

United Nations (2001). *Handbook on Census Management for Population and Housing Censuses*. Studies in Methods, No. 83, Revision 1.

Pages: 63-69

effective and may provide flexibility for the use of the mapping data for other purposes. Factors that should be considered include the following:

(a) A format. As formats are those that are widely used within the country, output products can be prepared readily to meet a wide market;

(b) The suitability of the data for commonly available desktop mapping applications. The map database for preparation of enumeration maps may be large and detailed and may present problems for desktop mapping use. In this case, a programme to thin the data set may be required.

(b) *Contract/agreement based mapping programmes*

The development of a mapping project beyond rudimentary clerical systems requires considerable knowledge of mapping, cartography and geographic systems. In the event that a census agency cannot draw on such skills from within the agency, it may be required to contract out the preparation of census maps.

Establishing a contract or agreement between the statistical and mapping agencies is based on the specification of the statistical agency's requirements and the mapping agency's ability to meet those requirements at an agreeable cost. In some cases, the production of a complete, digitized base map of a country suitable for a census (and, subsequently, electoral, postal and other purposes including commercial ones may be a sufficient reason for the Government to approve additional funding, on an exceptional basis, to establish the base map. A complete, consistent base map of an entire country suitable for small-scale activities is a national resource of high value. In other cases, a contract or agreement between the agencies provides the opportunity for the mapping agency to consolidate or increase its own mapping skills and capacity while lessening the resource and technical burden on the statistical agency. The two agencies must develop a cooperative and long-term (or strategic) relationship, but the outcome will be worth the effort.

For the census, a mapping agreement between the agencies would comprise two broad elements:

(a) Mapping for field purposes;

(b) Mapping and map-based products for dissemination purposes.

Using the same base map as the common source for both of these elements adds a level of quality assurance and consistency to the census programme that can be difficult to achieve where field and dissemination mapping are two separate elements.

Mapping for field purposes under a contract or agreement basis requires the statistical agency to specify its requirements of the mapping agency. These may include the following:

(a) Acquiring the base map data;

(b) Creating (or obtaining) the statistical boundaries and aligning them to the base map;

(c) Providing a process for enumeration area designers to advise on changes to boundaries (and updates to associated aspatial data);

(d) Producing hard-copy maps as specified for field work.

The statistical agency would undertake the enumeration area design work and validation of the associated aspatial data, as well as take delivery of the hard-copy maps for quality assurance checks and subsequent delivery into the field logistics programme. The statistical agency would also provide, after the census, any feedback received from enumerators about the base map that may be of use to the mapping agency.

Mapping for dissemination purposes is more difficult because the outputs will involve representation of statistical information (with, or as part of, a map) and often be accompanied by analysis or commentary about the information. Advances in mapping software have made it easier for census agencies to produce a wide variety of standard thematic maps.

However, advanced mapping products may require the expertise of the mapping agency. In these cases, it may be better for the statistical agency to focus on the statistics and let the mapping agency provide the technical skills required to produce the actual products.

The statistical agency would direct the development of map-based products as part of the overall output plan, taking into account user needs and requirements and the demand for different types of products. For example, it may be established that there is a strong demand for a series of thematic maps showing population change between censuses. The statistical agency would determine how the final maps should look, what standards should be applied (colour scales, etc.), what analysis should be included and how it should be presented and so on. The mapping agency would produce drafts of the maps using the information provided. These would be reviewed, changes made and so on until the product was final.

Part of the contract or agreement would cover how both agencies are represented in the presentation of maps (e.g., logos) and what financial arrangements would apply where products were sold.

D. FORM DESIGN AND TESTING

1. *Introduction*

The purpose of the census form, or questionnaire, is to capture data. A well-designed form captures data efficiently and effectively, with the minimum number of errors. It would be possible to devote an entire handbook to the principles associated with form design but for the purposes of the present handbook some fundamental issues are discussed in the sections below. Further detail on recommended questions to be asked in a census can be found in *Principles and Recommendations for Population and Housing Censuses*, revision 1.¹

It is also recommended that countries draw on the experience of other countries by obtaining examples of forms used in previous censuses. However, caution should be exercised

Census questionnaire design

The type of questionnaire, its format and the exact wording and arrangement of the questions merit the most careful consideration, since the handicaps of a poorly designed questionnaire cannot be overcome during or after enumeration. Among the many factors that should be taken into account in designing the questionnaire are the method of enumeration, the type of questionnaire, the data to be collected, the most suitable form and arrangement of the questions and the processing techniques to be employed. Many decisions regarding processing are dependent on the final content, form and arrangement of the questionnaires.

