example, from non-registration or delayed self-registration on an administrative register (e.g., birth, death, or full population register). Some data records may not be transmitted to the NSI because of technical problems or be transmitted with errors if units are not maintained properly by the data supplier (resulting in duplicates).

27. Implausible or missing values are indicative of measurement errors (that is, error within variables) and may reduce the accuracy of the raw data. To assess whether a value is implausible or missing, it is important to examine not only specific records, but also variable distributions for all records. Reasons for a lack of accuracy might be technical, such as errors in the process of data transfer. Or a lack of accuracy may be systematic. For example, this may result from an inadequate submission or maintenance on the part of the data supplier, particularly if the variable is not of administrative importance for the data supplier, therefore it is not systematically recorded (e.g. a person's occupation in the population register). Missing values may also be due to an administrative source (or variables on a source) being only recently established.

28. It should be noted that representation errors may cause measurement errors where the unit of statistical measurement changes. For example, a person missing in the administrative population register may lead to an understated value for the variable 'size of household'. For an overall coverage assessment of a dataset, an examination of both over- and under-coverage is needed. Under-coverage may be of particular importance with respect to 'hard-to-reach' populations.

### **3. Timeliness**

29. Timeliness refers to *the delay between the time reference point (usually census day) to which the information pertains and the date on which the information becomes available*. Often for a census there are several release dates to be considered in a dissemination schedule. Typically there is a trade-off against accuracy. Timeliness can also affect relevance.

### **4. Accessibility**

30. The accessibility of statistical information refers to *the ease with which it can be obtained*. This includes the ease with which the existence of information can be ascertained, as well as the suitability of the form or medium through which the information can be accessed. The data obtained are of great value to many users including central government, local administrations, private organizations and the public at large. To maximize the benefit of the information obtained, it should be widely accessible to all of these potential users. Consequently, censuses often provide a mix of free products, standard cost products and a user pay service for ad hoc commissioned/customized products. The strategy adopted and the cost of the services also affects accessibility.

### **5. Interpretability**

31. The interpretability of statistical information reflects *the availability of supplementary information and metadata necessary to interpret and use it*. This information

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<sup>4</sup> Zhang, L.-C. (2012), Topics of statistical theory for register-based statistics and data integration. *Statistica Neerlandica* 66: 41–63.

usually covers the underlying concepts, definitions, variables and classifications used, the methodology of data collection and processing, and indications of the accuracy of the information.

## 6. Coherence

32. Coherence reflects *the degree to which the census information can be successfully brought together with other statistical information within a broad analytic framework and over time*. The use of standard concepts, definitions and classifications — possibly agreed at the international level — promotes coherence. The degree of quality on coherence can be assessed via a programme of certification and validation of the census information as compared to corresponding information from surveys and administrative sources.

33. Additional dimensions are usually considered (e.g. the institutional environment, linkability, accuracy of record linkage, accuracy of conflict resolution, etc.) when assessing quality of administrative sources for use in censuses. Indeed, even though the six standard quality dimensions capture many relevant aspects of administrative data quality, alone they are considered not always sufficient to assess the quality of administrative data (Daas et al, 2008, p. 2)<sup>5</sup>.

34. A separate section will be devoted to quality assessment of administrative sources, with specific reference to the four quality assessment stages (Source, Data, Process and Output) identified as relevant for administrative sources (see below paragraph ‘Ensuring quality in register-based and combined censuses’).

## C. A quality management framework

35. Quality management is generally considered to have five main components<sup>6</sup>:

### 1. Setting quality targets

36. Setting census quality targets for each of these dimensions at the outset of the census programme enables all involved to know what they are aiming to achieve and, crucially, to determine what it will cost. Early publication of these targets also involves stakeholders, users of the data in particular, to comment and feed in their requirements. In reality, there will be iterations of such targets as initial aspirations may turn out to be unaffordable or unachievable in the time available. Having such a discussion is crucial at the outset to enable realistic, affordable targets to be set and stakeholder expectations to be managed.

37. Simplistically, setting quality targets enables an NSI to answer the question “What does good look like?” and enables a dialogue with stakeholders about “How good is good enough?”.

