

IPA National Programme 2009 part II – Bosnia and Herzegovina

Fiche 12 “Statistics - Census”

1. Basic information

1.1 CRIS Number: 2009 / 021-650

1.2 Title: Procurement of Equipment for the 2011 BiH Census

1.3 ELARG Statistical code: 03.18 European standards / Statistics

1.4 Location: Bosnia and Herzegovina

Implementing arrangements:

1.5 Contracting Authority: European Commission

1.6 Implementing Agency: European Commission

1.7 Beneficiary:

Agency for Statistics of Bosnia and Herzegovina
Institute for Statistics of Republika Srpska
Institute for Statistics of Federation of Bosnia and Herzegovina

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Financing:

1.8 Overall cost (VAT excluded): EUR 2 000 000

1.9 EU contribution: EUR 2 000 000

1.10 Final date for contracting: Two years following the date of the conclusion of the Financing Agreement

1.11 Final date for execution of contracts: Two years following the end date of contracting

1.12 Final date for disbursements: One year following the end date for the execution of contracts

2. Overall Objectives and Project Purpose

2.1. Overall Objective

To prepare for the Population and Housing Census in 2011 by providing IT and other necessary equipment

2.2 Project Purpose

To supply the necessary equipment needed for carrying out the Population and Housing Census available in time for the 2011 Census.

2.3 Link with EP:

The European Partnership 2007, Short-term priorities, European standards:

"Establish the legislative framework necessary for carrying out the population census. Agree on a target date for the census and start preparations for implementing it."

The European Partnership 2007, Medium-term priorities, European standards, Sectoral policies: "*- Carry out the population census*"

2.4 Link with MIPD:

2.3.1.3 Ability to assume the obligations of membership – Statistics: Bosnia and Herzegovina develops the capacity to collect and produce reliable statistics, in particular economic and agricultural statistics. Data collection is improved and statistical methods are harmonised between the state and the entity statistical institutes. The new population and housing census is successfully completed.

2.5. Link with National Development Plan

National Development Strategy 2008-2013 is currently in the final phase of preparation.

2.6 Link with national/sectoral investments plans

The adopted and approved Statistical Programme of BiH for period 2009-2012 defines preparation and conducting of Population Census in 2011 as one of the priorities.

3. Description of the project

3.1 Background and Justification of the Project

The last population census in BiH was organised in 1991 as part of a general Census within the Socialist Federative Republic of Yugoslavia (SFRY). Due to a specific political situation in BiH, the 2000 census round was not organised in BiH. Bosnia and Herzegovina's statistical offices, coordinated by the BiH Agency for Statistics (BHAS) want to take part in the pan-

European census in 2011 so as to obtain a representative statistical profile of the country in the light of the enormous demographic, social and economic changes of the last 20 years.

The aim of the Population Census is to provide the State Government, the Entities, Cantons and Municipalities, and the civil society with necessary statistical data for the planning and application of the general development policy. Additionally the aim is also to increase the knowledge level and perception of the demographic, economic and social reality of Bosnia and Herzegovina.

The Population and Housing Census is one of the most important activities of official statistics and one of the most important data resources for statistics and society in general. However, the next population census in BiH has additional value and the data produced as a result of census will be invaluable for statistics and the country in general.

The country is continuing its progress towards European integration following the signature of the Stabilisation and Association Agreement in June 2008. The current European Partnership for BiH has also clearly defined preparation and carrying out of the census as one of the priorities.

After the war (1992-1995), Bosnia and Herzegovina, by signing the Dayton Peace Agreement, was split into two entities with high level of autonomy and obtained a complex institutional set up with a several levels of authorities. The new 2011 census round in BiH was also questionable for several years because of complex political situation and provisions of the Dayton Peace Agreement. However, the Council of Ministers of BiH (CoM), the highest executive body at the state level, on November 13, 2008, made the decision on conducting Population and Housing Census in BiH in 2011. By this decision, the Agency for Statistics of BiH is “*tasked to start official preparations for Census conducting, observing all relevant EU regulations, including questions concerning ethnic, religion and language issues*”. The Agency is also tasked to establish a working group for drafting the Law on Population and Housing Census.

The BiH statistics has to carry out 2011 Population and Housing Census in BiH according to the EU and UN recommendations and obtain recognised and comparable results.

The successful implementation of the Population census depends very much on timely and comprehensive preparation. It is obvious that statistical institutions in BiH have to accelerate the process of preparations for the Census. Considering the twenty-year interval and the war in BiH, it is clear that the BiH statistical system has to make significant efforts to prepare for this activity. In the institutions, apart from a few exceptions, there is no staff with relevant experience and expertise in this field. Due to the complexity of BiH statistical system, the preparatory activities in the country need to be carried out carefully and with technical expertise provided by the international community.

According to the activity plan agreed among the statistical institutions in BiH, the pilot census should be organised in the period from 1 to 15 April 2010 and the main Census will be carried out in the period from 1 to 15 April 2011.

All methodological documentation, organisation of the field work, IT equipment and staff competencies should be tested within pilot census.

Furthermore, a complex state system/structure complicated the adoption of necessary decisions related to the organisation and preparatory activities for the census. Many BiH ministries and institutions (at the state and entities level) are involved in the preparation for the Population and Housing Census in 2011 but the most important activities will be implemented by the three statistical institutions: *Agency for Statistics of Bosnia and*

Herzegovina (BHAS), Sarajevo (including Branch Office in Brcko District) at the state level and two entity institutions, *Institute for Statistics of Federation of Bosnia and Herzegovina, Sarajevo* and *Institute for Statistics of Republika Srpska, Banja Luka*. According to the Law on Statistics, the Agency for Statistics of BiH coordinates work on the preparations for the Population Census.

