Using PDAs for Data Collection

Lessons Learned and Recommendations

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Executive Summary

In 2005 and 2006, three Population Services International (PSI) programs – Madagascar, Rwanda and Kenya – piloted the use of personal digital assistants (PDAs) as data collection tools during field surveys. PDAs were found to be efficient in replacing paper questionnaires and audit sheets during Tracking Results Continuously (TRaC) and Measuring Access and Performance (MAP) studies. Despite the important initial setup costs due to the high price of equipment and due to the need for specialized training, the use of PDAs reduces the costs of data collection. Furthermore, they provide high quality data in a fast and reliable manner. This paper describes these experiences in the form of a number of lessons learned document organized into three sections:

Preparatory Stage

- The appropriate type of PDA and accessories are required in order to fully benefit from the advantages of PDA data collection.
- Choosing appropriate software packages is essential in order to create data entry forms for PDAs.
- Training of skilled PDA programmers is key.
- PDA form building is often time consuming.
- Testing of the tool is needed during the entire programming phase, and its importance must not be underestimated.
- Comprehensive training of interviewers requires more time than traditional interviewer training.

Using PDAs in the Field

- PDA data collection requires detailed logistical and field planning.
- Interviewers need to avoid fear of technology among respondents.
- The comfort of data collection and quality of data are greatly improved.
- Supervision and safeguarding systems are essential.
- PDAs require trustworthy, responsible interviewers and a specific security system.
- Interviewers and supervisors need access to sufficient troubleshooting documentation.

Data Management

- Data collected in the field is rapidly available for analysis.
- PDA-based data collection improves the quality of the dataset.
- PDAs are best suited for multi-round research applications: TRaC, MAP, Framework for Qualitative Research for Social Marketing (FoQus), exit interviews.

Based on these PDA experiments, the PSI Research Division recommends that:

a. All PSI countries should consider the adoption of PDAs as a standard tool for field data collection for all relevant applications.

b. Wherever PDAs are available, countries should use them for all their quantitative studies that require data to be collected in the field. Non-research applications of PDAs should also be tested over the coming year.

c. PSI Research Division, REsuITs Initiative, and country staff are responsible for the skills building of technical experts who will act as focal points for the implementation of PDAs.
globally throughout PSI. Capacity building also includes the development of a curriculum for an introductory training to PDAs and a curriculum for the technical training of PDA programmers.
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Introduction

One of the main activities of Population Services International (PSI) researchers is to conduct field surveys in order to gather data for Tracking Results Continuously (TRaC) and Measuring Access and Performance (MAP) studies, which are required to produce PSI’s dashboard tables. Due to the large number and often considerable size of these surveys, a significant amount of financial resources is spent each year by PSI programs simply to collect data. As a result, several programs have identified means of cutting down these costs, most noticeably by introducing the use of personal digital assistants (PDAs) for data collection in the field.

PDAs are small pocket personal computers (or “hand held computers”) that are made up of a touch screen, a processor, memory, and a number of network functionalities. They include a number of “light” computer utilities such as Word, Excel, a calculator, and various file viewers (e.g., PDF files, images). Besides these basic functionalities, PDAs usually also contain a number of communication and multimedia utilities allowing for the viewing of video clips and for the playing of music files or Flash animations. They can be tailored for highly specific uses such as mobile mapping applications, provided that a GPS (Global Positioning System) extension or an internal GPS receiver is available. The ability to upload data entry forms into a PDA and to subsequently transfer data collected to a database on a desktop personal computer (PC) make pocket PCs highly suitable for collecting survey data in the field. The equipment was found to significantly reduce the financial costs and the human resources that are required for TRaC and MAP data collection, while at the same time improving the quality of the information that is collected.

PDAs were used for the first time in a PSI country at the end of 2004 during a TRaC study in Madagascar. The main reason for adopting this innovative data collection tool was that the research department was spending considerable time and important financial resources on the collection of data in the field for its various research studies that were being carried out by the program. Moreover, there was a need for a flexible tool that could easily store and manage large volumes of field data from a wide range of surveys and at the same time ensure a high level of quality of the data – all aspects which are insufficiently handled when using traditional paper questionnaires and manual data entry procedures. Since its first PDA experience, PSI/Madagascar’s research department has used its PDAs during all major quantitative surveys (i.e., several TRaC studies and two MAP studies). During 2006, two additional countries, Rwanda and Kenya, piloted the use of PDAs for TRaC and/or MAP data collection. More countries are expected to follow in 2007, including PSI programs that will use PDAs for routine data collection by their sales teams, something which has not yet been piloted within PSI.
This paper describes the experiences from these countries and highlights the various lessons learned about the use of PDAs as data collection tools for MAP and TRaC surveys. It is largely based on the individual experiences as documented by the three pilot countries. The various lessons learned have been divided into three main categories: preparatory stage (before data collection), using PDAs in the field (data collection), and data management (after data collection). Finally, this document provides recommendations on the use of PDAs by PSI programs.

Box One: Implementing PDAs in PSI/Rwanda

“Due to the novelty of using PDAs, our first experience was bumpy and exhausting. We would like to share our lessons learned with you to help ensure that your first experience is smoother and less demanding than ours was.”

