# Enumeration and Logistics

## Introduction

The enumeration phase is among the most important stages for a population and housing census that happens after several years of preparatory activities. The main objective of enumeration is to ensure that all individuals are covered and enumerated only once to achieve a proper description of the total population of a country and its geographical distribution within the country.

Census enumeration is conducted on either a de facto basis (enumerating individuals where they are found on census day regardless of where they normally reside) or de jure basis (enumerating individuals where they normally reside regardless of where they are found on census day) based on a specific reference date. The enumeration takes place over a varying period of days. In the 2020 round, according to the survey completed at the 2024 Expert Group Meeting of African Census Managers, the number of days planned for enumeration ranged from 7 to 50, with an average of 19 days. However, no country managed to complete their enumeration in the time originally planned, with the average number of 11 additional days being required to complete the enumeration.

A census relies on successful enumeration within a strict time-bound period. To achieve this requires robust logistics planning for effective implementation of all the processes. Census logistics broadly entails procurement of equipment and materials, provision of devices, transportation, and storage. During procurement, the process of acquisition and storage of the census equipment and materials needs to be planned effectively.

This chapter focuses on the areas of provisioning of tablets, pre-enumeration listing of households, EA identification, and census data collection.

### Enumeration and logistics during the non-digital vs digital era

In the digital era, the traditional method of enumerating the population through face-to-face interviews is done using handheld devices (CAPI) or by self-enumeration online (CAWI). See also [enumeration instruments](#_CHAPTER_FOUR:_Enumeration). This means that the data is automatically captured electronically as opposed to using a paper questionnaire. In turn this means that the data is ready for monitoring progress of the census in real-time; analysis can be started sooner than in a non-digital census; and thus outputs can be produced in a more timely manner.

However, the use of technology introduces the potential for one central disaster having an impact across the whole enumeration process, which is more devastating than in the non-digital census, where failures are more likely to have localized impacts. In addition, the failure of a significant part of the technology close to census day such as the central server can have a more serious impact and therefore a lot more preparation and testing is required compared to the non-digital census.

With regard to census logistics, in a traditional census, large quantities of materials such as field gear for cartographic mapping teams, uniforms for the enumeration team - usually t-shirts or reflector jackets, field bags, umbrellas, printing of manuals, questionnaires, etc. must be procured and delivered to the appropriate locations. In a digital census, there is additionally the procurement of ICT equipment like server, tablets and accessories, sim-cards and bundles etc. Mobile devices are usually delicate and need careful handling during storage, provisioning, and transportation to the field and back to the warehouse for decommissioning. During provisioning and decommissioning a spacious warehousing facility with good racking systems for ease of retrieval will be required.

### Considerations for digital census enumeration and logistics

Countries should develop appropriate enumeration procedures that will ensure that full coverage of the population is attained, within the predetermined budget and set timelines as well as maximizing efficiency and cost-effectiveness. Consider how to achieve the highest response rate and best possible data quality. This will involve publicity campaigns and engagement of local leaders to ensure that they cooperate with the NSO to assist in community acceptance of the census. See also [Chapter 13: Publicity and Advocacy](#_Publicity_and_advocacy).

Consider populations that might be particularly hard to enumerate and how you can reach such populations. Special population groups such as include migrants, nomads, defense forces and persons in restricted areas, homeless persons, diplomats etc may need a specific strategy in place in order to ensure they are included in the census. See [P&R v4](https://unstats.un.org/UNSDWebsite/statcom/session_56/documents/BG-3b-Draft_P&R_4th_Rev-E.pdf) para 3.198 and 3.532.

Also take into consideration the safety of your field staff. If they are working in areas that are hard to reach or are likely to be dangerous, how will you ensure their safety and the security of their equipment?

Consider how best to use dashboards for effective real-time monitoring of the data collections process, and of the quality of the data being collected. This will require effective HQ/coordinator/supervisor/field-staff working arrangements. See also [dashboards](#_Real-time_Monitoring_with) and [data quality monitoring](#_Chapter_TEN:_Quality).