Organisation of the fieldwork, data collecting, entering and processing are a part of the responsibilities of the statistical institutions in BiH. The *State Law on Census* has been drafted and sent to the BiH Council of Ministers (It has, however, not yet been adopted. The Draft law includes two options for the census organisation and implementation: centralised and decentralised and it is up to the CoM and BH Parliament to decide which one will be implemented. Obviously, adoption of the BH Law on the Population and Housing Census is one of the most important preconditions for solving many pending issues including detailed budget and specification of equipment.

Thus, the supply of necessary equipment for support to national census activities in 2011 will have to be based on the successive technical specification and budget design. Screening of sectoral needs in that regard is provided further in Annex VI.

3.2. Assessment of project impact, catalytic effect, sustainability and cross border impact

N/A

3.3 Results and measurable indicators

Results and measurable indicators:

1. Equipment units installed

Objectively verifiable indicator: Number of equipment units procured and tested

2. Specific databases established

Objectively verifiable indicator: All procurement units delivered, installed and functional

3.4 Activities

Activity 1: Procurement of ICT equipment hardware and software for specific quantities

Activity 2: Installation and testing of equipment units

Activity 3: Provide basic training to ICT staff

3.5 Conditionality and sequencing

Important assumptions for continuation of efficient preparations are availability of sufficient human and other resources, support of policy-makers, EU support, strong management capacity, permanent training of staff in all related and relevant fields. The Eurostat support to BiH statistics is of utmost importance. It has been reflected through continuous interests of its management and staff. The Eurostat also provided the Agency for Statistics in BiH with the concrete technical assistance needed for carrying out preparations, and it represents the motivation and assurance of support to the statistical institutions in BiH. .

Problems that are not exclusively the responsibility of the statistics are cartography and sufficient funds to implement the Census.

The equipment procurement is just one of the elements needed for the successful implementation of all preparatory activities. The activities related to the equipment selection and purchase should be carried out before the Pilot census, which is planned for April 2010. This issue also depends on the selected type of census implementation (centralised or decentralised) and it has to be clarified by the provisions of BiH Census Law. For the purpose of procuring equipment for the Pilot Census, the European Commission has allocated EUR 200 000 under IPA 2008.

Ideally, procurement of equipment for the Pilot Census would be done by the end of 2009, and subsequently to have the census questionnaires scanned, system tested and staff trained to use the equipment. The procurement of such equipment after the above-mentioned period would jeopardise the process because of non-preparedness of the staff and lack of skills concerning the equipment.

3.6 Linked activities

The preparation activities for to the Population Census in BiH can be divided into two phases: first phase, until the decision of the BiH Council of Ministers in November 2008, and the second, after the decision was made.

The first phase of preparation activities was conducted only within the statistical system of BiH. As there was no decision on the state level, it was not possible to ask for a full cooperation and engagement of other relevant institutions and it was not wise to involve and inform general public. The preparations were mainly conducted in the scope of projects supported by international donors.

UNFPA project

The most important pre-preparation activity for population census in BiH was project implemented in cooperation with United Nations Population Fund (UNFPA) in the period 2005-2006. Together with an expert, who spent about two months in total in BiH, staff from three statistical institutes in Bosnia and Herzegovina prepared a comprehensive document, so called "Concept paper". It is a Project Proposal for the pre-preparation of the Census of Population, Households and Dwellings in Bosnia and Herzegovina.

Five working groups were preparing this document, and its content presents a very important base for the future preparation activities. The Concept paper has not been presented to the broader public so far. It is important to say that certain assessments and recommendations have not been fully agreed by professionals from all three Institutes. All open issues will be solved by the future census law and decision on centralised or decentralised census organisation and implementation.

The second phase of preparations, official preparations, began immediately after the Council of Ministers of BiH made its decision. The inter-institutional statistical working group for the Census preparation, coordination operational body, composed of relevant statisticians from all three statistical institutions, was established for implementation of the preparations. Immediately after the CoM's decision this body had a work session, during which they prepared a detailed activity plan, namely, set up deadlines for finalising all activities.

They also defined a list of following working groups for the preparations of the Population and Housing Census:

- The Working Group for methodology and organisation with the following teams:
- Working team for demographical, geographical and migration characteristics
- Working team for educational characteristics
- Working team for economic characteristics
- Working team for enumeration of dwellings
- Working team for agriculture
- Working group for cartography (GIS)
- Working group for IT
- Working group for legislation
- Working group for control of coverage and quality
- Working group for publication and dissemination

The Agency for Statistics facilitated the establishment of the Legislation Working Group, composed of representatives from all relevant BiH institutions and prepared rules of procedures. The Legislation Working Group prepared draft law and sent it to CoM for consideration and adoption in Parliament procedure.

EU assistance

The EU has approved assistance to the Census preparatory activities in BiH through the national IPA 2007 and IPA 2008 projects. The beginning of the IPA 2007 project implementation has been delayed and statistical institutions had to start with preparations for the Population Census 2011 without technical support foreseen in this project.

Eurostat, based on the request of the Agency, has ensured an initial technical assistance for BiH statisticians within IPA 2007 Multi-Beneficiary Project. This was approved at the beginning of 2009 and it was agreed to provide three missions of the expert for methodology as well as two missions of the IT and budget experts.

Until now, methodological expert completed two missions (the last one should be implemented in May 2009), IT expert completed both planned missions and expert for budget completed one mission (the second one should be implemented upon adoption of the BH Law on census).