Source: Principles and Recommendations for Population and Housing Censuses, Revision 1 (United Nations Publication, Sales No.E.98.XVII.8), para. 1.114.

when examining the form design and question wording from other countries. This is because a particular question wording that works in one country may not necessarily work in another country. Even within a country, various regions may require questions to be worded differently to elicit the same information owing to the cultural differences that exist in the country.

There is broad consensus on the five different types of census questionnaire:

1. Building, housing units and household;
2. Household and living conditions;
3. Collective institutions;
4. Establishments;
5. Agriculture.

2. Form design

With the form design requirements varying according to the methods of enumeration and processing, there are several issues that need to be considered. These include:

- (a) Respondent burden;
- (b) Format and question wording, which are affected by whether interviewer or self-enumeration methods are used;
- (c) Layout and design of response areas, which are influenced by the need for good interviewer/respondent perception and the data capture method;
- (d) Whether a combination of short and long forms is used.

(a) Respondent burden

Minimizing respondent burden will assist in obtaining accurate answers to the questions on the census form. The length of the form, the number and type of questions and how easy the form is to complete can all add to respondent burden. This should be borne in mind when designing the census form and is particularly important if the self-enumeration method is used.

(b) Question wording and format

The wording and format of questions will influence how well the form works. Issues that need to be taken into account when designing questions include:

- (a) Data needs of users;
- (b) Level of accuracy and detail required;
- (c) Availability of the data from the respondent;
- (d) Appropriate language that is easily understood by respondents and interviewers;
- (e) Data item definitions, standard question wording and any other relevant information;
- (f) Data processing system being used;
- (g) Sequencing or order of questions;
- (h) Space required for each answer.

An important factor to note here is language diversity. For example, Indonesia has 300 spoken languages and Zambia has 73 different dialects. This proliferation and diversity of languages has a direct effect on the methods and techniques used to train field staff, as well as on the census management structure and questionnaire preparation. This may require the questionnaire to be provided in more than one language. Additionally, field staff may have to be trained to translate into the regional languages and/or dialects spoken in the area.

(c) *Layout and design*

(i) *Interviewer/respondent perception of the form*

The layout and design of the form will have a direct impact on how interviewers or householders will complete the form and the accuracy of the data supplied. Therefore, special consideration should be given to graphic presentation, placement and presentation of instructions, the use of space, layout and colours and the wording used.

Poor use of any form design element, be it language, question sequencing or layout, creates an obstacle for the respondent or interviewer. Each obstacle may be only minor, but they all accumulate in the person's mind until a point is reached when the person no longer cares about what responses go on the form. As the purpose of the census form is to obtain high-quality information, it is important to minimize obstacles so that the form is filled in before this point is reached.

(ii) *Processing system requirements*

Differing requirements for the data-capture components of processing systems, ranging from key entry to electronic imaging through scanners, will require markedly differing form design. The form design requirements and form size for differing technologies may vary greatly and should be taken into account when designing the forms. It is also important to note that it is possible for the form design to easily incorporate provision for contingencies in data processing. For example, even though a form may be designed for automatic data capture (e.g., imaging, character recognition), it is a simple task to include space and codes alongside response areas on the form. By incorporating these codes on the form, responses can be easily key entered, if necessary, owing to the failure of the intelligent character recognition system.

It is important that the respondent's perception of the form is not unduly impacted by data-capture requirements.

When designing forms for more advanced data-capture methods, such as imaging, it is necessary to establish that the respondents are able to provide answers in a suitable format that can be recognized by the data-capture equipment. If the forms are self-enumerated, this will require extensive testing that includes processing of live data from tests.

A general principle that should be adopted is that pre-coded response areas should be used as much as possible. Open-ended questions should be limited to essential topics such as occupation and industry.

The use of different languages in the census

Special provisions will have to be made if two or more languages are used in the country. Several methods have been used to deal with this situation: a single multilingual questionnaire, or one version of the questionnaire for each major language, or translations printed in the enumerators manual of the questionnaire in the various languages. The problem is more serious in the case of non-written languages. Staff recruitment and training procedures (see paras.1.133-1.138) will also have to take language problems into account. Information on the distribution of languages in the country is important for sound census planning and; if not available, will have to be collected at some stage of the census preparations.