38. It is easier to set targets for some dimensions than others. It is relatively straightforward to set targets for accuracy, timeliness and accessibility. For example, simple targets could be of the form:

(a) Accuracy: “We will aim to produce national population estimates that are within X per cent of the (unknown) true value with 95 per cent confidence.”<sup>7</sup>;

<sup>5</sup> Daas, P.J.H., J. Arends-Tóth, B. Schouten and L. Kuijvenhoven (2008). Quality Framework for the Evaluation of Administrative Data. Paper presented at the European Conference on Quality in Official Statistics.

<sup>6</sup> E.g. see Handbook on the Management of Population and Housing Censuses, Revision 2, [https://unstats.un.org/unsd/publication/seriesf/series\\_f83rev2en.pdf](https://unstats.un.org/unsd/publication/seriesf/series_f83rev2en.pdf).

<sup>7</sup> For an actual example of early declaration of accuracy targets, see e.g. accuracy targets (95% confidence intervals of +/- 0.2% nationally and +/- 3% for each local authority) set by UK Office for National Statistics (ONS) and declared to users in a White Paper published in 2018 (see para 1.7): <https://assets.publishing.service.gov.uk/media/5c13e08aed915d0b9211b98d/Census2021WhitePaper.pdf>.

(b) Timeliness: “We will aim to publish our first population estimates within one year of census day”;

(c) Accessibility: “We will aim to disseminate all outputs online.”<sup>8</sup>

39. Setting targets for some of the other dimensions, however, is not so straightforward, and it is sometime helpful to consider setting process-related, rather than outcome-related, targets. For example:

(a) Relevance: We will consult with users on the required census content at least two years before finalizing the content of the census questionnaire.

40. It is clear that even such simplistic targets will have a significant impact on cost and timetable, hence the necessity of considering such aims early in the planning process. It is suggested, therefore, that all NSOs should set targets for each dimension of quality at the early stages in the census programmes, and that these should be published to enable stakeholder views to be taken into account. It is particularly important to set targets for accuracy.

## 2. Quality design

41. Having set quality targets, it is necessary to consider whether or not the census statistical and operation design is capable of meeting those targets. This can draw on experience of previous censuses or wider international experience.

42. Pre-census tests (or pilots) provide a useful vehicle for planning and developing the actual census. Census tests can be conducted as a national sample (useful for testing content, mail and/or Internet response, and other questionnaire-related features of the census), or as a site test (useful for testing operational procedures). Other pre-census testing could involve cognitive testing of the questionnaire, research and testing of the automated processes for address list development, questionnaire addressing and mail out, messaging (styles of initial contact letters and reminders and content of mail materials) and the mail contact strategy, data collection, data capture, data processing, communication approaches, conducting research into the use of administrative records, improved cost modelling, and improved methods of coverage measurement.

43. Prior to conducting the actual census, a complete rehearsal provides an opportunity to test the full array of operations, procedures, and questions, much like a play’s dress rehearsal provides an opportunity to ‘address any remaining issues’ before the actual event.

44. Such testing should result in a review of the initial quality targets to confirm their achievability. It may at this point be necessary to change budgets, timetables, or the targets themselves if testing has shown them to be unachievable. Rehearsals should, therefore, be undertaken late enough in the planning stage to be able to assess the final census design yet earlier enough to enable any necessary changes to be implemented.

## 3. Operational quality control

45. Because of the size and complexity of census operations, it is likely that errors of one kind or another may arise at any stage. These errors can easily lead to serious coverage

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<sup>8</sup> A useful example of a comprehensive users’ consultation programme can be found at the following link, showing the 2021 census consultations held by ONS:

<https://www.ons.gov.uk/census/censustransformationprogramme/consultations/the2021censusinitialviewoncontentforenglandandwales>. In June 2015, ONS launched a public consultation asking census users for their views on the topics that the 2021 Census questionnaire in England and Wales might cover. Anyone could take part in this consultation, which closed in August 2015, and the resulting users’ feedback has been informing further research contributing to the development and testing of appropriate census questions. The outcome of the consultation is described in the report, published on 23 May 2016, which provided an overview of the evaluation process used to assess the responses and summarizes the results of the evaluation:

<https://www.ons.gov.uk/file?uri=/census/censustransformationprogramme/consultations/the2021censusinitialviewoncontentforenglandandwales/assessmentofinitialuserrequirementscontentforenglandandwalesresponsetoconsultation.pdf>



or content errors, cost overruns or major delays in completing the census. If not anticipated and controlled during implementation they can introduce non-sampling error to the point of rendering results useless.