The national IPA 2007 project is planned to commence in the 3rd quarter of 2009. However, not being able to afford a delay, the preparations for Census have been initiated by BHAS without delay. Support of the experts (especially for methodology and IT) is still needed for the working groups and should be continued until the moment the IPA 2007 starts with the implementation.

3.7 Lessons learned

This is the first time that the BiH statistical institutions are beneficiaries of assistance for acquiring equipment for the 2011 Population and Housing Census in Bosnia and Herzegovina.

4. Indicative Budget (amounts in EUR)

			TOTAL EXP.RE	SOURCES OF FUNDING								
				IPA COMMUNITY CONTRIBUTION		NATIONAL CONTRIBUTION			PRIVATE CONTRIBUTION			
ACTIVITIES	IB (1)	INV (1)	EUR (a)=(b)+(c)+(d)	EUR (b)	%(2)	Total EUR (c)=(x)+(y)+(z)	% (2)	Central EUR (x)	Regional/ Local EUR (y)	IFIs EUR (z)	EUR (d)	% (2)
Activity 1												
1. Supply Contract		X	2 000 000	2 000 000	100							
TOTAL IB			2 000 000	2 000 000	100							
TOTAL INV												
TOTAL PROJECT			2 000 000	2 000 000	100							

Amounts net of VAT

- (1) In the Activity row use "X" to identify whether IB or INV
- (2) Expressed in % of the **Total** Expenditure (column (a))

5. Indicative Implementation Schedule (periods broken down per quarter)

Contracts	Start of Tendering	Signature of Contract	Project Completion
Contract 1 (supply)	4 th quarter 2009	2 nd quarter 2010	2nd quarter 2011

6. Cross cutting issues

6.1. Equal Opportunity

No discrimination of whatever nature will be applied.

The principle of non-discrimination regarding nationality, gender, religion and race will be applied during tendering, contracting and implementation of this project and all parties involved in all phases of the project will have equal opportunity.

The project will support BHAS and its partners in order to recognize and address issues of equal opportunity.

6.2 Environment

No environmental impact is expected.

6.3 Minorities

Please see 6.1 above.

LIST OF ANNEXES

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ANNEX I Logical framework matrix in standard format

LOGFRAME PLANNING MATRIX FOR Project Fiche		Programme name and number	
Procurement of Equipment for the 2011 BiH Census		IPA National Programme 2009 part II – Bosnia and Herzegovina Fiche 12 – “Statistics - Census” CRIS number: 2009 / 021-650	
		Contracting period expires: two years following the date of conclusion of the Financing Agreement	Disbursement period expires: one year following the end date for the execution of contracts
		Total budget : EUR 2 000 000	IPA budget: EUR 2 000 000
Overall objective	Objectively verifiable indicators	Sources of Verification	
To prepare for the Population and Housing Census in 2011 by providing IT and other necessary equipment	Census data published	Census related reports	
Project purpose	Objectively verifiable indicators	Sources of Verification	Assumptions
To supply the necessary equipment needed for carrying out the Population and Housing Census available in time for the 2011 Census.	Number of equipment units operational	Reports of BiH Agency for Statistics on procurement of ITC equipment	
Results	Objectively verifiable indicators	Sources of Verification	Assumptions
1. Equipment units installed	-Number of equipment units procured and tested	Guarantee lists and dispatch lists for all procurement items	
2. Specific databases established	All procurement units delivered, installed and functional		

Activities	Means	Costs	Assumptions
<p>1. Procurement of ICT equipment hardware and software for specific quantities</p> <p>2. Installation and testing of equipment units</p> <p>3. Provide the basic training to ICT staff</p>	Supply contract	EUR 2 000 000	Prepared technical specifications for supply of census equipment with detailed budget breakdown

ANNEX II - Amounts in Euro Contracted and disbursed by quarter for the project

Contracted	2nd Q 2010	3rd Q 2010	4th Q 2010	1st Q 2011	2nd Q 2011
Contract 1	2 000 000				
Cumulated	2 000 000				
Disbursed	2nd Q 2010	3rd Q 2010	4th Q 2010	1st Q 2011	2nd Q 2011
Contract 1	1 200 000				800 000
Cumulated	1 200 000				2 000 000