Good training and guidelines for the enumerators are essential so that the data gathered is consistent and of a high quality. See also [training](#_CHAPTER_SEVEN:_Recruitment). In particular, consider whether the census is de facto or de jura and then give enumerators clear instructions about all possible cases that may create confusion when identifying the correct place of enumeration. Good training will help to ensure that every individual has only one place of enumeration and thus avoid double counting. There should also be clear guidelines on who should be included or excluded from the enumeration. See [Field enumeration, Handbook on the Management of Population and Housing Censuses](https://unstats.un.org/unsd/publication/seriesf/series_f83rev2en.pdf).

Remember that the enumeration exercise should observe the fundamental principles of official statistics, and specifically should ensure confidentiality of census data among the enumerators. See also [data security](#_Data_Security). Furthermore, the census enumeration procedures should be complied with and remain consistent across all the regions of the country.

With regards to logistics, census implementing agencies should consider collaborating with other government institutions that can support in providing logistics arrangements such as transportation, use of existing infrastructure like school classrooms for training, warehousing services for storage of census materials at both national and sub-national level etc.

In device provisioning, a key consideration should be to think through what needs to happen to the devices to make them ready for field work. Usually, this will include but is not limited to, installing the CAPI and its runner application, loading the assigned EA maps, loading instruction manuals (usually pdfs) on CAPI and device use installing required applications such as map viewer/navigator, pdf reader, etc.

Consider which of the core and non-core census activities may need to be contracted out as a way of increasing efficiency where methods and technologies are not available internally. Ensure proper understanding and management of elements that contribute to final data quality and maintain confidentiality when contracting out census activities.

Consider setting up a census logistics committee with responsibility for planning and implementation of all of the logistical activities and process. Census logistics requires timely completion of a census implementation plan and careful linking of the different activities of the census phases. See also [census implementation committees](#_Census_Implementation_Committees).

Early planning for procurement of all the census materials and equipment is key to the success of census implementation. However, this is also dependent on availability of financial resources. There also need to be plans in place for the secure transportation and storage of the tablets for the enumerators. Consider how many of each item will need to be transported and stored and the availability of suitable secure storage facilities before dispatching equipment to the field.

Finally, consider the processes to be used for documenting the experiences and lessons learned to inform the next round of census. Any major gaps that occurred in the previous census enumeration should be addressed to ensure a relatively higher coverage rate

## Key Implementation areas for enumeration and logistics in a digital census

### Provisioning of Devices

Census tablet provisioning is basically “*getting the tablets from factory state to enumeration readiness*”. It involves loading each tablet with all the necessary resources that it requires to be used by enumerators to collect and transmit data from the field. The resources to upload on the tablets include mobile apps required for the enumeration (such as CSEntry), data files (such as questionnaires, user manuals, navigable maps). Resources such as maps are specific to an area, each tablet might have to receive different maps.

To help with the distribution of customized data to each tablet, consider first assigning unique identifiers to each tablet then use those on a computer system to “assign” each tablet to a respective area (Enumeration Area). The provisioning process would then have to look up assignments and deploy the respective payload for each tablet.

UNECA developed an end-to-end provisioning system which is made up of a back-end system, mobile apps for copying data and quality control, and a tablet decommissioning system that will reset all tablets to factory state once the census exercise is over. This technology has been used in the 2020 Round in various countries including: Egypt, Kenya, Sierra Leone, Ghana, Seychelles, Zimbabwe, and Mauritius.

The provisioning process can be summarized and demonstrated as shown in figure 8.1 below.

**Figure 8.1: Process of provisioning tablets**

A diagram of a diagram of a person

Description automatically generated

Some advantages of the automated provisioning process include:

* Minimizes possible human error that would arise from doing this manually in a monotonous manner.
* Saves on financial and human resource costs, the system for provisioning of tablets works over Wi-Fi and requires little human intervention.
* Capability of provisioning multiple tablets at once thereby cutting down on the time it takes to get the tablets ready.