46. To minimize this risk, it is essential to monitor and control errors at all stages of census operations, including pre-enumeration, enumeration, document flow, coding, data capture, editing, tabulation and data dissemination. Every national census organization should establish a system of operational quality control.

47. The dimensions of quality outlined above are overlapping and interrelated and each must be adequately managed if information is to be fit for use. Each phase in executing a census may require emphasis on different elements of quality. Again, this requires careful design at the outset to identify:

- (a) The types of errors that may occur at each phase of the operation;
- (b) What information is required to enable such errors to be identified, should they occur;
- (c) How this information will be collected in a timely fashion during live operations; and
- (d) What actions will be taken should the error be found to have occurred (ideally before the phase is complete).

48. Given the speed and scale of census operations, this is no simple task and it requires careful planning and testing. Operational quality control processes and systems should be included in both pre-census tests as well as rehearsals to ensure they work as expected during census operations.

49. There is no single standard operational quality control system that can be applied to all censuses or even to all steps within a census. Census designers and administrators must keep in mind that no matter how much effort is expended, complete coverage and accuracy in the census data are unattainable goals. However, clear quality targets should sit at the heart of decision-making processes and efforts to first detect and then to control errors should be at a level that is sufficient to produce data of a reasonable quality within the constraints of the budget and time allotted.

50. The development of a Risk Management plan identifying potential risks and strategies for dealing with them is also crucial to ensure a sound operational quality control system. The Risk Management Plan should identify potential risk events and their probability of occurring, provide measures of potential impact, offer strategies for dealing with risks if they occur, and identify the area(s) responsible for addressing each risk event, and should be a dynamic document where risks can be modified as needed.<sup>9</sup>

#### **4. Quality assurance and improvement**

51. Once data collection and processing operations are complete, it is essential that final statistics are quality assured and, where possible, improvement made to the results prior to publication if significant problems are discovered.

52. Quality assurance can be through comparison with statistics from other surveys, through comparison with statistics from administrative data sources, or through analysis of information collected as part of operational quality control. But such quality assurance is challenging, and sufficient time should be allowed from the outset to enable such studies to be completed prior to publication.

#### **5. Quality evaluation and reporting**

53. It is generally recognized that a population census is never perfect and that, despite rigorous quality control and quality assurance, errors can, and do, occur. Most errors in the census results are classified into two major categories — coverage errors and content errors. Coverage errors are those that arise due to omissions or duplications of persons or housing

<sup>9</sup> See chapter on Emergency preparedness.

units in the census enumeration. Content errors are errors that arise in the incorrect reporting or recording (or linking) of the characteristics of persons, households, and housing units enumerated in the census. A third type of error classified as operational error can occur during field data collection or during data processing.

54. Many countries recognize the need to evaluate the overall quality of their census results and employ various methods for evaluating census coverage as well as certain types of content error. In fact, some countries, the United Kingdom for example<sup>10</sup>, includes coverage assessment as an integral part of the census process and aims to publish all results after an adjustment for coverage error. Most countries, however, undertake coverage assessment only as part of their evaluation process, as described in the paragraph on Coverage evaluation of the Annex on Quality management programme implementation.