ANNEX III - A tentative description of the costs

ICT, Equipment & Comm					
Type of Equipment	Price	Quantity	Unit	Total Price	
Scanner	70,000.00 KM	4		280,000.00 KM	
Maintenance	50,000.00 KM	4	year	200,000.00 KM	
Servers:					
OCR	20,000.00 KM	3	piece	60,000.00 KM	
Images storage Server	20,000.00 KM	3	piece	60,000.00 KM	
DB-SQL	20,000.00 KM	4	piece	80,000.00 KM	
Backup for SQL DB	40,000.00 KM	4	piece	160,000.00 KM	
Storage System	50,000.00 KM	3	piece	150,000.00 KM	
Storage System	80,000.00 KM	1	piece	80,000.00 KM	
Rack box					
42 U	10,000.00 KM	4	piece	40,000.00 KM	
Network	5,000.00 KM	4	piece	20,000.00 KM	
PC					
Desktop	1,500.00 KM	50	piece	75,000.00 KM	
Mac	10,000.00 KM	3	piece	30,000.00 KM	
Lap top-12"	3,000.00 KM	6	piece	18,000.00 KM	
Lap top-17"	4,000.00 KM	15	piece	60,000.00 KM	
UPS System					
Each Institution	20,000.00 KM	4	peace	80,000.00 KM	
Printers:					
LJ Color, A3	2,000.00 KM	6	peace	12,000.00 KM	
LJ Network, A3, printer, Copier	5,000.00 KM	9	peace	45,000.00 KM	
Plotter	5,000.00 KM	3	peace	15,000.00 KM	
LAN/WAN & ICT infrastructure	100,000.00 KM	3	set	300,000.00 KM	
Infrastructure-Connections					
BHAS min 2 Mbps	3,000.00 KM	40	month	120,000.00 KM	
FZS FBiH min 2 Mbps	3,000.00 KM	40	month	120,000.00 KM	
RZS RS min 2 Mbps	3,000.00 KM	40	month	120,000.00 KM	
DB min 2 Mbps	3,000.00 KM	40	month	120,000.00 KM	
SW					
OCR for Server	80,000.00 KM	3	piece	240,000.00 KM	
OCR for Clients	2,000.00 KM	50	piece	100,000.00 KM	
WIN Server 2008 each 5 call	4,000.00 KM	14	piece	56,000.00 KM	
WIN Vista Professional	400.00 KM	50	piece	20,000.00 KM	
SQL server 2008 min 10 calls	10,000.00 KM	8	piece	80,000.00 KM	
Antivirus SW SEPM + SEPC	100.00 KM	70	piece	7,000.00 KM	
Other SW, coding, controls..	100,000.00 KM	3	piece	300,000.00 KM	
Adobe Design for MAC	6,000.00 KM	3	piece	18,000.00 KM	
Dissemination, web portal	30,000.00 KM	1	piece	30,000.00 KM	
		Budget for IT		3,096,000.00 KM	
		+ 10 % unplanned costs		3,405,600.00 KM	
		ICT Equipment Budget		1,741,282.34 EUR	7.07% of TOTAL
Remark:		Total Census Budget		24,645,722.88 EUR	
Costs of Training are not included in this budget.					

ANNEX IV - Institutional framework

Institutions involved and responsible for the census implementation

The BiH Agency for Statistics according to the Article 8 of the BiH Law on Statistics shall coordinate planning, maintaining and publishing of the results of the BiH Census of Population, Households and Dwelling Units pursuant to the General Framework Agreement, Annex 7 and 10.

Institutions and organisations in BiH responsible for census operations (BiH Law on Census):

- F BiH Institute of Statistics and Institute of Statistics of Republika Srpska,
- Entity institutions and organizations responsible for census operations (Entity Laws on Census Organization)

The BiH ministries that are responsible for census operations in addition to the Census bodies created by the *State Law on Census* are:

- The BiH Ministry of Defence,
- The BiH Ministry of Foreign Affairs,
- The BiH Ministry of Justice
- The BiH Ministry of Civil Affairs
- The BiH Ministry for Human Rights and Refugees
- The BiH Ministry of Security

The bodies and organizations in the entities, pursuant to the *Entity Laws on Census Organization*, that shall be responsible for the census preparation, organization and taking are, within the scope of competence, the following authorities:

- In F BiH: Ministry of Justice, Ministry of Internal Affairs, Ministry of Displaced Persons and Refugees, Bureau of Geodetic and Property Issues;
- In Republika Srpska: Ministry of Justice, Ministry of Veterans and Disabled Persons Protection, Employment Bureau, Republic Geodetic Administration Office

ANNEX V

Reference list of relevant laws and regulations

LEGAL FRAMEWORK FOR POPULATION CENSUS

Constitutional aspects

- State Constitution: the legal basis to enact the Laws on Population is defined in the Article 1 and/or Article 3, paragraph 1- Competencies of the BiH institutions, under the subparagraphs f, g and h.
- Federation of Bosnia and Herzegovina Entity Constitution: the legal basis to enact the Law on Population is defined in the Article 4.A.20/1.d according to which the Federal Parliament is competent to enact the Law on the Implementation of the Federal Authority Function.
- Republika Srpska Entity : the legal basis to enact the Law on Census in the Amendment 32, paragraph 9 to the Constitution of the Republika Srpska, by which the Republika Srpska defines and provides collection of statistical data being of general interest. The Parliament of the Republika Srpska is obliged to enact this Law pursuant to Article 70, paragraph 2.

Existing Laws on Statistics

- State: BiH Law on Statistics (Official Gazette of BiH, 26/04 and 42/04) establishes the BiH statistical system with clear definition of the competencies of the BiH Agency for Statistics and entity statistical institutes for the organization, preparation and distribution of statistical data.
- The Article 8 of the BiH Law on Statistics stipulates that the BiH Agency for Statistics shall coordinate planning, maintaining and publishing of the results of the BiH Census of Population, Households and Dwelling Units pursuant to the General Framework Agreement, Annex 7 and 10.
- F.BiH: Law on Statistics (Official Gazette of FBiH, 63/03) says that the Federal Institute of Statistics is the competent body for the statistical activities in the FBiH. The Article 9 of this Law defines the activities related to the organization and implementation of the statistical surveys under the competence of the Federal Institute of Statistics.
- Republika Srpska: Law on Statistics (Official Gazette of the RS, 85/03) says that the Republic Institute of Statistics is the competent body for the statistical activities. Article 13 of the Law says that the large scope of statistical activities shall be defined by a separate law.

International Recommendations

The *Recommendations for the 2010-2011 Censuses of Population and Housing in the ECE Region* jointly prepared by the United Nations Economic Commission for Europe and the Statistical Office of the European Communities (Eurostat), shall be relevant for the Census. These recommendations are aimed at facilitating and improving the international data comparability by harmonizing the definitions and classifications of the population censuses in the region. For this, they provide detailed definitions of the units of enumeration, characteristics and modalities specifying them as obligatory and/or facultative, etc.

