# Enumeration Instruments, Applications and Tools

## Introduction

Development of the questionnaires and manuals is among the initial preparatory activities that should be well planned to ensure the census captures the intended quality data to meet the global, regional, and national data requirements. The main tools to be developed include the questionnaires for cartographic mapping, pilot census, the enumeration as well as the Post Enumeration Survey (PES) and their corresponding instructions manuals.

Important to note is that the implications of a poorly designed questionnaire cannot be rectified during and after enumeration thus successful implementation of tools development has a significant impact on the quality of data and census outputs.

### Census tools development during the non-digital vs digital era

A digital census requires additional efforts during the development of tools and instruments. In addition to the traditional paper questionnaire and instructions manual, a digital census will require a modified paper questionnaire to be programmed for CAPI together with an instruction manual. The planning stage should therefore be started earlier than for a paper questionnaire.

For a digital census, the post-enumeration editing is reduced compared to a non-digital census. This is achieved through programming of consistency and data validation checks that are implemented during enumeration by the CAPI application.

For a digital census, the tools development process has additional tasks after finalizing the questionnaire content that go along with the development of the CAPI application. There is an iterative process which involves development of the application, testing it, revising after testing, and then testing the revised version again until the implementors are comfortable with the application. Hence, several small-scale tests are done before and after the pilot census and this makes the tools development process for a digital census more expensive and should be budgeted for appropriately.

Documentation of the development process in a digital census is more detailed compared to the paper questionnaire because data validation checks, and error messages need to be documented so that they can be part of the metadata.

### Considerations for development of digital census tools

The following considerations must be made during the development of digital census tools:

**Extensive stakeholders’ engagement**

Development of the questionnaires must take into consideration the national priorities and the core topics discussed in part four of the UN Principles and Recommendations (UN P&R) for Population and Housing Censuses Rev. 3.

**Massive stakeholder needs**

When taking on stakeholder data needs, consider factors such as respondent fatigue, respondent privacy, time and cost needed. To take care of some of the needs, a short and long questionnaire can be adopted (see details on page 80 in the UN P&R rev3)

**Quality of previous census data**

During tools development, an assessment of the previous census quality of data, enumeration time taken, stakeholder feedback and available resources should be considered to inform the process.

**Timeliness**

It is essential for the census managers to ensure that questionnaire specifications are done in time in close collaborations with the subject matter specialists and the CAPI developers. It is important to note that development of the CAPI application cannot be done until the questionnaire content and specifications have been completed. Adequate time should be provided for programming and multiple tests of the CAPI application.

**Questionnaire versioning**

During the CAPI development process, programmers are required to keep clear versioning of the applications, and this should be done together with the subject matter specialists who should also keep and label the versions appropriately.

## Selected country experiences

**Kenya**'s approach to developing census tools was highly consultative. A secretariat was formed to draft the tools, which were then reviewed by a technical working committee (TWC) and approved by a steering committee. The process incorporated lessons from the 2009 Census and national government commitments. Stakeholder engagement played a key role, with requests reviewed and approved by the TWC. The questionnaire development followed a structured process: identifying user needs, pretesting, piloting, and finalization. After finalizing the paper version, the questionnaire was digitized with skip patterns and prefilled fields. Benchmarking with other African countries and support from the US Census Bureau helped refine the tools. The questionnaire was translated into Kiswahili, and various manuals were created for training and fieldwork. A CAPI manual and an in-app help feature supported enumerators during data collection.

For cartographic mapping, Kenya developed a comprehensive set of forms and manuals for each phase. These included rural and urban household listing forms, administrative area listings, and templates for map production. Tools like the EA

digitization schema ensured consistency in geographic data. Verification forms helped identify mapping issues, administrative disputes, and newly gazetted units.

During enumeration, Kenya used five questionnaires: a main one and four short forms for specific populations (emigrants, travelers, street persons, and institutional populations). A hybrid questionnaire was also used, focusing on individual characteristics.

**Namibia** began its tool development by reviewing past census questionnaires and aligning with the UN Principles and Recommendations (P&R) for Population and Housing Censuses. Consultations with stakeholders and the NSA census team helped identify relevant questions, while others were excluded for contextual relevance. New modules, like the Washington Group short set on disability, required further in-country consultation. After content approval, the electronic data collection application was developed, with multiple field and pilot tests conducted. The questionnaires were refined during Master and Trainer of Trainer sessions, and critical issues identified during the pilot were addressed in the CAPI application.