55. A comprehensive evaluation programme should, however, also include assessments of the success of census operations, in each of its phases. Countries should ensure, therefore, that their overall census evaluation effort addresses the census process (hereafter referred to as operational assessments), as well as the results (referred to as evaluations). Together, operational assessments and evaluations tell us “How well we did”. A third component of a comprehensive research includes experiments. Experiments tell us “How can we do better?” Thus:

(a) Operational assessments document: final volumes, rates, and costs for individual operations or processes, using data from production files and activities; quality assurance files and activities; and information collected from debriefings and lessons learned. Operational assessments can include some discussion of the data, but do not involve explanation of error. The final volumes, rates and costs can be broken out by demographic, geographic level, and housing unit and/or person-level data at intermediate stages of operations or processes. Operational assessments may also document operational errors, although they will not necessarily include an explanation of how those errors affect the data. For administrative sources used in the census, operational assessment documents should include: quality assurance files and activities related to the processing of the different administrative sources, including actions taken to improve the fitness-for-use of the admin sources;

(b) Evaluations analyse, interpret, and synthesize the effectiveness of census components and their impact on data quality and coverage using data collected from census operations, processes, systems, and auxiliary data collections. For register-based and combined censuses, evaluations should also include measures such as the rates of record linking and imputation, the use of methods such as the signs-of-life and their impact on census coverage. In addition, evaluations should also be made on the impact on census output, especially for countries transitioning to admin-based census;

(c) Experiments are quantitative or qualitative studies that must occur during a census to have meaningful results to inform planning of future censuses. The census provides the best possible conditions to learn about the value of new or different methodologies or technologies and typically involve national surveys with multiple panels<sup>11</sup>.

56. Evaluation efforts that focus on census results should generally be designed to serve one or more of the following main objectives:

(a) To provide users with some measures of the quality of census data to help them interpret the results;

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<sup>10</sup> See:

<https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/methodologies/coverageadjustmentforcensus2021inenglandandwales>.

<sup>11</sup> For example, the US Bureau of the census conducts experimental studies to identify potential topics for early 2030 Census life cycle research and testing. In general, decennial census experiments involve comparisons (usually of response rates) between a control group that reflects 2020 Census production methods or procedures and a treatment group(s) that tests modifications to them. See: [Census Evaluations and Experiments](#).

(b) To identify as far as is practical the types and sources of error to assist the planning of future censuses; and/or

(c) Feed into the quality assurance and improvement processes and serve as a basis for constructing a best estimate of census aggregates, such as the total population, or to provide census results adjusted to take into account identified errors<sup>12</sup>.

57. Evaluations of the completeness and accuracy of the data should be made by all countries, and should be issued with the initial census results to the fullest extent possible, including the detail of the methods used. In order to ensure transparency about data quality and enhance users' confidence into census results, it's important to assess quality of census data as much as possible prior to their release, and to make this information publicly available, even though, in order to provide detailed coverage results and information on how accurately the census counted certain population groups, it might be necessary to wait for the results of the PES or other coverage surveys. Additional results can be issued after the initial results are published. However, the evaluations of the completeness and accuracy of census data should also be included in the evaluation or quality report.

58. If census estimates are adjusted in the light of quality assurance and evaluation activities (including adjustments to population counts), countries are encouraged to thoroughly document the type (whether at the microdata or aggregated level) and the extent of changes. Furthermore, countries are encouraged to document and publish the methodologies used for imputation of total non-response, detailing the techniques and rationale. They should also report the magnitude of these imputations.

59. More broadly, an assessment of all six dimensions of quality should ideally be made against the initial targets set, with the results published.

60. Such evaluations and measurements can be valuable to indicate priorities and establish quality targets standards for the next census, thus completing the quality cycle.

61. A number of methods exist for carrying out census evaluations and, in practice, many countries use a combination of such methods to fully serve these objectives. A short guidance on methods of census evaluation is provided in paragraph 'Methods of census evaluation' of the Annex III.

62. Finally, census quality reports should also describe any Statistical Disclosure Control method used to ensure data confidentiality and the resulting consequences on data quality (such as the level of loss of accuracy).

63. Indeed, ensuring data confidentiality is an indispensable element for keeping the trust of respondents. If respondents believe or perceive that a national statistical office does not protect the confidentiality of their data, they will be less likely to cooperate or provide accurate data. This may in turn affect the accuracy and relevance of the statistics.

64. Therefore, NSOs should aim to determine optimal SDC methods and solutions that minimize disclosure risk while keeping information loss to a minimum and users of census data should be aware of the logic and methodology behind statistical disclosure control methods applied to data, and their impact on census data, especially at lower geographies (such as at the squared kilometre grid level).