ANNEX VI

ICT SECTORAL SCREENING

Following activities have been for planned in June and July 2009:

First mission - To prepare specification of IT training (type and number of IT trainings) based on need assessment; defining number of required IT staff and their responsibilities

- Analysis of best solution for solving ICT issue (outsourcing has been proposed during the last mission); what to cover with subcontract; availability of local services providers; what is the best solution for equipment – renting, procurement, etc;
- Analyses of drafted ICT activity plan (IT Working group has made proposal for the following 12 months); based on experts comments to make changes and prepare final version of ICT Activity plan for all activities and covering full period. The Activity plan has to be agreed and adopted by staff from all three institutions.

Second mission, - Members of IT WG will prepare in advance specification with technical features of required equipment; IT expert to give comments and recommendations; defining all technical equipment needed for data entering and processing; preparing required technical documentation for the selection of equipment supplier (firstly a call for interest should be issued).

Taking into account the complexity of this project, costs and implementation it is necessary to prepare good quality documentation and select an adequate solution and purchase of adequate IT equipment; solution covers defining software, hardware and trainings needed for statistical IT staff. This is very important activity and has to be emphasized that BiH statistical staff have no experience in this kind of work.

2- Preparation of budget breakdown based on selected option for IT and drafted proposal (Staff of BiH Statistical institutions has already prepared a draft budget estimate)

Expected outputs after two expert IT missions (in June and July 2009) are:

- Specification of IT training (types and volume of IT training) prepared
- Detailed calendar of the ICT activities prepared and adopted
- Specification of all required technical equipment finalised
- Tender documentation for the selection of equipment supplier and services prepared
- ICT Budget breakdown (for each activity and allocation per years) prepared

Following activities should be implemented until the end of the year (*experts' support will be needed for some of listed activities*):

- Coding of census documentation that should be done in cooperation between methodological and IT group (*one joint mission of IT and methodological expert is highly recommended*)
- IT Design of questionnaires required for OCR (optical character reading) – for this activity is necessary to engage OCR/IT expert (*IT expert with specific skills needed*)
- Preparation of methodology for defining various controls (contingency control, computer control and logic control), and in line with this, the activities for preparing software (*expert's support needed*)
- Development of application for manual data entry (as an emergency option)
- Basic IT training implemented

- Selection of the sample for the pilot census
- Tender procedure started
- Activity plan for implementation of the pilot census
- All methodological documents finalized (*expert's support needed*)
- Study visits to Croatia and Serbia implemented (study visits will be financed by own funds or within IPA 2007 Multi-beneficiary project)

1. The Outcomes of IT Expert's Missions in BiH and Recommendations for Solving Equipment Issue

During the two missions held, the international IT expert and BiH working group for IT, jointly analysed a current situation in the country and provided the following inputs for the procurement of equipment.

References to documents used in the missions

- IT strategy for official statistics in Bosnia and Herzegovina (ISTAT & BHAS)
- Principles and Recommendations for Population and Housing Censuses Rev. 2 (United Nations 2008 - Department of Economic and Social Affairs -Statistics Division).
- Conference of European Statisticians – Recommendations for the 2010 Censuses of population and housing (United Nations Economic Commission for Europe in collaboration with the Statistical Office of the European Communities (EUROSTAT)).

Census processing has always been a daunting task for most statistical offices. The huge quantity of questionnaires (in case of BiH around 10 million A4 format pages) to be handled poses a great challenge to the data processing capabilities of the statistical offices.

1. Technology Overview

1.1 Intelligent Character Recognition and Optical Character Recognition

Intelligent Character Recognition (ICR) and Optical Character Recognition (OCR) recognize and capture alphanumeric characters on computer at a very high speed.

ICR/OCR, the two terms are often used interchangeably, provide complete form processing and documents capture solution. They use modular architecture that is open, scaleable and workflow controlled, and the modules include forms definition, scanning, image, pre-processing, and recognition capabilities.

ICR/OCR captures data from forms, thus reducing keystroke errors, reducing data entry time, error and cost and as a result brings data entry one step closer to complete automation, while maintaining the high level of accuracy required in form processing applications.

Forms containing character images can be scanned through scanner and then recognition the engine of the OCR system interprets the images and turns images of machine printed characters into ASCII data while ICR has the ability to turn images of hand written or printed characters into ASCII data.

1.2 Optical Mark Reader

OMR works with specialized forms. Each form contains data in pre-coded format, ID marks, which look like black boxes on the top or bottom of a form, to identify the form, and timing tracks along one edge of the form indicate to the scanner where to read the marks. OMR is a

data collection technology that does not require a recognition engine since it cannot recognize hand – printed or machine printed characters. The use of Optical Mark Reader was one of the first attempts to optically process statistical information. With OMR the image of the document is not scanned or stored, hence it is considered a simpler technology than OCR / ICR and, if the forms and the system are properly designed, OMR is more accurate than either ICR or OCR. The main limitation of OMR is that it occupies a lot of space on a form and so it can only be used on short uncomplicated questionnaires.

2. Stages of ICR-based Census Processing

The ICR technology is a system which is acknowledged to be fast, reliable, and efficient at extracting information from documents of all kinds, such as forms, questionnaires, faxes, and the like. The stages of ICR-based processing are as follows:

1. Image Capture Stage;
2. Interpretation/Recognition Stage;
3. Data Verification Stage; and
4. Data Transfer/Data Generation Stage;

The ICR-based census processing should run on a local area network consisting of large-capacity image/database server with fast servers, PCs, scanners, and backup devices.

3. Situation in BH statistical institutes

In the statistical institutes (BHAS, FIS and RSIS), servers with Microsoft Windows Operating Systems and personal computers with Windows XP/Vista are installed.