Depending on the Android version installed on devices, there are alternate methods of provisioning devices such as by directly connecting multiple devices to computers/laptops via USB ports and then using UNECA’s provisioning script to “send” the requisite files to the respective devices. This method, in general, will take more time and perhaps more resources (in the form of computers) but also requires less infrastructure setup and is also the only alternative for devices running Android version greater than 10.

### Pre-enumeration listing of households.

The cartographic mapping undertaken prior to enumeration provides the number of EAs and management areas, estimated number of households and population as well as information about problem areas for planning purposes (see [cartographic mapping](#_CHAPTER_THREE:_Geospatial)). Just before the enumeration period, a household listing may be undertaken to get a more accurate estimate of the number of households in each EA as a way of quality control to measure coverage. This pre-enumeration household listing should be carried out immediately after the training of enumerators and before the start of enumeration. An ideal EA should be conversed by an enumerator within one day during the pre-enumeration household listing exercise. The listing exercise should preferably capture the GPS coordinate of the households, name of household head, number of usual members of the given household among other variables.

The objectives of pre-enumeration household listing exercise include:

● Aid in evaluating the expected workload during the planned days of enumeration

● Aid in monitoring the level of coverage as enumeration progresses

● Give a snapshot of the expected population

● Gauge the effectiveness of data transmission to the server

### EA identification

Most of the censuses in Africa during the 2020 PHC round used geospatial data during enumeration. Maps showing EAs provide a means to ensure full coverage of the census and support supervision of enumeration activities. During the census, maps assist enumerators to easily identify their assigned EAs. EA identification is the process of establishing census enumeration unit boundaries.

In the digital era, high resolution maps of the respective areas of work are uploaded on enumerators and supervisor’s tablets using various software that are compatible with the data collection application. The handheld devices therefore contain EA maps with addresses detailing assignments for geo tracking to ensure complete coverage of an EA as well as satellite imagery for housing unit identification.

The objectives of using maps during enumeration is to:

* Ensure that correct EAs are identified and locate the structures and households.
* Ensure there is completeness of enumeration coverage.
* Aid the enumerator to move systematically within the EA.
* Assist supervisors to allocate work, monitor progress and supervise the enumerators.

### Census Data Collection

In the 2020 PHC round, a few African countries started to explore multimodal enumeration methods such as face-to-face interview with an electronic questionnaire, telephone interview, self-enumeration with a paper questionnaire collected by enumerators, self-enumeration with a paper questionnaire returned by mail, self-enumeration via the Internet, register-based enumeration, and use of pre-existing administrative records. These data collection approaches can either substitute or complement the traditional face-to-face or used in combination (multi-mode method).

During data collection, the following should be in place:

* A hierarchical field organization structure, the central level being responsible for monitoring the enumeration of the entire country, the regional level focusing on preparing and conducting the data collection process, the local level mainly to provide census enumerators and their immediate supervisors within their operational area during the enumeration. The local level should have IT-related skills.
* A real time online monitoring tool for successful field enumeration, it is desirable to transfer data immediately after completing the enumeration of each household. This tool can be set up at the regional level to complement the national system. UNECA has provided support to countries in this area through field monitoring dashboards, issue trackers and set up of call centers. See also [Deployment and supervision of field personnel](#_Deployment_and_Supervision).
* A well-documented data transmission plan to support enumeration efforts. See also [Data capture, transmission and management](#_Data_Capture,_Transmission).

## Selected Country Experiences

**Kenya** implemented a highly automated and streamlined census process in 2019, minimizing human interaction through the use of mobile devices and a self-contained network that did not require internet connectivity. The enumeration was conducted using a de facto approach, counting individuals based on their location on the census reference night. Special populations such as travelers, prisoners, and hospital inpatients were enumerated using short or hybrid questionnaires, often by personnel from those institutions. Data was transmitted to a central server, or via Bluetooth when internet access was unavailable. Pre-enumeration involved listing households and assigning unique structure and household numbers, which were marked visibly on buildings. Enumerators used both digital and hard copy maps to identify enumeration areas, with urban areas relying more on hard copies due to file size and clarity issues.