#### **D. Ensuring quality in register-based and combined censuses**

65. Administrative 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. In the last census round there has been a clear trend towards increased use of administrative data in censuses across the countries of UNECE region and beyond, in line with a more generalized

<sup>12</sup> For example, ONS adopted changes to coverage estimation processes based on quality assurance (validation and evaluation) processes. See: <https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/methodologies/maximisingthequalityofcensus2021populationestimates#changes-made-because-of-the-quality-assurance-process>.

trend towards increased use of administrative data for statistical production, further increased and or accelerated as a result of the COVID-19 pandemic, particularly to support the production of census statistics where field data collection has not been possible or has been delayed<sup>13</sup>.

66. Nevertheless, there are many key quality considerations that must be taken into account before incorporating the use of administrative sources into a census. It is important that NSOs understand the strengths and limitations of administrative data in order to make the right decisions about the use of such data<sup>14</sup>. The pandemic has also had a significant impact on the quality and content of administrative sources<sup>15</sup>.

67. In a census context, the quality of administrative data used should be considered in relation to the ways data are collected and processed by data suppliers and NSOs, through to the final census outputs. Throughout the process, errors may occur which will compromise quality. Assessing the quality of administrative sources requires mapping the errors which may occur before and after the data is supplied to NSOs and determining how any such errors can be mitigated (e.g. through changes to collection, processing and/or integration with other sources).

68. Quality measurement and assurance should be undertaken throughout all stages of the framework. More precisely, four stages of production have been identified in relation to the use of administrative sources in censuses, applicable regardless of census type (i.e. regardless of the census process in which administrative sources are being used), broadly related to the lifecycle of using administrative data in the census:

- (a) *Source* (understanding, evaluating, and working to acquire a source);
- (b) *Data* (receiving the actual data and assessing its quality);
- (c) *Process* (processing the administrative data for use in the census);
- (d) *Output* (assessing the quality of the census outputs that use administrative data)<sup>16</sup>.

69. The quality of administrative data may be assessed, by identifying the key quality dimensions at each stage and the respective tools and indicators for Quality Assessment. Besides the six standard quality dimensions, additional dimensions are taken into account, depending on the census lifecycle Stage.

70. In (a) the *Source* stage, information is gathered about an administrative source through communication with the data supplier and by reviewing existing metadata. At this Stage, the focus is on assessing the relevance of the source against the needs of the census, covering accuracy, timeliness, coherence and comparability, accessibility and interpretability. An assessment is also made about the institutional environment, including whether the data

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<sup>13</sup> Where the shift towards more use of administrative data has been expedited by the impact of the COVID-19 pandemic, this has required rapid changes and improvements to data collection and processing systems across both administrative organizations and NSOs. The need to deliver new services and support to the public has led to the development of new administrative processes and systems. See UNECE (2021), Keeping count: conducting the 2020 round of population and housing censuses during the Covid-19 pandemic, <https://unece.org/statistics/publications/keeping-count>.

<sup>14</sup> See Guidelines on the use of registers and administrative data for population and housing censuses, <https://unece.org/guidelines-use-registers-and-administrative-data-population-and-housing-censuses-0>.

<sup>15</sup> For example, some types of interactions with health services may have decreased (with people avoiding health care services due to concerns about catching the virus) while others have increased (with people registering to be tested, treated or vaccinated), does impacting the coverage of health registers; while the pressures on the public and administrative organizations due to the pandemic have impacted the timeliness and accuracy of other administrative data. Examples include delays in registrations of births and reductions in the level of quality assurance (with resources being temporarily diverted elsewhere). See UNECE (2021), Keeping count: conducting the 2020 round of population and housing censuses during the Covid-19 pandemic.

<sup>16</sup> See Guidelines for assessing quality of administrative sources for use in censuses, [https://unece.org/sites/default/files/2021-10/ECECESSTAT20214\\_WEB.pdf](https://unece.org/sites/default/files/2021-10/ECECESSTAT20214_WEB.pdf).

supplier can meet the needs of the NSO, considering factors such as the strength of the relationship with the supplier and the status of the supplier.

