

# **Field Test of Integration of Palm Computer-Collected Data with a Geographic Information System Database for the Republic of Indonesia**

*Courtenay Teska*

Senior, Computer Science Major  
University of Wisconsin-Parkside, Kenosha, WI USA  
Phone: +1 262 632-7203 Fax: +1 262 632-3685  
Email: courtenayt@visto.com

**Presented at SIRC 2000 – The 12<sup>th</sup> Annual Colloquium of the Spatial Information Research Centre  
University of Otago, Dunedin, New Zealand  
December 10-13<sup>th</sup> 2000**

## **ABSTRACT**

Deputy Minister Lalu Sudarmadi wants to develop a cutting-edge geographically-accurate population/living standards database that can be cross-cut and analyzed multi-dimensionally. This will allow his government to better plan and provide services to citizens and encourage sustainable economic development in locations with both need and resources; will provide a clearer picture of what areas are in need of particular services (e.g. elementary schools), or incentives to change behavior to help reduce future population-related problems; and will help organizations like the Red Cross and the United Nations focus their efforts effectively. To create a comprehensive technological means of acquiring and analyzing data requires a simple and reliable means to collect field data digitally rather than manually. Transferring data to the GIS database system for further spatial analysis is also needed. This ongoing Indonesian project is focused on the integration of palm computer-collected data with the PopMap GIS system which is designed and distributed by the UN for developing countries. The background of this project will be provided, and the challenges and successes encountered in field-testing a pilot system for digitally collecting field data in urban and rural settings will be presented.

## **1.0 INTRODUCTION**

The Republic of Indonesia has the fourth largest population in the world. Establishing and maintaining sustainable population growth is a vital issue to this country. It is deeply intertwined with issues of quality of life, sustainable economic development and protection of the environment, which in turn play a key role in the stability of the country. The government agency charged with creating sustainable population growth and monitoring the well-being of each family is the Badan Koordinasi Keluarga Berencana Nasional, BKKBN. A nation-wide means of assessing each family's progress toward prosperity has been established by BKKBN, volunteer field workers go door-to-door interviewing their neighbors about their use of contraceptives and their standard of living. Regional offices collect the information and forward it to BKKBN and the Coordinating Ministry of People's Welfare and Poverty Eradication (formerly the Ministry of Population). Bapak Lalu Sudarmadi is Sekretaris Utama, first secretary, chair for BKKBN, and second in line to State Minister Ibu Khofifah Indar Parawansa. The magnitude of the challenge BKKBN faces is awesome: Indonesia is comprised of more than 17,000 islands, more than 400 distinct ethnic groups, and nearly 400 languages. Every ethnic group has its own customs, traditions, community, and religious beliefs. Cirebon Regency, West Java, is one of five

regions where the Indonesian government and the United Nations have established a pilot project to enter manually-collected field data into a database on a networked MIS computer system. The data entry process is extremely time-consuming and inaccurate, and frustration with it has led the First Secretary to a vision of a comprehensive technological means of acquiring and analyzing population data. I began working with Bapak Lalu as a volunteer on the project during the summer of 1998.

## **1.1 Purpose**

The purpose of this extended abstract is to document the process I have undertaken to accomplish piloting and field testing the computerization of house-to-house collection of family planning and living standards data in The Republic of Indonesia.

## **2.0 PILOT SYSTEM DEVELOPMENT**

Completed in April, 2000:

- Learning Indonesia's present paper-based system
- Acquiring and learning PopMap, the GIS system designed and distributed by the United Nations to developing countries and used by BKKBN
- Defining and verifying hardware and software criteria and design parameters
- Deciding whether to use form development software to program the paper system or to develop original software
- Hardware equipment search, software search
- Programming selected computer to replicate the present paper-based system using Pendragon Forms TM software
- Running data tests on palm computer forms
- Testing data transfer from palm computer to BKKBN PopMap GIS program connecting family planning and living standards data geographically via city or town name

## **3.0 FIELD TEST**

Completed in August, 2000:

- Defining scope and key determinants of field test
- Developing volunteer field worker training approach and field test evaluation methods
- Learning culturally appropriate approaches to field testing
- Obtaining authorizations and support at all levels of BKKBN
- Conducting tests with field workers in both urban and rural settings
- Attempting data transfer from rural and urban tests from palm computer to the PopMap GIS program
- Evaluating results and drawing conclusions

I began field test planning 15 May 2000. Meetings with BKKBN officials and computer technicians began in Jakarta with Bapak Lalu on 28 June. Training and field tests took place between 15 July and 16 August in the village of Kanci, a largely peasant population of 6,000 in the township of Astanajapura, Cirebon Regency, West Java, and in the city of Cirebon, West Java, population 250,000. Field test review by Bapak Lalu and discussion of next steps occurred on 30 August, 2000.