The logistics of the census were extensive, involving thousands of vehicles, including boats and helicopters, to reach remote areas. Materials such as tablets, power banks, and identification badges were centrally procured and distributed through a detailed delivery plan. Local universities assembled the mobile devices, which were stored in secure facilities guarded by police. The return of materials followed a structured process, with devices logged into a database for future use. The logistics team, including coordinators and casual workers, managed the entire operation from preparation to the return of equipment.

**South Africa** conducted its 2022 census using a fully digital, de facto approach, offering three modes of participation: face-to-face interviews (CAPI), online self-enumeration (CAWI), and telephone interviews (CATI). This multi-modal strategy allowed flexibility and increased accessibility, especially for populations in transit or in institutions. The CAWI method gained popularity as users found it quick and easy, prompting a surge in registrations. The online form was accessible via smartphones or computers and was data-free for the user, making it more inclusive. The census emphasized user convenience and efficiency, with the process taking between ten to forty-five minutes depending on household size.

**Tanzania** faced the challenge of provisioning 205,000 tablets for its 2022 census. To address this, the country developed a custom provisioning tool using open-source technology, which significantly improved efficiency by automating software installation, security settings, and data collection. This system allowed each workstation to provision ten tablets in two minutes, saving 90% of person-hours compared to other methods. The logistics committee, formed from various government bodies, managed the distribution and return of equipment. Transportation was handled by government and private entities, including a logistics company that volunteered its services. Around 1,800 vehicles, along with boats, motorcycles, and helicopters, were used to reach all areas. Materials transported included training manuals, power banks, identification badges, and publicity materials, ensuring comprehensive support for the census operation.

Link to case studies in separate section

**Kenya**

The provisioning process was highly automated and required minimal human interaction. A network was set up to connect all the various hardware together so that the provisioning process can take place in a scalable and reliable manner. The network was relatively simple and self-contained and did not require Internet connectivity. After provisioning of the tablets, quality assurance was done to check if the provisioned tablets were ready for enumeration in the field again this was highly automated and required minimal human interaction such as pressing the volume button.

The 2019 KPHC adopted a de facto approach where all persons within the boundaries of Kenya were enumerated based on where they spent the census reference night (24th/25th August 2019) and continued for seven days up to 31st August 2019. A mop up exercise was conducted for two days (1st and 2nd September 2019) to ensure that all persons were enumerated. Data was collected through the canvasser method and captured using mobile devices (tablets).

Whereas the enumeration of the population living in conventional households continued throughout the census week, enumeration of special population (travelers, vagrants/outdoor sleepers, hotels, prison inmates, remand homes, police cells, hospital inpatients, and children’s homes) was strictly done on the census night using short questionnaires; while enumeration in the special areas such as army barracks, GSU camps, police lines, prisons, NYS camps, monasteries and convents was done by enumerators drawn from those institutions using hybrid questionnaires. Dignitaries and other VIPs were mainly enumerated within the first two days. After each household was enumerated, the enumerator added letter “E” on the structure and household number earlier written during pre-enumeration household listing on doors to indicate that the household had been enumerated (e.g., S015/030/E).

The collected data was sent to the central server by enumerators after completion of every household or several households depending on the availability of internet connectivity. Coordinators, ICT, and content supervisors supported by County and Sub County census committee members coordinated and supervised the exercise. In the event of a tablet’s failure to send the data to the server, the enumerators shared their data via Bluetooth with their respective content supervisors, who eventually sent it to the server.

Pre-enumeration listing of households involved visiting, identifying, and listing all the households within the EA. It was undertaken for two days on 22nd and 23rd August 2019 immediately after concluding EA identification. In the households, enumerators informed the respondents that the listing would be followed by actual census enumeration, starting on the night of the 24th /25th August 2019. Households missed during pre-enumeration household listing were covered, along with the actual enumeration. The actual implementation involved using an uploaded pre-enumeration household listing questionnaire in the CAPI, the enumerator captured the following variables: GPS Coordinates of the main structure of the respective household; Structure number; Household number; Name of household head; Total number of usual members in the household (de jure).

