Modern Technologies in Omani Censuses

Dr.Khalifa bin Abdullah bin Hamed Al Barwani
Director General of Social Statistics
National Centre For Statistics and Information
Muscat-Sultanate of Oman
kbarwani@ncsi.gov.om

Abstract

Making progress in organizing and implementing large statistical process such as population census is not only dependent on the possibility of providing hardware and modern techniques for it, but also in the ability of statistics offices to take advantage of the technical possibilities for those devices and technologies. For example, computers are today accessible to the people who are responsible for conducting censuses anywhere in the world, but investing and employing their capabilities to serve the various aspects of the census program is more important. It is clear that involving information and communication technologies in implementing the phases of census operations will lead to time efficiency in all processes, cost reductions, better data quality, consistency and validity, and control over field work. This in turn leads to improvements in the management of the whole census process on a macro and micro level, as well as better communication and collaboration.

The paper sheds light on the efforts to utilize the advancement of information and communication technologies (ICT) in conducting population and establishment census in Sultanate of Oman (Oman). The paper gives a short introduction about Oman, then a quick brief about Census ١٩٩٣ and Census ٢٠٠٣. After that, it will describe the different technologies used in the latest Census ٢٠١٠. Finally, the paper will present some recommendations to be considered while utilizing ICT in implementing any statistical process in general and census in particular.

Keywords : Technologies, Census , Population , GIS , CATI, PDA.

Introduction:

The General Census of Population, Housing and Establishments (٢٠١٠) was abounding with many processes and methodologies which were different from those used in Population Census (٢٠٠٣). While some of these processes were considered as mere development and improvement of previous ones, others were considered as completely new.

However, it will not be possible at this juncture to review all new methodologies used in the ٢٠١٠ censes, since they were numerous and diversified and related to the different organizational, technical and procedural aspects. Nevertheless, the most prominent features of this census as compared to the previous one are represented in the dependence**,** to a great extent**,** on the modern technologies and methods at the different implementation phases and steps which could be considered as a qualitative development in the planning, organizing and managing the different activities.

The contents of this paper would be confined to the review of the modern ways and methodologies applied in the Omani Population Census program (٢٠١٠). It must be clear from the beginning that highlighting this subject should not mean the downgrading of the previous census in terms of its adoption of modern methods. The personnel responsible of the census have also benefited from available technologies at the time of the census. Additionally, most of the new aspects availed to this census stemmed from lessons and experiences learned from the previous census.

It is also worth noting that review of the modern technologies used by the census was confined to descriptive side only. It is not the purpose of this paper to indulge in evaluating the extent of the success of the use of these technologies, their viability or their impact on total cost of the census.

Automated Applications of PDA

These applications are considered the most complex devices being the forefront of all the applications and main driver of data collection for the whole project, because of the current capability of PDA devices (portable computers) is still limited in terms of memory, storage capacity and dimensions of the screen when compared to laptops. Furthermore, the needs of users at this stage are diversified and overlapping which would necessitate various geographic and statistical controls and technical rules which are required to be programmed in these devices.

The automated applications of the field work based on these PDA devices provide technical tools that assist in its execution with ease. These applications begin with the handing over of geographic and statistical data to data collector from the workstation at supervision center up to his/her return and handing over of the work to the database at the workstation in the supervision center. The applications consist of two parts:

Firstly: The applications pertinent to the identification of population settlements.
Secondly: The applications pertinent to data collection of buildings and their composition in terms of units, families and establishments.
The following tools depict the most important components of these applications incorporated on PDA devices:-

١) Navigation and GPS systems for guiding the field work staff to their areas of work.
٢) Using the geographic location of the building from the digital map loaded on the PDA device as a starting point for opening the screens related to statistical data collection.
٣) Automated roaming between data collection screens in accordance with the controls and statistical technical rules.
٤) Updating the geographical database related to buildings in terms of additions and omissions.
٥) Inform data collector in the field about the progress of work executed by him/her in terms of revealing the condition of the buildings visited and the completion of collecting all data pertinent to units and components of the building using bulging codes and colours.