## **3.1 Key Field Test Determinants**

Whether or not development of a paperless data collection system could progress successfully beyond creation of an initial prototype unit was dependent on whether or not workers, including those meeting the minimum BKKBN education and skill level requirements, would accept the system and could learn to operate it; whether interviewees would be too intimidated by the technology to provide useful data; whether palm computers currently on the market were capable of acceptable performance in an Indonesian field environment and if data collected on the palm computer could be transferred to the PopMap GIS program at the BKKBN city and county offices.

### **3.1.1 Volunteer field worker acceptance**

Investigate: Are all of the volunteers literate? What reading and writing capability must be accommodated? Does the equipment intimidate them? Is the palm computer too difficult for them to learn to use? Does the program I created seem similar enough to the paper forms to satisfy them? Does the program I created successfully replicate the paper forms in actual use? Are the letter shapes required by Palm to record handwritten data too complex for them to remember? Is Indonesian handwriting legible to the software? Does the occasional use of English words in places that the form software didn't allow me to change too confusing/distracting? How long does it take, on average to train a volunteer field worker? How many can be trained at once? Is a trained field worker able to train others or is it necessary to have a BKKBN official conduct all training? How long does it take for a trained field worker to become completely comfortable using the palm computer instead of the paper forms? Once completely comfortable, does it take them the same amount of time, less time or more time to collect data using the palm computer than using the paper forms?

I conducted three types of training: group, individual, and on-site. Field workers came to the field test with a wide range of educational backgrounds, varying levels of understanding of how to enter data on the paper forms, and differing degrees of confidence in their ability to learn to use the palm computer and the paperless forms.

Within three hours, two of which were spent on introduction and group training, even the least confident were able to conduct a full family interview and successfully record all data on the palm computer.

An essential element in gaining field worker acceptance was doing a point-by-point comparison of the computerized forms and the paper forms field workers were accustomed to. I designed the computer program with a simple user interface, using as many buttons and pop-up menus as possible. However, some information, like the name of the interviewee, required text input. As I suspected, the largest technical difficulty for the field workers was remembering the specialized calligraphy required for text entry on a Palm TM computer. During training I gave each field worker a reference sheet to help them learn and remember the specialized calligraphy. My hope is that by the time full implementation of a paperless data collection system occurs, better handwriting recognition for palm computers will be affordably available.

The on-site field worker training took place in the homes of actual interviewees, sometimes a single person, sometimes as many as 15 people divided into 3 family units, all living in one house. It was during this phase of the field tests that I gained the most insights about changes to the program that might improve the user interface and the accuracy of data collected.

### **3.1.2 Interviewee acceptance**

Investigate: Does the equipment intimidate family members? Confuse them? Distract them?

Interviewees gave no detectable indication that the technology affected their participation in the data collection process.

### **3.1.3 Acceptable equipment performance**

Investigate: Does the equipment I chose tolerate the heat and humidity and torrential rains of Indonesia? Does the charge last long enough to cover a typical round of family interviews? Is recharging practical? If the palm computer crashes, how much data is lost? Can anything be done to recover the data after a crash? If the data is recovered after a crash, can it be recovered in an easy enough way for the volunteer field worker using the palm computer to do it without help?

Without a case, stored in pockets, handled by up to a thousand people, used by up to one hundred people, the unit functioned reliably in 95°F, 90% to 100% humidity and in very dusty conditions for two months, the normal time span of data collection. Two total crashes unrelated to the environment occurred; all data survived both. Charge was sufficient for a full round of field worker home interviews each day, but a system for recharging on a daily basis will have to be developed.

### **3.1.4 Data transfer ability**

Investigate: What is the current process for data entry? How many people do data entry? How many hours does data entry take? How many computers are available for data entry? What data is entered into the computer? How is the information collected linked geographically? What method does BKKBN use to collect its geographic information?

At both the city and county levels of BKKBN data entry practices were not standardized. Unlike indicated by BKKBN's central office, the PopMap GIS program was not yet being used at the lower levels of BKKBN. This made the test of data transfer between the data collected on the palm computer and the PopMap GIS program impossible to attempt during this field test. Instead this portion of the project has been moved to the next steps where a new system of data transfer will need to be developed based on the final product produced by IBM for a new MIS for BKKBN focused on standardizing the computerization of all levels of BKKBN from the central office through the city and county. Currently no decision has been made on whether the PopMap GIS will still be used for the project or if the IBM MIS will incorporate its own geographic information component.

Currently the only level of BKKBN using the PopMap GIS is the central office in Jakarta. Their geographic information is entered from the recapitulated data received from the BKKBN offices in each of the provinces and the data is linked geographically by province. This process gives a very general information base of what regions of the country are in need of what services, but does not begin to get near the level of detail needed to help identify individual communities or families in need of services.