The inbuilt application automatically generated structure and household numbers that started with an S. The enumerators used these numbers to generate a three-digit number for the structure, then a slash followed by a three-digit number for the household. For example, if the structure number was fifteen, and household number was thirty, the enumerator wrote the generated as S015/030. All the structures in the EAs were numbered in a systematic manner to avoid omissions or duplications. The enumerator either used chalk, felt pen and/or card to number all the structures somewhere conspicuous but where it could not be easily tampered with.

The enumerators got the opportunity to know and create rapport with the village elders and potential respondents. This also helped them to identify dignitaries, VIPs and any institutions or non-conventional households within the EA. It is during this period that the special area enumerators assigned to cover non-conventional households’ such as travelers, vagrants/outdoor sleepers, hotels, army camps/barracks, GSU camps, prisons, KWS camps, remand homes, police cells, hospitals, children’s homes, convents, and monasteries identified the location of the areas assigned.

An enumerator was assigned an EA and was required to be accompanied by a village elder. With the guidance of the assistant chiefs and the village elders, the enumerators used the EA maps to identify their enumeration areas. Both hard and soft copy digital EA maps were produced for census enumeration purposes. Two soft copy pdf maps, one for the sub-location and the other for the EA were uploaded into the tablets for rural areas only. For urban areas such as Nairobi, Mombasa and Kisumu cities, hard copy maps were used because soft copy maps were too huge for uploading and lacked clarity. Thus, both soft and hard copy maps of an EA were used for the identification of the EAs.

Many vehicles were used to facilitate implementation of all the census activities. The vehicles included the KNBS fleet and mobilized vehicles through hiring; borrowing from other government departments and ministries; use of alternative transport such as boats and motorbikes; and use of flights/helicopters in difficult terrain and insecure places. During the actual enumeration stage, about 4,500 vehicles were used. Fueling and maintenance of the vehicles during pilot cartographic mapping was done by the transport section at the headquarters by allocation of specific fuel cards. While during enumeration, fueling and maintenance was done at approved petrol stations and garages.

During the pre-enumeration phase, the materials included: T-shirts, fliers, notebooks, field bags, identification badges, dustless chalks, felt pens, umbrellas, field boots, and tablets among others. These materials were issued to the team leaders centrally who in turn distributed them to their team members. The publicity materials included brochures and posters. The recruitment materials included printed forms for recording applicant’s details, counter books that acted as a register for applicants. The training materials included manuals, notebooks, marker pens, pens, chalks, tablets, and power banks/solar chargers. The enumeration materials included tablets, bags, ID badges, power banks, solar chargers, torches with batteries, reflector jackets, and cards (structure numbering, call back and travelers). The census logistics team prepared and effected a delivery plan of the procured materials. The materials were either procured centrally at KNBS headquarters or at the counties. The team also developed issuance forms and guidelines on handling, storage, and issuance.

The mobile devices were assembled by two local universities namely, Jomo Kenyatta University of Agriculture and Technology and Moi University. The mobile devices were delivered directly by the universities to the storage facilities in the counties. The tablets for use by ICT Supervisors were delivered directly to counties that had venues for the ICT Supervisors training. The other tablets and power banks/ solar chargers were distributed to the county storage facilities.

All counties had been guided to identify appropriate storage facilities at the county level. The Bureau requested and was granted use of storage containers from the Ministry of Energy. The containers were referred to as “Gas Yetu Containers” and were initially used by the Ministry to distribute LPG and were available up to sub county level. Other storage facilities included KNBS offices and county commissioner offices. Armed security, through Kenya Police Service, were deployed to guard the premises when census materials were within the counties.

