Using geospatial-related technology to build the sampling frame for the Generations and Gender Survey in the Republic of Moldova

In 2018, Moldovan Government decided to conduct the Gender and Generation Survey (GGS) to address the demographic changes with robust data that will be used to develop evidence-based and people-centered policies. Fieldwork commenced in March 2020, with the aim of conducting 10,000 face to face interviews with individuals aged 18-79. The survey is conducted by UNFPA Moldova Country office in close cooperation with the Ministry of Health, Labour and Social Protection (MoHLSP), the National Bureau of Statistics (NBS) and Netherlands Interdisciplinary Demographic Institute (NIDI). To ensure the quality and accuracy of the data, a probabilistic sample was considered necessary. Because the Republic of Moldova does not have a good quality, up-to-date list frame of residents from which to draw the GGS sample, it has been decided to develop an area frame based on a complex listing process by listing all the households in the selected geographic areas. This document details this process for reference to countries who encounter similar constraints in fielding the GGS.

For this purpose, NBS developed with UNFPA's support a mobile application uploaded into tablets, to identify and locate all the households that will be interviewed during the survey. The use of this application reduced the statistical bias due to missing values and inconsistencies that are often present in "traditional" methods of data collection based on paper questionnaires. This listing process conducted by using geo-spatial technology for data collection represents the first step in modernization of the national statistical system in Moldova through implementing new modern methods of data collection. The customized GIS application used for the first time to build the sample frame for GGS will serve not only for national statistical surveys but also for large statistical operations such as agriculture census and the next round of Population and Housing Census in the Republic of Moldova.

The app. The *Census Fieldwork application* was developed and customized by *TeamDev Company* in close cooperation with NBS experts during the period of July-October 2019. Due to the fact that this was the first NBS' experience in using an online method for household surveys, several preparatory activities were conducted to understand local needs and challenges: one in-country mission of a GIS international expert to familiarize with the local context and identify local needs for using online tools of data collection; assess the quality of maps available at local level to be used for listing exercise; assess the technical specifications of tablets to be used, assess the nationwide coverage of internet network; establish the IT capacity of NBS and where the data will be stored etc.

The developed listing system is composed of 1) Server Application 2) Web Client Application 3) Mobile Client Application. The system supports many processes of map updating and therefore both the updating of spatial information and of the alphanumeric information associated with it. Due to its characteristics, this system, is able to support the following four phases:

1. planning of the map updating
2. data collection
3. monitoring of the ongoing process.
4. control of the acquired data (quality control)

Thanks to this mobile App, field operators can easily enter alphanumeric and geometric data (data input, modification of points and polygons). It also allows the operator to work while being disconnected from the mobile network. The system makes it possible to monitor the activities in the field (including the operator tracking). It has a geographical vision and indicates in a clear manner the progress graphically. The listing

system can be deployed on-premises or in a cloud environment. To select the deployment method to be used for GGS, a cons and pros analysis was conducted by the international GIS consultant. Due to costs and time constraints the cloud deployment method was chosen.

For GGS, the system was deployed on Azure Microsoft Cloud. Two types of maps were used in Moldova: Orthophoto maps provided by the public authority – Public Services Agency "Cadastru" and Orthophoto Esri for areas with bad quality maps provided locally.

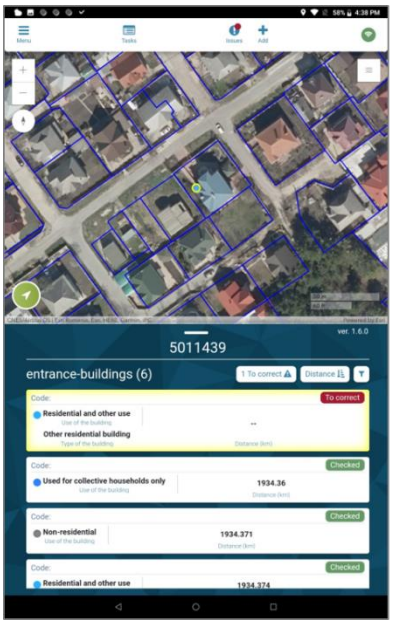
Testing. One-day testing was conducted by NBS on 25 September 2019 by using Huawei MediaPad T5 Android tablet. with the following technical specifications: Android 8.0, Internal Memory: 16 GB, RAM: 2 GB RAM, Network Technology: GSM/HSPA/LTE. A total number of 100 tablets and 70 power banks with 20,000 mAh were purchased by UNFPA for GGS data collection. These supplies also were used for the listing exercise. Due to the lack of technical specifications, several adjustments were conducted by GIS experts in order to avoid slowing down of the app. Since no essential problems related to the use of new listing application were identified during the testing exercise, NBS proceeded with installation of the customized app on devices and training of field operators to be involved in data collection. The App is available on Google Play by searching for Census Fieldwork or using the following link:

https://play.google.com/store/apps/details?id=it.teamdev.mapUpdatingPro

The application has hierarchical geographic design, starting with the identification of PSUs up to Raions and development regions. In this matter, NBS staff developed a file including the selected PSUs, parcel boundaries and PSUs link to Raions they are part of. For GGS, 202 were selected. On the basis of information provided by NBS, was decided to set up this hierarchical geographic subdivision based on the following:

1. Raion
2. Enumeration Area

The enumeration area layer will be polygons where field workers will have to collect data. One work area includes around of 600-800 buildings. This data was imported into the application by *TeamDev Company* team.



After that, the established Work areas were distributed to the field operators according to their location. Each field operator was assigned at a specific area (polygon) that is usually an aggregation of smaller areas. So, for example, a user could be assigned at a specific municipality that is an aggregation of smaller polygons (e.g. enumeration areas). A total number of 64,712 points (43,259 residential only) were collected.

70 field operators trained on using the mobile listing application. To collect the data in the field, NBS contracted and trained 70 field operators how to use mobile the developed listing application and tablets. The monitoring process was conducted by 7 NBS supervisors that were trained in the same period. The training sessions were conducted in October 2019 and included theoretical part and simulation activity in the field. Two methodological guidelines were developed and translated in local languages (User Manual for Management Web and User Manual for Census Mobile App).

Challenges. The process of data collection started in November 2019. After two weeks of fieldwork (approx. 100 points collected in the tablet), field operators started to face serious problems related to devices. Due to the lack of technical capacity of tablets, the app started to slow down and, in some cases, stop working. To collect data for one building, the field operator had to wait up to 2-3 hours.

The lack of technical characteristics of devices caused serious challenges that impacted the period of data collection, frustration and dissatisfaction of field operators. NBS started to lose human resources involved in this exercise. In this context, NBS requested UNFPA support to overcome this challenge and finalize the listing process.

Several solutions were applied to overcome this challenge, including the following:

1. Avoid to collect photos;
2. Work in a connected environment to avoid to download tiles (cache) for basemap (imagery);
3. Split big enumeration areas into smaller one up to 100 buildings. This means that each Enumeration Area was divided into 6-7 parts.

During one week, the process of data collection was pending for reducing the big Enumeration Areas into smaller one and save the data that field operators have already collected in the system. This task was conducted by NBS staff in cooperation with *TeamDev Company* and international GIS expert involved into the customization activity.

The segmentation of Enumeration Areas had a positive impact that allowed NBS to restart the fieldwork and lasted it in 2 months (November-December 2019). The field operators confirmed that using small sectors eased the listing process without any further technical difficulties. However, NBS mentioned that higher performance of tablets (4GB RAM) could increase the speed for collecting data and avoid possible problems related with data storage.

Other challenges faced by NBS under this experience are lack of knowledge and experience in collecting data online by using tablets; lack of institutional human resources, especially in GIS and IT; lack of institutional technical capacity of NBS (servers, tablets, IT supplies etc.), low coverage of internet network etc.

Based on the lessons learned, several recommendations were proposed:

1. Apply on-premises storage of data, including increasing the institutional costs allocated for ongoing maintenance, hardware, and IT personnel. The organization has more control over the implementation. However, it can take significantly longer to get up and running the process.
2. Facilitate change of experience and good practices in using geo-spatial technologies for listing process;
3. Increase institutional capacity in using geo-spatial technologies for data collection on tablets;
4. Use high performant tablets with a minimum 3 GB RAM and 32 GB ROM, Battery: 6000 mAh, and Android operational system;
5. Ensure good internet network coverage nationwide during listing process;
6. Customize the app according to local needs and data;
7. Increase the period of time allocated for testing and identify possible challenges and solutions before starting the data collection;
8. Involve a bigger pool of field operators, since 20% of them will refuse to finish their assignment.
9. Make sure the availability of high-quality maps necessary to be used for.