Mobile Application

Data collection methods have been employed with the purpose of easing the response burden of the population while ensuring highest completeness and quality of the data to be collected. Enumerators armed with PDAs will conduct door-to-door interviews. Information gathered will be validated and corrected by means of internal consistency checks using automatically enforced business rules and question skip patterns. All mobile applications contain geospatial data utilized in digital maps to help enumerators navigate their surroundings and electronically fence them in their allocated enumeration work area. Fieldwork will be organized and coordinated by a well-designed hierarchical structure of crew-leaders, assistant supervisors and supervisors in regional offices located throughout the Sultanate and assisted with a number of applications . Regional office systems will provide full control over fieldwork and the ability for real time immediate follow up and intervention to ensure

smooth execution, full coverage and qualitative data. Data collected by enumerators will be automatically synchronized to regional offices. After synchronization data can be reviewed and assessed for any red flags through predefined key indicators before being transferred to the central database. Following is its main features:

- Applications are guarded with a username/password specific for each field enumerator to ensure data security and confidentiality.
- Global positioning system (GPS) technology used to accurately capture the position of enumerators.
- Geographic Information System (GIS) maps used to guide enumerators and help them navigate their surroundings.
- Use of color coding and different icons to distinguish buildings according to completion status.
- Electronically fence enumerators in their allocated work areas thus eliminating duplication and overlap during fieldwork.
- Electronic and user-friendly questionnaire designed in a wizard-like approach.
- Automatically enforce business rules to ensure data quality, validity and consistency.
- Automatically enforced question skip patterns utilized to avoid unnecessary or irrelevant questions with regard to nationality, age and gender of the respondent.
- Automatic data synchronization eliminating the need for data entry and all problems associated with it.
- Automatic synchronization of enumerator tasks to and from the PDA.
- Search features to filter through long lists.
- A handy help feature available for all questions to assist enumerators during interviews.
- Mobile reporting for work progress at enumerator and crew leader levels.
- Comments can be added for further clarification and can be viewed at the back end systems.

I-Census Website

During the population phase of the census, internet-based census website was accessible throughout the Sultanate. This approach was adopted to accommodate households that would rather fill their census information online without the need to be interviewed by enumerators. It enables any computer literate member of the household or outside of the household to fill an online and user-friendly wizard-like questionnaire whenever suitable. All entered information is validated and corrected on the spot to ensure internal consistency using automatically enforced business rules and question skip patterns. Members can logon to their accounts and submit their information online. The website has the following features:

- Accounts are guarded with a username/password specific for each household to ensure data security and confidentiality.
- Enable households across the Sultanate of providing their information whenever they find suitable instead of being interviewed by enumerators.
- I-Census households will be clearly marked and blocked on PDAs to avoid being visited.
- Bilingual interface with multi-browsers support.
- Intuitive and user-friendly.
- Wizard-like approach to facilitate data entry
- Automatically enforced business rules on the spot to ensure data quality, validity, and consistency.

- Automatically enforced question skip patterns utilized to avoid unnecessary or irrelevant questions.
- The ability to save the questionnaire and continue at a later time.
- Business rule violations are presented in a user-friendly tooltip clearly explaining the violation.
- A summary of all business rule violations are presented at the end of the questionnaire.
- Business rules can be added/deleted/modified and reflected on the website instantaneously
- Uses a Secure Socket Layer (SSL) connection to ensure data security during transmission.

Computer-assisted Telephone Interviewing (CATI) System

Data quality, validity and cleanliness are of utmost importance in this census project. Accordingly, data collected through PDA applications and the I-Census website will be further checked and validated by a Computer-assisted Telephone Interviewing (CATI) system. The CATI system developed will enable trained operators conduct telephone interviews with households to complete and validate their data avoiding the need for field revisits where possible. It will also be used for response coding, communicating with the public and answering inquiries.

A CATI system will be deployed and used to validate the gathered information through the telephone. "The Call Centre and Quality Assurance" uses this CATI System for re-interviewing households by means of sampling for double assurance of coverage and content quality. The following are the main features:

- Full telephony features to communicate with the public.
- All conversations are recorded and can be played back when needed.
- Will serve ٣٠٠+ operators simultaneously.
- Communicate with the public in ٦ different languages.
- Provide support and help for the public throughout the census period.
- Send promotional and informational emails/SMS to households participating in the I-Census.
- Communicate with the public to validate their information through telephone thus avoiding extra field revisits where possible.
- Review and validate all collected data through automatically enforced business rules.
- Business rules can be added/deleted/modified and reflected on the system instantaneously.
- The system is guarded with a username/password to limit access and ensure data security and confidentiality.
- Authorization on specific screens and data is granted according to predefined user roles that match their responsibilities.
- Perform response coding tasks.
- Advanced search features to filter long lists and huge record sets.