Dispatch of the census materials was done using various modes. Lorries and canters from the National Youth Service and Special Programs department were used to ferry materials to various regions. Courier services were used to send materials which were urgently needed to the counties. Helicopters from the department of defense airlifted material to the far counties. At the county level, the CSOs with assistance of the county lead coordinators distributed materials to the personnel. Most of the materials were distributed at the various training centers where the ICT and content supervisors handled the distribution.

Guidelines were developed on return of the census materials from the counties. The materials that census personnel were to return included tablets, power banks, solar chargers, maps, ID Badges, questionnaires, and notebooks. The enumerators submitted their materials to their content supervisors then the content supervisors submitted them to the ICT supervisor who in turn returned them to the CSO. The mobile devices (tablets, solar chargers, and power banks) were returned to the main storage facility at KNBS headquarters. A delivery plan had the first devices received at the main storage facility on 9th September 2019 and the last county delivered on 2nd November 2019. The returned devices had their details captured into an MS Access database to ease future retrievals.

The census logistics team was composed of one census coordinator and four logistics officers. The logistics officers were allocated specific counties. Up to 40 logistics casuals were engaged prior to census enumeration and were engaged up to the period when the devices had been received at the KNBS HQs storage.

**South Africa**

STATSA conducted a fully digital census de facto census, i.e. all people in South Africa were counted from where they were on the designated census night (02 February 2022). A multi-modal approach to data collection was used with three alternative methods for households to participate -Computer Assisted Personal interview (CAPI) which involved face-to-face interviews with a census fieldworker who visited households and collected data from populations in transit/travelling, homeless and Special Dwelling Institutions (Hotels, B&B, guest houses, hospitals, police and military barracks, Prisons and boarding schools, nursing homes, etc.). Computer Assisted Web Interview (CAWI) were used to enable the respondent to complete the census questionnaire online after registering. Computer Assisted Telephonic Interview (CATI) was also used, where the respondent completed the census questionnaire telephonically with the assistance of a STATSA official.

Household registrations increased significantly in the days preceding the original close of registration which coincided with the first week of enumeration, Stats SA official’s quote on the advantages of CAWI. “It appears that once households realized how quick and easy it is to complete the online Census form, word got around prompting the spike in registrations. There have been numerous requests to the call Centre for us to reopen registration. The online form can be completed on a computer or smartphone and is data free to the user. Stats SA says the form is simple to complete and will take about ten to 45 minutes, depending on the size of the household.”

**Tanzania**

Tanzania’s 2022 census required the provisioning of 205,000 tablets for enumerators, IT supervisors, and content supervisors. The task involved preparing the tablets with the necessary software (CAPI application), data files (questionnaires, maps), and security settings before deployment to the field. Tanzania developed a custom provisioning tool, leveraging open-source technology. The system comprised 25-30 workstations, each with a computer connected to multiple tablets via USB hubs. The custom tool automated the installation of applications, files, security protocols, and collection of tablet information. The custom tool significantly increased provisioning speed, provisioning 10 tablets in 2 minutes at each workstation. It led to 90% savings in person-hours compared to available alternative solutions. The automated system enhanced quality control and monitoring of the provisioning process. The system automated the setting of security protocols on the devices. Logs of the operation on each workstation were synced to a local server for monitoring and quality control. The initial challenge was achieving the target provisioning rate of all 205,000 tablets within seven days. This was overcome by developing the custom tool, which was tailored to Tanzania’s specific needs and resources. Tanzania intends to use a similar approach in future censuses, with potential advancements.

The logistics committee for the 2022 PHC was created on June 20, 2022 with members from various Government Ministries, Departments and Institutions. Along with other duties, the committee was responsible for distributing the Census equipment during the second and third level training period and during enumeration throughout the country in parallel with returning the equipment which were supposed to be returned to the NBS Headquarters immediately after completion of the census exercise.

The logistics committee transported the Census materials using trucks and vans from NBS, Prime Minister's Office, Tanzania National Army and National Electoral Commission. Also, the Postal Corporation Office was involved in transporting equipment, especially the tablets in order to ensure such equipment are available in field on time.