Source: *Principles and Recommendations for Population and Housing Censuses*, Revision 1 (United Nations Publication, Sales No.E.98.XVII.8), para. 1.116.

(d) Format of census forms

The choice of format for the form will be influenced by the enumeration method. Census forms can be household forms or individual personal forms. A household form can be arranged as a matrix providing for answers from all members of an average-sized household on each page. Another approach to the design of household forms is the use of a booklet, with all of the personal questions asked first for person 1, then repeated for other persons in the household. Annex VII includes different types of census forms. The form used in the Argentinian census of 1991 is an example of a questionnaire designed as a booklet. The census form used in Botswana in 1991 is an example of a questionnaire arranged in a box format. The form used in South Africa in 1996 is an example of a column format. The examples of the census forms used in Uruguay and in New Zealand are included to highlight the differing requirements for automated data capture. Uruguay is an example of a system that relies on optical character recognition and New Zealand represents a system that relies on optical mark recognition.

3. Form testing

It is likely that as the census form is developed it will undergo several changes as its performance is tested and evaluated. Many countries concentrate their testing programme on new topics or questions, but it is also important to test the impact that these new questions may have on other questions on the form.

The principles of good form development are:

- (a)* Always evaluate the performance of a form before changes are made;
- (b)* If necessary, change the form to improve its performance;
- (c)* Always evaluate the form after changes are made to find out if its performance has improved.

The evaluation of tests provides the basis for good form design. However, there is no single best procedure for evaluating forms. Each procedure will provide a slightly different view of a form's performance. For example, three procedures that can be adopted are the following:

- (a)* An analysis of errors. This will provide data on the most obvious errors that respondents make, but does not explain why the errors occur;
- (b)* Cognitive testing. During this procedure, respondents are observed completing the form;
- (c)* Analysing the quality and level of detail given in response to particular questions on the form.

Using these procedures will give an overall picture of the form's performance, with each particular procedure giving a distinctive, though incomplete, picture of the relationship between the form and the respondents.

(a) Analysis of errors

An analysis of errors consists of counting and tabulating the number and type of errors that have occurred on a sample of forms during field tests or from the previous census.

The purposes of an analysis of errors are the following:

- (a)* To find out what errors are occurring on a form;
- (b)* To provide a benchmark against which to judge the form's performance;
- (c)* To provide information on which to base modifications of the form which will lead to a reduction in errors;
- (d)* To determine the costs of repairing the errors, both before and after re-design.

An analysis of errors is the most important quantitative measure of a form's performance. It is the basic quantitative benchmark against which the performance of one form can be compared with another. It also provides an estimate of some of the less obvious costs such as:

- (a)* The repair of errors in the processing phase which can be expensive;
- (b)* Respondent burden.

If errors remain unnoticed, they can seriously affect the quality of data; good design can reduce the incidence of errors on forms. However, it is not possible to improve the design of a form if it is not known how the form has performed in the past. Therefore an analysis of errors should always be conducted first before attempting to improve the design of a form. After the form has been improved another analysis of errors should be conducted. A comparison of the before and after results is the best evidence that the form has been improved.

There are many kinds of errors, and they have a variety of different causes for which different remedies are necessary. When conducting an analysis of errors, it is important to distinguish between the different kinds. There are generally three basic types or errors: *(a)* omission, *(b)* commission and *(c)* mistakes.

(i) Omission

Errors of omission occur when respondents fail to answer a question. Respondents may fail to answer a question because they do not notice it, because they deliberately avoid it or because they do not understand it.

Omissions are extremely hard to diagnose in an analysis of errors, partly because they can be due to many reasons. Also, a blank answer space on a form may be perfectly legitimate and not particularly significant in itself. The reasons for these errors have to be analysed in conjunction with other procedures.

(ii) *Commission*

Errors of commission result when respondents give information they were not asked for. They can arise because of a misunderstanding of questions or incorrect assumptions. Commissions are easier to notice than omissions in an analysis of errors, but caution should be exercised in drawing conclusions without the support of results from other investigations. In most cases, unnecessary information is not as expensive to deal with as omissions or mistakes. Errors of commission often result from failure to follow routing instructions such as “Go to part...”. While the additional answers provided are not harmful in themselves, the increase in respondent effort and often frustration can have a serious effect on how accurately the remainder of the form is completed.