Regional Office Systems

In order to complete the census on time, huge number of employees were hired most of which are enumerators. Using traditional approaches to control fieldwork, assess performance, progress and quality and assign tasks can be very difficult if not impossible. Dedicated systems were developed to facilitate such a process. Supervisors and assistant supervisors can follow up on all tasks assigned to their team members, the progress on each task and coverage. Predefined key indicators are used

to assess the performance, coverage and progress and spot any red flags that might hinder or jeopardize field work for immediate corrective intervention. Regional office applications with the following features were installed in these offices:

- Systems are guarded with a username/password to limit access and ensure data security.
- Authorization on screens and displayed data according to predefined roles and responsibilities. Each user can only see data belonging to team members reporting to her/him.
- Electronically synchronize collected data to the central database.
- Database backups for protection against unexpected hardware/software malfunctions and disasters.
- Track progress, performance, coverage and spot any red flags through key indicators.
- Drilling through key indicators for more detailed information.
- Display collected information for reviewing.
- Advanced search features to filter huge record sets.
- Logging of certain features such as data transfers for editing purposes.

Operation Room Systems

Effectively managing a temporary organization of ٦٥٠٠+ employees dispersed all over the Sultanate posed a great challenge. The Census Administration at headquarters must be able to track progress, performance and spot any red flags that might risk the success of the census. Effective control is impossible to achieve with the lack of accurate, timely and up to date information which in turn is impossible to attain using traditional census techniques. Operation room applications will be installed in the headquarters to help officials and census managers track performance, progress, coverage completeness, quality and to identify any red flags that might hinder or jeopardize the success of the census through the use of predefined key indicators.

Dashboard applications were developed to provide control over the census process all over the Sultanate. Key indicators were updated regularly helping officials to follow up on progress, performance, coverage and quality on a general or granular level. It also allows them to spot any red flags early on to avoid any risks that might jeopardize the census. Below are the system's main features:

- The systems are guarded through a username/password to limit access and ensure data security.
- Authorization on screens and displayed data according to predefined roles and responsibilities. Each user can only see data belonging to team members reporting to her/him.
- Track progress and performance and spot red flags for the whole Sultanate through key indicators.
- Drilling through key indicators for more detailed information.
- Generate reports that help monitor census progress and coverage.

Communication System (E-Office)

Communication amongst the ٦٥٠٠+ census staff dispersed all over the Sultanate can make or break a project of this magnitude. Making sure that information reaches all parties instantaneously is imperative to guarantee success. A dedicated communication and collaboration system was deployed. Through this system, staff can share memos, announcements, bulletins, minutes of meeting, folders.

Furthermore, recipients will be notified through SMS/email of any new communication. Some main features look like the following:

- Used to communicate and collaborate through Memos, Minutes of Meetings, Announcements, Bulletins, SMS Push & Pull, Shared folders and Shared links.
- Define multiple surveys with different hierarchical structure, access policies and users.
- Notify recipients of memos, announcements, etc… through SMS and email by integrating with SMPP (SMS) and email gateways.
- Give users the look and feel of each survey by customizing the logo and theme.
- Users can switch between the different surveys assigned to them.

Government Resource Planning System (GRP)

GRC is a comprehensive resource planning solution specially implemented to automate the Census back-office operations to handle around ٦٥٠٠+ employees. It consists of the following modules:

- Financial Management
- Human Resource Development Management
- Payroll
- Fixed Assets Module
- E-Procurement and Inventory Management
- Transportation Management System
- Document Management System
- WavePortalT
- WaveFlowT
- Communication Server

Inter-active Voice Response (IVR) System

In its efforts to create wider knowledge and understanding about the ٢٠١٠ Census, the Census Administration introduced the IVR system as one of the new approaches to reach a wider segment of the population in the Sultanate of Oman, both nationals and expatriates. In addition, the IVR includes an all inclusive competition about the ٢٠١٠ census to contribute in creating census awareness among the population.

Summary and Conclusion

It is clear enough that selecting & applying appropriate information and communication technologies in the implementation phases of census operations would lead to a time efficient processes, & resulting in better data quality, consistency and validity, better control over field work, better management of the whole census process on a macro and micro level, and better communication and collaboration. However in order to achieve this, reengineering of census processes need to be considered as well as provide training in order to acquire the required diverse skill sets to all the staff ranging from planners, implementers and field workers.