As one of the successes of publicity and awareness raised by the government, one of the private transportation company namely “TUTUME logistic company” volunteered to transport the census equipment for free as part of their contribution to the Government.

Approximately 1,800 vehicles were used during the enumeration exercise. Vehicles used in census activities includes office vehicles and vehicles borrowed from other government institutions. Alternative modes of transportation, such as boats and motorcycles, were used in difficult and risky areas during the actual census exercise. Fuel and maintenance of office and non-office vehicles was covered in the census budget.

Helicopter from the Tanzanian People's Army was also used in transporting equipment, especially tablets and Light Reflectors which were used as a uniform to the enumerators during the census exercise.

Materials and equipment transported includes the

• Publicity materials such as brochures and posters, together with printed equipment handover forms.

• The training materials such as census manuals, power banks, plastic bags, brochures, notebooks, identification badges, chalk, pens and cards (for building enumeration, callback, and travellers’ cards).

## Challenges and Lessons Learnt

* In Kenya it was noted that there was inadequate publicity for the two days’ pre-enumeration listing of households. Although, the teams were accompanied to the households by village elders who introduced them to the households. This could cause confusion in the community by households thinking that this is the actual enumeration coupled with the earlier mapping exercise that may have visited the same household head.
* Large EAs took a long time to navigate for pre-enumeration and led to fatigue among the enumerators ahead of the actual census enumeration. The EA demarcation should also consider the time considerations required for pre-enumeration household listing.
* Weak GPS signals in forested areas, around tall buildings and ASAL areas affected the accuracy of the readings. Kenya had no mitigation measure to this but in future a system that uses tapped coordinates can be employed to ensure complete and accurate GPS readings.
* Enumerators experienced difficulties with the EA maps such as in identifying EA boundaries in some urban areas while in other areas, EAs along county boundaries overlapped. The enumerators were supported by the local leaders to allay the problem.
* In some instances, the application on the tablets could not read maps in PDF format implying the system was not interactive. In such cases, hard copy maps were required yet the teams also experience delays in delivery of printed maps to the field. Hence forcing enumerators to use the uploaded EA maps with their inherent challenges. This predisposes coverage concerns.

In relation to logistics, the following was noted:

* The late constitution of census logistics team to handle tasks during enumeration led to hurried development and implementation of activities which lead to gross errors and mistakes. For instance, in Kenya, the census logistics team was constituted and officially started work after three days of its constitution. The inspection and evaluation committee for mobile devices was also constituted late and most of the members had no prior experience in undertaking the task.
* As a result of the absence or late establishment of a logistics team, several logistical issues generally get disorganized. Again, giving an example of Kenya, the Bureau had not identified a warehouse or storage facility at the headquarters in time; most suppliers of the procured materials delivered the materials late in unplanned phases and yet the quantities were voluminous and weighty which required a lot of time and energy to load. This brought a challenge with further downward distribution of materials to the training centers and enumeration areas, catalyzed by low staffing at the county and sub-county.
* The available fleet management can also pose challenges to the smooth running of the enumeration which in turn leads to concerns about the data quality in instances when a central team must physically respond to a problem. In Kenya, the following would have been avoided if logistics management had been prioritized early during the census planning - delays in acquiring additional fleet when initial fleet proved was insufficient, coupled with frequent breakdowns of vehicles especially during rainy season and in areas with bad terrain. As well as a lack of established petrol stations and garages in some counties that could not issue electronic tax receipts which presented accountability issues that can affect implementation of work.
* Arising from the limited availability of government vehicles to cover a census in most African countries, the use of non-government vehicles with private non-field-based drivers comes with their limited appreciation of field procedures and understanding of documentation as per the government guidelines. This poses a challenge in executing field work easily.
* Digital enumeration was affected by gadget related concerns such as:
  + Failure in real time data transmission to the central server arising from poor network connectivity,
  + Failure to update and data sharing between the enumerators and content supervisors affected by blockage of the application and late introduction of Mobile Device Management software.
  + Interference and slowing down of the enumeration process because for some devices, sim cards kept popping out. (Case in Kenya)
  + Continuous updating of the census software posed some challenges and the system stabilized after installation of Census live. (Case in Kenya)
* Logistical challenges may affect enumeration if not handled appropriately such as:
  + Inadequate transport for ICT Supervisors, administrators, and census committee members hampered effective monitoring during enumeration.
  + Having few people with knowledge of troubleshooting the CAPI application during enumeration.
  + Need to have more than one enumerator assigned to an EA with over 150 households can arise and if managed can cause major challenges to the enumerators and supervisors to cover.
* Some respondent refusals may arise during enumeration for instance in Kenya, the “Kavonokia” Sect members in Kitui and Tharaka Nithi counties refused to be enumerated. At the same time, there may be respondents reporting not to have been enumerated during and after the enumeration period.