The above mentioned institutes have an Internet/Intranet network but are not connected through a private LAN (i.e. VPN) among each other.

At the moment data are stored in local archives consequently making integration and sharing data and programs for IT staff is rather difficult. At present MS SQL Server, as RDBMS program, is used.

The Web technologies are outsourced to a private company.

The hardware/software equipment can not be exploited in the census process because it is under-dimensioned and already in use for internal purposes and.

Faster and with higher memory (RAM and Hard Disk) computer with 17” screens are needed for ideal display of the image. Robust servers (i.e. Blade servers c-class) and additional computer memory are required to appropriately store and process images. However, this is a minor extra cost compared to the massive benefit of having the questionnaires in electronic format.

4. Recommendations

The experiences on ICR-based processing from 2000 on censuses in other countries demonstrate that this technology is beneficial to the office in the long term. The ICR equipment and software are reusable for surveys and other censuses. In BiH the BHAS is planning, for example, to use this technology to process the next Census on Agriculture and Fisheries.

4.1. Census processing using ICR technology

In a nutshell, ICR-based census processing consists of document scanning, interpretation/recognition, data verification, and data transfer/generation stages. But prior to actual processing, it is noteworthy to consider the preparations that ought to be done on the census forms, the overall processing strategy, and the resources needed for an effective ICR-based census processing.

4.2. System Requirements

4.2.1 Hardware

The hardware requirements for ICR-based processing are basically the same as that of the traditional census processing except the introduction of the document scanners. As in traditional processing, a local area network (LAN) is needed in ICR-based processing. However, the server for ICR technology should have a large disk and high memory capacity due to the nature of image processing. Besides the server for the ICR-based processing other servers are also used as image server and as database server, aside from the normal networking operations requiring large memory for processing. The LAN for ICR-based processing should include verifier, scanning, manager, and backup devices. It is preferable that these servers and computers be of the latest generation satisfying high performance benchmarks. Document scanners with sheet feeders are attached to scan servers through local network. The manager server is used to monitor the status of processing. This server is also used to run data transfer and interpret modules of the ICR software. A backup device is used to create backup copies of document images into optical storages. Newer storage technologies like Ultra Density Optical (UDP) disks (from 30 to 60 GByte) and drives are also available and may be used as reliable ROM data storage devices.

Main hardware components must be carefully selected. These are:

- Pc's (for scanning, recognition , verification, validation, and tabulation).
- Servers (for data storage, validation and tabulation).
- Scanners. Scanner selection is critical for the success of the process.
- Backup system
- Data repository
- ROM data storage

The following factors of the scanners must be considered:

- Paper size.
- Paper handling (Automatic document feeder).
- Resolution.
- Scanning speed.
- Drop out colour.
- Forms processing capabilities (Form ID, registration, de-skewing and form template removal. Form ID allows sorting of forms in a batch by allowing unique identification of graphical object or character strings. Recognition and de-skewing features automatically align and re- size images to their original dimension and provide more precise from template removal leading to much higher recognition accuracy).

4.2.2 Software requirements.

The selection of an appropriate ICR software package is crucial to the success of an ICR-based census processing. The software should have at least the following characteristics:

- Ability to identify fields in the forms.
- Ability to adjust the character recognition accuracy levels or probability of recognition for each character in the form.
- Ability to allow data entry from unidentifiable forms by manual keying of characters from images.
- Compatibility with standard scanning devices.
- Ability to do automatic assignment of forms for verification and workload balancing among verify operators.

Usually, a scanning module is included in the ICR software. It is best to use this built-in module because it is designed for processing of forms. It is also possible to use a document scanning software external to the ICR software but it may not include some features that are useful in forms processing.

Aside from the ICR software, there is also a need to acquire or develop a monitoring system in order to determine the status of processing at any time. The software should be able to generate processing statistics on productivity of various personnel involved in the census processing. The SIs can use a tailor-made Census Progress Monitoring System (CPMS) for this purpose.

The software that will be used in the census should consist of modules for recognition, verification, validation and tabulation. The scanning module is bundled with the scanner. The recognition module must recognize and interpret different data forms including hand written, machine – printed barcodes, check boxes, marks, numeric field, alphabetical field and mixed field.

It should be able to convert the scanned image file into a text/ASCII file. In the case of BHAS, the software development team will be involved in the development and deployment of the remaining modules. All the modules will be integrated into one application.

Character recognition is an important process. Different approaches are often used to increase the recognition rate. These include the use of the same recognition engine with different settings and the parallel use of different engines with different capabilities, since some engines are better recognizing numeric while others are better recognizing alpha characters.

BHAS should use, at least, two different engines during the pilot project (discussed later) census to determine the best approach that delivers a high degree of confidence.

Manual coding should be replaced with automatic coding in order to reduce time and achieve more accurate results. Automatic coding is the process of selecting a code that matches the response given to a question. Possible answers to questions and their appropriate codes are included in a coding library, and during the data entry a list of codes appear on the operator's screen. The operator may select a code from the list that matches the answer, or enter a different one.

4.3. Resources for the ICR-Based Processing

4.3.1. Peopleware for the ICR-Based Processing

The first thing that comes to mind when adopting new technologies is whether there is enough skilled personnel who can learn and use these technologies efficiently. For the ICR-based processing, the following personnel are needed for smooth operation:

1. Scan Operators;
2. Verifier Operators;
3. Data Processing Supervisor; and
4. A Team of IT Personnel who will customize the ICR software.