(iii) *Mistakes*

These result when respondents give incorrect information. There are many reasons why people make mistakes on forms which lead to problems in identifying the causes of this type of error. Moreover, not all mistakes are noticeable. For example, if the question on the form asks respondents to give their income and they give their net income when their gross income was needed, the mistake would go unnoticed unless there was an independent check. However, one of the great advantages of analysing mistakes is that many of them are directly observable and they can provide clues to a form’s performance. Other procedures, such as cognitive testing, can be used to determine the causes of mistakes.

(b) *Cognitive testing*

Cognitive testing can be used as a viable supplement to full-scale field testing. In essence, cognitive testing involves a market research approach to form design testing. Typically, cognitive testing will comprise a mixture of the following:

(a) Focus group research. This is often referred to as “behind the glass testing” where a moderator leads a group of people through a structured discussion;

(b) Observational studies. This is where observers watch respondents complete forms in the environment in which they would normally do this, for example in their home.

As noted elsewhere cognitive studies are relatively expensive. To ensure the studies are directed at the topics of particular interest, an abbreviated form could be prepared. Where necessary, specific demographic groups will be recruited as subjects for cognitive testing. For example, should a topic relating to country of birth be tested, the panel of people for cognitive testing should include a high proportion of immigrants.

Advantages of cognitive testing include the opportunity to closely observe participants in completing the test form. Factors such as the time it takes to read instructions, the order in which questions are answered and the care taken when completing the form can be assessed. The facilitator of the cognitive testing exercise can also involve participants in a discussion during which specific questions can be asked. As a result, form designers are given a greater depth of understanding of how particular questions are interpreted by respondents.

Table II.1. Census from testing programme

Purpose of Test	Time to Census Date
Specific purpose test for proposed new question	3 years
Form design and enumeration procedures	3 years
Specific purpose test for proposed new processing technology	3 years
Specific purpose test for enumeration procedures in remote area	2 years
Major test (or pre-test) of final form design, enumeration and processing systems	2 years
Dress Rehearsal (or pilot test) of enumeration, processing and dissemination systems and procedures	1 year

The Pilot Census

The kind of tests usually carried out first during census preparations are questionnaire tests. Their purpose is to test the suitability of intended census questions, including their formulation and the instructions provided, as well as the suitability of the questionnaire design.

A comprehensive test of all census procedures is often called a pilot census. Essential features of a pilot census coverage of one or more sizeable administrative divisions and encompassment of the preparatory, enumeration and processing stages of a census, by which it thus tests the adequacy of the entire census plan and of the census organization. In order to best serve this purpose, it should be undertaken in conditions resembling the actual enumerations as close as possible. For this reason, it is often taken exactly one year before the planned census so as to conform with the expected seasonal patterns of climate and activity. It is generally unwise to consider the pilot census a source from which to derive usable substantive data. Apart from the sampling problems involved, such a use inevitably detracts from the central purpose of the pilot.

Source: Principles and Recommendations for Population and Housing Censuses, p.21, paras. 1.120-1.121.

Extreme care should be taken when assessing the results of cognitive testing. By necessity, sample sizes are small and problems with form design may not be detected. Conversely, because of the small sample size and specific demographic groups selected, the significance of problems detected may be biased. The fact that testing conditions are not identical to census conditions should be considered.

(c) Analysing the quality and level of detail provided

This is particularly important for open-ended questions such as occupation. How the question is worded will impact on the level of detail given by the respondent. Subsequently, the level of detail given by the respondent will impact on how the response can be coded and, ultimately, on the quality of the output from the census.

Therefore, as part of the testing programme, these questions should be coded to the established classifications to ensure that the level of detail being reported is sufficient for coding purposes.

4. Census tests

The approach to testing will be greatly influenced by the size and diversity of the population, the enumeration method, the processing method and the resources available. It is highly desirable to provide for more than one form design

test to eliminate the need of having to use an untested question in the census itself. Form design is only one of several objectives in testing.

The test programme should be comprehensive enough to test effectively all of the main components of the census. As well as testing the form, the test programme should test any guide or other information booklet, enumeration procedures (including training and administration of temporary census staff) and processing procedures. Ideally, at some stage during the programme each of the major systems to be used in the census should be tested, up to and including the delivery of output.