## Recommendations

* It is recommended that the pre-enumeration listing of households is done soon after the training and completed the day before enumeration starts and should have the community well informed. It should be done electronically for quick results.
* It was noted that although it is a digital census, the hard copy map print outs may need to be available to the enumerators depending on the circumstances and findings from the pilot census. Therefore, a budget for printing maps should be put into consideration especially for urban areas.
* The cartographic mapping process should be done well in advance of the enumeration and the pilot census should target the likely boundary problematic areas and test the map reading application thoroughly so that a uniform solution is achieved before the census enumeration is carried out.

In terms of logistics management before, during and after enumeration, it is recommended:

* For integrated logistics, a comprehensive logistics plan is needed for the secure distribution of the data collection devices (tablets, phones etc) to every enumerator across the country and a reverse logistics plan for their collection post-enumeration.
* To effectively manage census logistics, there should be strong partnerships and collaboration both within and out of the country. For instance, in Kenya, other government departments with good infrastructure assisted in movement of materials such as the disciplined forces (Army and police) for provision of transport and security. This collaboration can also continue for future censuses.
* The constitution of a census logistics team is good practice but should be done early in the census planning cycle, at least one year to census enumeration and the team should be part of the [pilot census](#_5.1_￼Key_areas). The operations at the sub-national level should be given attention in terms of staffing and training on logistical operations.
* It is ideal to have a separate warehouse that should be ready at least three months before census enumeration. The material handling should be computerized and integrated into Enterprise Resource Planning systems. However, to minimize costs and in the event of a lack of proper planning, the logistics team should be in a position to improvise within the available resources. For instance, Kenya did not have proper storage space at the national level, and it utilized the unfinished office space that was to be used by library at KNBS HQ as storage space and logistics operation center. Other offices within KNBS HQ were also used as storage facilities.
* The required fleet should be planned for and acquired in good time. Petrol stations should be identified and fueling mechanisms should be established to take care of refueling in all areas of the country.

Based on the country experiences and lessons learnt from the data collection processes, countries should develop a risk management plan for the enumeration phase, and the following recommendations are made:

* In case of failure of some gadgets to send data to the server, there should be a clear strategy on alternative ways of how data can be sent such as: utilizing blue tooth sharing with supervisors or manually extracting data from the tablets. although the latter has a risk of total loss in case the tablet is lost. The ICT programmers come in handy for possible solutions and should always be available in sufficient numbers as well as the local administrators who can arbitrate in case of respondent refusals.
* A toll-free line provided to the public to make calls to the census call centre at headquarters should be in place to easy communication between the office and the community during enumeration.
* For refusals in enumeration, be clear about the mandatory nature of the census, about why it's important to be counted etc – use a mixture of convincing messaging and legal aspects.

## References

1. UN Principles and Recommendations for population and housing Census. Revision 4. <https://unstats.un.org/unsd/publication/SeriesM/Series_M67Rev4en.pdf>
2. [Handbook on the Management of Population and Housing Censuses](https://unstats.un.org/unsd/publication/seriesf/series_f83rev2en.pdf).