For enumeration, Namibia developed three main tools: the main census questionnaire (Form A), two additional forms for institutional and special populations, and an instructional manual.

**Botswana**’s census tool development was led internally by the National Statistical Office (NSO), with support from the US Census Bureau. Statisticians created the paper questionnaire and edit specifications, which guided the development of the electronic data collection application. A multidisciplinary team—including statisticians, cartographers, developers, and data entry supervisors—was responsible for testing the application and documenting results after system tests.

Link to case studies section

The country practices outlined below in as much as possible followed the principles and recommendations for development of a digital census questionnaire. The US Census Bureau provided support to some countries to develop the electronic data collection application.

**Kenya**

Both the cartographic mapping tools and the census enumeration tools were developed through a consultative process. A secretariat was established which drafted the tools which were later reviewed by the established technical working committee (TWC) which had membership from various institutions. The tools were approved by the Steering committee that was at the apex of the management of the 2019 Census. During drafting of the tools, the secretariat reviewed the recommendations from the 2009 Census and the various commitments of the national government. During the stakeholders’ engagement several requests were made, and a review of the requests was done by the TWC, and approvals given where necessary.

The questionnaires underwent various processes and tests before finalization and approval. The broad stages included determination of user needs and data gaps, development of the questionnaires, pretesting, piloting, readjustment, and finalization.

After finalization of the paper questionnaires, the questionnaires were modified and skip patterns included for programming. Some of the fields that were traditionally filled during enumeration were prefilled in the data collection application, e.g., part of the identification panel.

It was important to benchmark other countries and institutions, especially those within Africa that had conducted a census using handheld devices. Countries that were in the final planning stages of planning for their censuses were also considered. This provided useful insight on how to plan for the census. The US Census Bureau also provided some technical support in the finalization of the data collection application. The questionnaires were translated to one local language- Kiswahili.

Various manuals and guides were developed to ensure consistency in training and execution of duties at all levels. These included a training guide to assist in the training of trainers, a supervisors’ manual that outlined the roles and responsibilities of both content and ICT supervisors, and lastly an enumerators’ training manual which acted as a reference guide for all persons undertaking the census.

The CAPI manual was uploaded into the mobile devices for easy access. An in-app self-help button was also available in the application, enumerators would use this tool for any clarification they needed during an interview.

During cartographic mapping, various forms, manuals, and templates were developed for use during each of the phases of cartographic mapping to ensure consistency and quality data.

Prior to the field mapping, the following forms were developed and used:

* Form F-54-5-1A- Rural household and homestead listing form for village elders to capture homesteads and households’ information within their villages.
* Form F-54-5-7 that was used to fill names and contact details of the chief and assistant chiefs and number of villages within their area.
* A sensitization manual that was used to guide those sensitizing the NGAOS in different parts of the country.

During field mapping, several forms were developed used:

* Form F-54-5-1B- Rural homestead and household listing form for mapping assistants.
* Form F-54-5-2- Urban structure and household listing form
* Form F-54-5-3- Villages and EA summary form.
* Form F-54-5-4- List of Administrative Areas and their Codes.

During map production, various tools and instruments were developed and used:

* A map production manual which detailed processes and steps to be used by the GIS technicians to produce maps,
* An EA and Sub-Location Map templatethat was used to help produce standardized maps.
* An EA digitization Schemathat was used to ensure uniform county geo-files are created for ease of merging when creating the country geo-file. It contained all fields required in the geo file.

During EA map verification various forms were developed to assist the team to confirm whether the maps and geo-files reflected the actual picture on the ground. The following forms were developed and used:

* Form F-54-5-9 that indicated the nature of problem identified on the map and geo-file.
* Form F-54-5-12 indicated administrative units with disputes and fragmented area and the causes of the disputes and fragmentation.
* Form F-54-5-13 that was used to document newly gazetted administrative units that came up after the cartographic mapping was completed in each county.

Five questionnaires were developed to enumerate various populations in Kenya, for both the pilot and actual census enumeration. These were the main questionnaire and four short questionnaires that comprised:

* Emigrants Questionnaire that enumerated persons who had moved out of the country in the last 15 years.
* Travelers and persons on transit questionnaire.
* Street persons/outdoor sleepers/ vagrants, hotels/lodges questionnaire.
* Hospital in-patients and prisons/police cells questionnaire.