## **4.0 FACTORS THAT COMPLICATED THE PROJECT**

- Need to maintain communication with the Ministry in Indonesia to assure each decision made was in accordance with its plans and desires, which involved considerable translation work at each step
- The first democratic elections in more than 30 years last year resulted in major changes in personnel in the Cabinet, dissolution of the Ministry of Population as it was previously organized, and decentralization of BKKBN; during my field tests an attempted impeachment of the President, a high security alert that required I develop an evacuation plan, and a Cabinet reshuffle potentially affecting the Ministry all occurred
- The time it took to set up appointments and formally meet with 20 officials at various levels of BKKBN
- Discussion of the totally new MIS system being commissioned from IBM by BKKBN surfaced a number of previously unrecognized problems to be resolved, i.e. data storage, recapitulated vs. actual data, as did planned changes in some data to be collected beginning in February 2001
- Cirebonese, Sundanese or Javanese were spoken by some field workers and many interviewees rather than the national language, Bahasa Indonesia which I am more familiar with

- Volunteer field worker education backgrounds ranged from elementary school through university, and training had to be comprehensible to all and condescending to none
- Some field workers don't fully understand how to use the very complex paper data collection system
- No reliable information on how many volunteers in each locale normally do data collection as opposed to other volunteer BKKBN jobs was available, making it impossible to ascertain whether all appropriate field workers at each site were trained and assessed
- Jam karet - rubber time, meaning that punctuality is not of great importance and meeting time and dates with BKKBN officials and field tests did not occur on my original schedule
- Distraction caused because I am a Caucasian which led to large crowds forming for field tests not typical in a normal family interview session
- Lack of standardization of computer programs used for data entry (each office I visited used a different database or spreadsheet program for entering data into and some offices used different programs on each of their computers)
- New MIS is still under development by IBM and no specifications of MIS functionality or specifications were available at the time of the field test

## 5.0 EVALUATION METHODS

Every step of the field tests was digitally videotaped, and the tapes are available for viewing upon request. These were the most valuable method of evaluation, because they are open to assessment by anyone for any purpose. They were of great importance to the First Secretary in deciding upon the first two of the key determinants, field worker acceptance and interviewee acceptance. The following chart illustrates which methods were used to evaluate what aspect of the project, and my and the First Secretary's assessment of the effectiveness of each. A questionnaire is the only method I would not use again in Indonesia.

Evaluation Methods Employed	Applied To										Effectiveness 1=hi 3=lo
	A	B	C	D	E	F	G	H	I	J	
Questionnaire	•					•	•	•	•	•	<b>3</b>
Video tape	•	•	•	•	•		•	•	•		<b>1</b>
7 pt. rating scale assessment	•			•	•		•	•	•	•	<b>1</b>
Assistant assessment	•	•	•	•	•		•	•	•		<b>2</b>
Group discussion	•		•			•	•	•	•		<b>1</b>
Unsolicited feedback -- direct	•		•	•	•		•	•	•	•	<b>2</b>
Unsolicited feedback -- indirect			•					•	•		<b>1</b>
First Secretary Review	•	•	•	•	•	•	•	•	•	•	<b>1</b>

**A** Field worker acceptance **B** Interviewee acceptance **C** Group training sessions **D** Individual training sessions **E** Field worker capability in the field **F** Equipment performance **G** Changes to program **H** Which field workers would make the best trainers **I** Whether to proceed to next steps **J** How to proceed with next steps

*Figure 1: Effectiveness of each type of evaluation method used during the field test*

## **6.0 CONCLUSIONS**

Key benefits to the Ministry of implementing a paperless data collection system will be 1) a dramatic increase in the accuracy of data collected and 2) the elimination of time-consuming manual recapitulation and data entry by paid BKKBN workers who will be freed to take on higher level responsibilities. Subsidiary benefits, which pertain directly to the Ministry's poverty eradication objectives, are identification of leadership/management potential and skill development (computer use, ability to train) among the populous.

Use of palm computers by fully trained field workers will actually save little time at the data collection point, although that finding is contrary to field workers' perceptions. Saving time at the data collection point is not an objective of the Ministry, because time spent on data collection is not a Ministry expense. However, enhancing the job satisfaction and the local prestige of volunteer field workers are objectives of the Ministry, and evaluation results indicate implementation of a paperless data collection system will accomplish both.

## **7.0 NEXT STEPS**

Make changes to system to accommodate field worker suggestions and problems

Develop a data download methodology after the new BKKBN MIS system being developed by IBM to the First Secretary's specifications is finalized

Make changes to system to accommodate new questions to be asked in the next data collection cycle

Evaluate new palm computer models and brands to locate equipment even better matched to the criteria: affordable, reliable, stable, suited to environmental conditions, and excellent handwriting recognition

Evaluate whether to create totally new software for the palm computer forms

Determine the best approach to implementing paperless system while minimizing the amount of change in procedure and still allowing for an efficient and sustainable system to be put in place

Develop and test new process for data transfer between palm computer and the new MIS being developed by IBM as soon as system is available

Prepare for a second field test to assess a new set of elements

Integrate use of GPS connected to palm computer for collecting geographic information on where family planning and living standards data is being collected

## **ACKNOWLEDGEMENTS**

Rita Juwita, my friend and project assistant, helped me at every turn. I would also like to thank Bapak Iwa Kartiwa, dra.Byarlina Gyamirti Msc, Bapak Bambang Marsudi, Bapak Maman Sundjana and all of the BKKBN field workers and officials who continue to help me.