The scan operators operate the document scanners to make computer images of census questionnaires. The minimum requirement for such position is basic knowledge of personal computers. The verifier operators (or verifiers) are the ones who re-enter or correct erroneous field entries. Again, only basic knowledge of personal computers is needed. An added training or briefing on basic concepts of the census may be conducted to help them resolve invalid or inconsistent field entries. The data processing supervisor is the key person during processing. Basic knowledge of computer operation and networking is necessary for the supervisor. He should also be knowledgeable in the various concepts used in the census. A team of IT personnel is needed to customize the ICR software. The team members should be knowledgeable in computer programming and networking. They work hand in hand with census statisticians in order to faithfully implement the editing and validation specifications for all the fields covered by the census. They should be trained in the various aspects of customizing the ICR software.

4.4. Use of ICR Technology for Census Processing

There are four (4) areas of processing:

- Data Capture Centre Strategy
- Forms Preparation
- ICR Software
- Image Capture/Scanning

4.4.1. Data Capture Centre Strategy

It is recommended that the SI creates data capture centres (DCC) to handle the data capture and forms processing for the 2011 Census of Population and Housing. Processing at each DCC is LAN-based, equipped with at least one-two (1-2) server based mid-volume scanners, twenty five - thirty (25-30) PCs, three (3) magneto optical disk drives, three (3) DVD/UDO writers, one (1) network colour printer. In order to process at least 7 million questionnaires, four (4) DCCs should strategically setup in the central Agency. Each DCC is assigned to process about 1.8 - 2 million census forms from a group of municipalities. The limitation on the number of DCCs is due to the cost of equipment for an ICR-based processing.

The DCCs will operate at least 16 hours a day, six days a week, with two-shift work schedule. A total of 120 (100 + 20 as spare) PCs should be installed for the DCCs. The personnel shall be trained for a week on the basic concepts of the census and machine processing at the DCC before the actual operation. The personnel need to have basic computer knowledge but should be able to learn and become proficient in their respective roles in the DCC within the one-week training.

Aside from the scan and verifier operators, SIs should also hire two (2) data controllers per shift per DCC. The data controllers prepare and check the batches of forms for validity of geographic codes, clarity of entries, and paper orientation. They make sure that the scan operators do not run out of forms to scan. SIs should also hire one (1) file preparation and transfer operator (FPTO) per shift. The FPTO runs the interpretation and transfers modules of the ICR software. He is also tasked to create backup copies of images in UDOs and/or DVD-ROMs. He also creates back-up copies of system log files and the databases of the CPMS and ICR software.

DCC sends its weekly report and output data files to the Central Office as e-mail attachments. These files are automatically consolidated once the e-mail messages are received. The consolidated report is then sent to the Administrator and other top-level officials.

The use of ICR will not eliminate manual processing. There was still some minimal manual processing for the censuses in 2000. This is because some questionnaires have incomplete or inconsistent entries. This affected the output data file wherein some critical fields were left blank by enumerators.

4.4.2. Preparation of ICR-Friendly Census Forms

One important aspect of ICR-based census processing is the preparation of ICR-friendly census questionnaires (forms). This matter should not be taken for granted for this may eventually determine the success or failure of census processing. Census forms should be very carefully designed so as to minimize processing errors.

The statisticians and data processing personnel should discuss and decide together whether to include more fill-ins (or handwritten) or more mark fields (check boxes), or a balance of both in the census forms. Mark fields are very accurate while handwritten entries have lesser recognition rates.

4.4.3 Use of ICR Software

The interpretation/recognition engine is the heart of ICR technology. It has been observed that during the processing of censuses in various countries from 2000, the recognition rates for mark fields is almost perfect while those of handwritten fields are much lower. Overall, the rate of interpretation/recognition ranges from 90% to 95%. The speed of interpretation is between 3,400 and 3,900 forms per hour.

Although recognition rates are high, most questionnaires still undergo verification. The rule to undergo verification is for a questionnaire to have at least one erroneous field. Verification provides an opportunity to correct the erroneous field. The rate of verification ranges from 280 to 370 forms per hour per verifier.

4.4.4. Image capture/scanning

The quality of form images is crucial to ICR-based processing. More than 7 million forms will be scanned using a mid-high-volume scanner. Due to the voluminous forms scanned, the quality of images is affected when dirt accumulate and embed lines in the image forms. Daily cleaning and monthly preventive maintenance ensured good quality of images and minimal downtime of document scanners.

4.5. Pilot projects

At least 2 pilot projects should be carried out to test the appropriateness of the use of ICR in the census data entry process.

The first can include 7000 households, and data entry can be limited to Latin characters only. The main problems to be identified during this pilot project can be the inappropriate design of the questionnaire that might lead to inaccurate filling of the form.

After the redesign of the form and the register, a second pilot project can be conducted by using 50,000 households. This pilot project should assess, besides the revision of the IT organisation, the use of Cyrillic characters. The recognition process should use a developed module to recognize Cyrillic characters. The recognition rate¹ of the pilot project should be satisfactory and encouraging.

5. Outsourcing

The IT Group analysed the situation in the statistical institutions in BiH (insufficient number of staff, time necessary for implementing the Census, ICT equipment; budget problems) and based upon experience, the IT expert recommends outsourcing of “hard tasks” from scanning of questionnaires to the output files (image, txt files) ready to be entered into databases. Moreover the printing, distribution and collection of the questionnaires should be outsourced. The SWOT analysis was conducted. This analysis detailed better the weaknesses which were more than the strengths. The opportunities of the outsourcing were discussed, too.