71. In (b) the *Data* stage of the assessment, data are received from the data supplier and are assessed through analysis of the data and through comparisons with other data sources. Besides standard quality dimensions, other dimensions such as validation and harmonization arrangements put in place upon data transfer to NSO and linkability (defined as availability of adequate linkage variables) are involved at this stage.

72. During both the Source and Data Stages, the assessment and measurement of quality is set against many data quality dimensions, using various tools and indicators, e.g. comparisons with alternative sources will reveal measurement or representation errors, to be measured against set accuracy targets. The information and insight gained through the Source and Data Stages are useful not only to determine whether a particular source could be used in the census, but also to determine the necessary processing of the administrative data for use in a census.

73. In (c) the *Process* stage, administrative data are transformed using the information gained at the Source and Data Stages<sup>17</sup>. The processes commonly carried out on administrative sources for census use are: record linkage; assessment of coverage errors (e.g. by using the ‘signs of life’ methodology’), resolving inconsistencies from different sources, editing and imputation. The quality of administrative data at the Process stage is to be assessed against several dimensions including accuracy of record linkage (where multiple sources are linked), accuracy of conflict resolution (referred to the methods for deciding between sources where different sources are linked and the same attributes are available in them), accuracy of editing and imputation (where census variables/units are derived/constructed through imputation or modelling techniques).

74. Finally, in (d) the *Output* stage, the quality assessment of census outputs which use administrative data is performed. Conceptually, this is not different from the assessment of the outputs of a traditional census, while at the same time it will provide valuable information about where there may be limitations or concerns about the administrative data, or the processing of these data, that were not identified initially at the Source, Data, and Process Stages. There is an iterative process of assessment, which can inform both ongoing improvements to the administrative sources (working with the data supplier to improve the source), and improvements to the processing of the administrative data by the NSO.

## **E. Ensuring quality in an outsourcing environment**

75. Some countries may wish to outsource certain parts of census operations. The motivations and considerations for outsourcing have already been discussed more fully in Chapter II. In the context of quality management, the outsourcing of components of census operations still requires the census agency to take full responsibility for, and manage the quality of, the census data. This aspect should never be delegated.

76. In setting up outsourcing arrangements, the census agency needs to ensure that it continues to have the ability to both understand and manipulate those elements that contribute to final data quality.

77. Some approaches to outsourcing put an emphasis on ‘turnkey’ arrangements — in which contractors deliver systems according to a set of predetermined client specifications with the expectation that the client focuses solely on the outputs and not the internal workings of the system. This assumes that the census agency completely understands and can fully anticipate all data quality issues that might arise during the census and has included these in the specifications. The client is not expected to have any understanding of how these systems work or how they might contribute to the final outputs. Any changes to the system typically

<sup>17</sup> As data in population registers and other administrative sources are not primarily collected for the purpose of a census, usually cannot be used directly in a census, due to conceptual and definitional differences. There are also limitations of coverage, completeness, and accuracy. A transformation process is therefore required.

require cumbersome processes to determine contract responsibilities and heavy financial costs. This sort of approach effectively hands over the quality of the census data to the contractor, while the risks associated with intervention remain with the census agency. It removes any flexibility and greatly restricts the ability of the census agency to react to quality problems that emerge during processing. This ‘turnkey’ approach is not recommended.

78. Suppliers should be made fully aware of the quality targets set at the outset of the census programme, and the quality requirements of the outsourced components that enable the overall census quality targets to be achieved. Operational quality control should apply to outsourced services in the same way as those that are carried out internally.

79. Even when components are outsourced, census agency staff should have an understanding of how such systems work, for example, automatic text recognition engines and coding algorithms, and have the ability to change the tolerances or parameters of these systems at little cost and in a timely manner during processing. Varying these parameters will allow the census agency to determine and manage the appropriate balance between data quality, cost and timeliness as processing progresses.

#### **IV. Conclusion**

80. The draft chapter on quality management for the 2030 round of population and housing censuses is presented for comments and discussion.

81. This proposal should be read in conjunction with document ECE/CES/GE.41/2024/16 containing the draft annex on Quality management programme implementation.

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