In general, the earliest tests will focus on form design issues and any of the collection procedures that warrant testing, such as enumeration area design, mapping and enumeration management. Later on in the testing programme, testing should include processing systems and procedures and dissemination systems.

The testing programme should include a final pilot test (or dress rehearsal) well in advance of the census. This is a final test, at which the enumeration, processing and dissemination systems, and the interface between them, are given a final test to resolve any outstanding problems. The form design should not be changed after this final test. This test also provides an opportunity to revise the costing estimates. In order for this to happen, the final form design needs to be available and all systems have to be acceptance tested beforehand.

Table II.2, an example of a testing programme, is a guide to the type and timing of tests that may be conducted in the lead up to a census. The nature of the testing programme for each country will largely depend on the resources available. It will also depend on factors such as the extent of proposed changes to the form, procedures and processing systems.

5. *Methods of testing*

Testing requires some benchmarks against which the trial procedures can be assessed. Often this can be the procedure that was used in the previous census, otherwise it can be some externally determined standard, which it is agreed must be met. It is common to use “split samples”. This is where one part of the test population is subjected to one procedure and another part to a second procedure, with the results analysed to determine which is the better outcome. The split sample approach is ideal for testing form design changes.

For tests to provide reliable results, it is important to design them to reflect as much of the final census environment as possible. Field operations, for example, should resemble census conditions as far as possible. However, using central office staff to do most of the work should be avoided. Assistance provided to respondents in the test should be similar to that available in the census proper. Processing of test data should also replicate census procedures as far as possible.

Recruiting, training and paying the staff necessary to carry out a test of the size necessary to produce worthwhile results is a major exercise, which will incur significant expenses. These expenses should be fully included in the total costing of the census. The importance of adequate testing to ensure successful census outcomes should not be underestimated.

E. INSTRUCTION MANUALS

1. *Introduction*

The present section includes suggested contents for the primary handbooks (or manuals) required for field operations. They are divided into three categories, representing the three levels of field staff used in this handbook. These are:

(a) Enumerators;

(b) Supervisors;

(c) Regional Managers/Deputy Regional Managers (a regional manager cannot supervise between 20 and 35 persons; in many countries, there may be someone in between and thus, quality can be enforced).

Given the hierarchical nature of the census operation, the handbook for each level of staff should supplement the handbook for the level below it. Therefore, the enumerators’ handbook will contain detail appropriate to that level, whereas the supervisors’ handbook assumes that the supervisor is familiar with the content of the enumerators’ handbook. Detail in the supervisors’ handbook provides additional information

about enumerator duties but avoids repeating material already included in the enumerators’ handbook. Therefore, while many headings will be the same between handbooks, the content under those headings will differ in each. The main exceptions would be the timetable and introductory parts, where some repetition is necessary or desirable.

All handbooks (and other manuals and materials) should aim for commonality, wherever possible. This includes consistency of layout, style and imagery (logos, etc.). The use of different colors for covers is recommended to provide easy distinction between topics.

2. *Enumerators’ handbook*

The enumerators’ handbook is, with the exception of the enumerators’ record book, the most important field document. It details the responsibilities and tasks of the Enumerator and should provide sufficient information for an enumerator, after training, to work independently in the field. While the enumerators’ handbook will often be the only reference available in the field, and as such should include sufficient information to cover most eventualities, it should not attempt to cover every eventuality. This may lead to the handbook being too bulky and give enumerators the impression that the job is more difficult than it really is. The aim should be to cover most ordinary situations in some detail and provide guidance on how to deal with unusual situations, should they occur.

The enumerators’ handbook should focus on issues related to census taking and avoid including information about administrative arrangements (such as recruitment and payment), which should be provided separately.

Topics, particularly process-type activities (such as filling in a form) should be covered in bullet (or dot) point form, wherever possible. This will assist in quick referencing, particularly when in the field.

(a) *Timetable*

It is recommended that a timetable of census tasks and activities be included on the inside front cover (or first pages) of all handbooks. This would provide easy referencing throughout the operation.

(b) *Introduction*

The introduction section should describe the census, who takes it and why. It should introduce the goals and objectives of the census, emphasize the importance of the enumerator’s role, explain how to use the handbook and describe the overall operational arrangements. Suggested sections include:

(a) About the statistical agency;

(b) About the census;

(c) Census organization;

(d) How to use the handbook.