5.1 Weaknesses

- Insufficient number of trained/experienced staff,
- Lack of equipment,
- Lack of spacious and secured premises,
- Time too short,
- Delay in drafting the census law,
- Weak coordination and decision-making,

5.2 Opportunities (general)

- Collaboration among institutions
- Equipment
- Experience
- Publicity

5.3 Opportunities (Outsourcing)

- Reduced costs
- Equipment (that can be left after the census)
- Experience (faster learning)
- Web site

The members of the IT working group agreed to the outsourcing, but to the different extent. There is an agreement regarding complete outsourcing for the following activities: Printing, distribution and collection of the material (questionnaires); Premises with infrastructure needed; Training and education.

As to the outsourcing from the scanning to the output files (image, txt), the members of the IT working group do not share the same views. The representatives of the Agency for Statistics

¹ Recognition rate is the proportion of data that is automatically accepted.

of BiH and Institute for Statistics of Federation of BiH agree with the recommendation of the IT expert, while representatives of Institute for Statistics of Republika Srpska do not.

6. Recommendation outlines

1. The Census must be ruled as a national law as soon as possible;
2. Time is a real limiting factor. Generally for a Census three years are needed. Therefore the SIs should proceed as a real 'task force' to prepare the pilot projects and the final census;
3. Centralization vs. decentralization should be decided soon and be effective. In any contest Brcko District should be linked to BHAS;
4. The questionnaire must be restyled and barcode in each page is needed;
5. The personnel is not enough to carry out seriously the census. Therefore the tasks should be well defined and for each task the trained needed should be indicated;
6. A good and strong coordination is needed;
7. Theoretical and practical training is compulsory. The local trainers need to be trained, too;
8. The census needs a big, well kept, secure with anti fire systems, etc. place(s);
9. At least the scanners with the scanning SWs (questionnaire-to-text(ASCII)) should be rented or outsourced;
10. Some programmers can prepare in Visual Basic the data verification and tabulation (text to database) software.

7. Conclusion

Using ICR technology is a progressive step, which shortens the data processing time and therefore the period from field level data collection to the production of reports and other dissemination applications. The leading up to data collection time will be extremely useful as it allows the IT team to develop and comprehensively test the data processing applications before data collection starts. It is expected that data entry and tabulation will be complete within 6 months of the end of data collection which will enable the team to produce the census documents and disseminate the census results in an acceptable time.

The followings should be considered:

Selection of IT equipment. It is necessary to consider technical specifications in the process of selection of equipment. All IT equipment to be purchased for the Census purposes should be the most contemporary one and be able to meet the time frame set for the implementation of the 2011 Census and other surveys in BiH.

Needs analysis in relation to hardware, software and services for conduction of the Census 2011. The draft of the tender should be prepared as soon as possible. For this purpose the centralization or decentralization of the IT activities should be clarified. A draft cost of the SW/HD equipments with a separate indication (centralized/decentralized) is in annex 2.

Centralized/Decentralized, characteristics of each approach. This issue is very important and must be clarified soon. BiH is a small country and the most feasible approach is the centralized one. This can be shown from the analysis of the followings:

Centralized approach:

- The costs are lower – see attached annex 2;
- Increased data security;
- Common database;
- Reduced number of personnel involved in the implementation of the of 2011 Census;
- Responsibility is located in one place;
- Reduced number of possible errors.

Decentralized approach:

- Involvement of local staff (a larger number of employees from the entity statistical institutions will be involved);
- Due to reduced quantity of the Census forms, it will be easier to receive the forms from the field;
- Higher costs for IT support (hardware, software, communications)- see annex2;
- Responsibilities and tasks are distributed but need more coordination.

Data entry. The manual data entry is not the option to be chosen. There are several reasons which support the stand. The most important ones are listed:

- Time for data entry and data processing is prolonged;
- It is necessary to engage much larger number of operators and IT staff;
- The possibility of error is increased.

8. Challenges

Several problems might arise during the preparation phases of the ICR/OCR implementation. The following restates the challenges:

A – Designing of documents

Some points should be taken into consideration:

- The paper quality.
- Using trial and run method is the best way to choose the suitable dropout colour.

B – Selecting the scanner

The type of scanner depends on :

- Speed.
- Ability to handle a large number of pages.
- Duplex (read both sides in the same time).
- Resolution.
- Driver and interface.

C – Choosing the image software

Many types of imaging software are available in the market and each with different degrees of accuracy, some modifications may be necessary with census data processing. Pilot tests are

important for testing different engines for choosing the most accurate one for the 2011 population census.

D – Variation in hand writing

Due to variations in hand writing a special training program for enumerators is required to ensure they fill in the forms using ICR friendly characters. The recognition rate must be as high as possible to minimize manual data verification, and corrections.

9. Training/education

It is concluded that it is necessary to start with the trainings of ICT staff as soon as possible. First of all, it is necessary to train ICT staff and select those among them who could be used as trainers to the others, later.

10. Controls and verification of data

The IT expert briefly presented errors which occur in the process of data processing, correction of errors and rejecting of questionnaires.

11. Document Management System (DMS)

Presentation of DMS basic elements and processes. It is recommended to introduce the DMS in the Census process. The IT working group will learn more about the concrete DMS and decide which software will be used for the Census needs. For the next meeting, each member of the IT working group is tasked to learn more about the software. The representatives of all three statistical institutions in BiH are tasked to prepare a presentation on their proposed solution for DMS.

12. Dissemination and communication

The importance of dissemination and communication during all census activities is pointed out. The recommendation of the IT expert is that one or two persons should deal with communication, which implies public relations. The preparation of an interactive Web site for the data dissemination/communication was discussed and agreed.

13. Calendar of activities

In order to create a quality plan of activities of the IT working group, it is necessary to have an urgent meeting with the Working group for methodology and organisation of the Census. The coordinator of the IT working group is tasked to organise this meeting as soon as possible.