There also existed a “hybrid” questionnaire (which was a modification of the main questionnaire and only covered questions on the individual characteristics (p series) of the main questionnaire except questions on relationship, and line number of the mother).

**Namibia**

The tools development process started with review of past census questionnaires to identify which questions have changed or are now being asked differently. This was followed by consultive meetings held with various stakeholders and NSA census management team, and recommendations were made based on the UN P&R for Population and Housing censuses revision 3 handbook to identify core questions which are key for the census enumeration and those that are not applicable to the Namibian context were disregarded. Some new modules (such as the Washington group short set questions for disability measurement) still required buy-in and further consultations in country with organizations of persons with disability.

After approval of the questionnaire content, development of the electronic data collection application was initiated. During development of the applications several field tests and a pilot test were undertaken. The questionnaires were revised by DSS and endorsed by NSA-CMC. The Master and Trainer of Trainer training was also used as an opportunity to refine the questionnaires and data collection manual before the pilot census. Proposed changes were discussed and incorporated into the CAPI application for critical issues that could compromise the quality of the pilot census exercise. Further review of the tools was undertaken after the pilot exercise.

Three questionnaires were developed for the Namibia census including the main census questionnaire (Form A), two additional forms to be used to count populations within residential institutions and special populations and an instructional manual.

**Botswana**

Development of the questionnaires was done internally by the NSO in collaboration with the US Census Bureau to support development of the electronic data collection application. Statisticians developed paper questionnaire including edit specifications (detailing the skip patterns and validations) which were used during the application development. Another team comprising Statisticians, Cartographers, Developers and Data entry supervisors were responsible for testing and documenting the test results after a scheduled system test.

## Lessons learnt

Countries identified some key lessons during the operationalization of the tool’s development process, and these include:

* When there is high demand for inclusion of several questions from various stakeholders this causes delays in the process of completing the development of the questionnaires; therefore, the NSO should be prepared with the UN P&R for population censuses to be able to get solutions and satisfy the users. Otherwise, the enumeration will take longer and is likely to become more costly. For instance, countries that took on too many questions for the cartographic mapping questionnaire experienced delays and failed to achieve the set timelines.
* In a digital census, not all populations will be enumerated using a tablet, therefore, all paper questionnaires should be well formatted and ready for printing when the need arises. For instance, Kenya realized after the pilot census and various pretests that enumeration of persons in hotels and lodges had to be undertaken using hard copy short questionnaires. This was because of the logistical challenge of visiting this population in their rooms, bearing in mind that they had to be enumerated strictly in the morning of the reference night.
* Insufficient time allocated to software development can be disastrous in terms of halfhearted outputs that lead to poor quality data, loss of time and money among others. It is therefore important to give sufficient time to develop and test the census system, the software manager must give the time needed to develop the system. Namibia had to postpone a pilot testing because the time allocated for application development was too short, resulting from a plan that fixed the pilot census dates without due consideration of the time required for development and finalization the questionnaire application.
* The questionnaires and instruction manual if not developed and tested concurrently can lead to delays and disrupted training if they are not yet in tandem. For instance, Namibia realized that they could not proceed with a pilot test because both instructions manuals for questionnaire and application had a lot of changes coming up during the Master training and decision was made to postpone training, go back and redo timelines to allow sufficient time for the tool’s development and testing.

## Recommendations

Based on country experiences, the following recommendations are based for development of digital census tools:

* Ensure that there is an app help function installed on the tablet especially for questions and variables that are harder for enumerators to remember, this allows for a quick reference point.
* Benchmarking with countries that had already undertaken a census using handheld devices was key. Input from other countries largely assisted the finalization of the tools and instruments.
* Questionnaires should be finalized and tested before the training of field personnel starts. This is to guard against having questions in the data collection application that have not been tested. The questionnaire must not be too long, and the questions must be clear.
* The success of the implementation of a paperless census was attributed to numerous pretests, office testing and the pilot census. In addition, the enumerators need to be comfortable with the devices, therefore having dedicated days for field practice using the devices is important. This ensures that enumerators and their supervisors can go through different scenarios but also familiarize themselves with the data collection application.
* Version control, you need to have one version of the software. When multiple people are working on the application, you need to have a central repository where changes are made to the system such as Github. Otherwise, if one software developer maintains the versions, multiple versions of the application may arise and cause confusion. In addition, an inventory of all forms should be kept as this is necessary for future reference and improvement.

## References

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