In the end of 2005, PSI/Rwanda decided to make the switch from conducting paper-based research surveys to conducting PDA-based surveys. The decision was made both for the expected cost benefits over time and for the expected improved quality of data. PSI/Rwanda began its PDA experience in November when we began the procurement process for the PDAs via PSI/Washington. We submitted our initial request in the beginning of November and received the PDAs by the beginning of December. In early December, our two regional researchers, Virgile Capo-Chichi and Edouard Talnan, and PSI/Madagascar’s PDA expert, Jacky Raharinjatovo, came to Rwanda to train us. Virgile and Edouard retrained us on TRaC/MAP surveys and helped us with our questionnaire. Jacky taught our programming team the ins and outs of programming. He then helped us to start programming our questionnaire. He stayed a total of 14 days in Rwanda, and we appreciated every minute of his time. In fact, we could have benefited from even more of his time and expertise overseeing us and correcting our errors as we began programming our first PDA questionnaire. By mid-December, we were on our own programming the PDAs. The process of learning-by-doing coupled with constant changes on the questionnaire side meant that it took us two months, working nights, days, and weekends, to program our first questionnaire. Programming took us all the way through January, and we finally launched our TRaC/MAP Family Planning, Malaria, Sûr’Eau survey in mid-February 2006.
Lessons Learned: Preparatory Stage

The following lessons apply to the stage prior to the actual data collection in the field, which includes the choice of appropriate hardware and software, the training of programmers and users, the programming of questionnaires or audit sheets as forms, and finally the pre-testing phase.

- **Lesson One: An appropriate type of PDA and accessories are required.** A large number of brands and types of PDAs exist on the market from the extremely sophisticated to the very basic. PDAs used for research require very specific capabilities and exact types of software. The available memory, operating system, quality/size of the screen, and writing (keyboard) functions are all very important features to ensure that the PDAs will be able to handle long questionnaires and relatively large data volumes.

PSI is currently using the Dell Axim X51v with stylus as this was found to be a suitable model, and it is also used by the CDC in several countries. In addition to the PDA itself, the following PDA accessories are a must:

i. A principal and a back-up battery. The batteries should have a shelf life of a couple of days and should be useable for at least five to eight hours, such as the 1100mAh batteries for the Dell Axim X51v. Backup batteries are required especially in countries with electricity problems. They should ideally be 2200mAh batteries since these provide double the amount of power as the basic type of batteries.

ii. A 256 MB additional memory card such as the Sandisk 256 MB Memory Compact Flashcard. The need for this will be explained in further detail later.

iii. A cradle and charger with an appropriate plug or adaptor. A car charger may also be needed depending on the availability of power in the areas where the survey takes place.

iv. Accessories for syncing the PDA with a desktop computer or laptop (computer connector or USB synchronization cable).

v. Preferably a hard case that can clip onto a belt. It can be critical to purchase waterproof, shockproof "otter boxes" for each individual PDA which are around $100 each. Having a bag of some sort that can protect the device from the elements as well as accidental dropping and rattling around in the back of a 4x4 is important as well.

vi. A lanyard so that the PDA can be put around the neck for security reasons.

vii. A backpack and/or fanny pack so that the PDA can be put away when not in use.

viii. Surge protectors to protect the PDAs from being “burnt” by electrical surges, especially if a country has unstable electrical flows.

ix. GPS receiver if needed. Some PDAs come with an internal GPS receiver, and others support a GPS extension (external) which needs to be purchased separately. It is also possible to use independent hand held GPS units (like the Garmin eTrex) and record coordinates in the survey form. However, it appears that PDAs that are connected with a GPS unit are easier to handle, and all GPS programs can be run from the PDA. There are
also advantages to having separate devices; for example, the fact that the GPS units can be used along with traditional paper audit sheets for short MAP surveys is an advantage. It also means that programs which already have a pool of GPS units can continue using these and do not need to invest in GPS extensions.

x. Extra styluses are recommended because they can break and are easily misplaced. It is important to budget for this in order to provide the teams with spare styluses to avoid the use of toothpicks/grass stalks and nails when operating the PDA/GPS.

Box Two: Power Issues and Charging PDAs in PSI/Kenya

“Since PDAs have to be charged daily, it is important that field teams learn about saving power.”

PSI/Kenya learned that battery usage varied by how enumerators handled their PDAs. Those who kept the backlight on (sometimes to avoid the freezing-up of GPS program and signal) spent more than 60% of their battery power in one day. Those who did not keep their backlight on spent about 40% of their battery power in one day. With such low battery levels, backing up can only be done when PDAs are connected to AC power. Field staff need to learn how to save power. The inclusion of extra features in the PDA (such as games, phone, music, etc.) would most likely increase power consumption levels. However, with 100% power, one can map and conduct interviews for a day (10 hours). In areas with no electricity or frequent power interruptions, charging the PDAs can be challenging. With 40% power remaining, fully charging the unit back to 100% can take one and a half hours. It is worth noting that when operating on below 40% power the device can freeze. Booting it up will only be possible after it has been charged. It will be very important to continue renting vehicles for fieldwork with PDAs for charging them. Also, it will be important that the vehicle charger receptor functions properly.

- **Lesson Two:** Choosing the appropriate software packages is essential. Several types of software applications are needed in order to operate the PDAs efficiently. The main software component is the operating system, which is usually Windows CE for Pocket PC or Windows Mobile made by Microsoft. The developing software is equally important since this is required for the PDA form development. PSI has been using Visual CE, which is an application that contains a database and an extensive form building tool. In order to be compatible with Visual CE, the PDA must have a function that allows it to create tables. If your PDAs are not compatible with Visual CE, you will not be able to run the software used to create the questionnaire on the PDA (note that some PDAs may require the use of a patch in order to update them so that they are compatible and that they can function with Visual CE). Visual CE in turn is compatible with Access which is compatible with SPSS. This compatibility is very important in facilitating the extraction and transfer of data into these programs for data cleaning and analyzing.
In order to connect a PDA to a computer, it is necessary to install the ActiveSync software (by Microsoft). Additional software that may be required is related to the multimedia functionalities of the PDAs: the BetaPlayer may be used for playing video clips (e.g., advertisements for PSI products), and the Windows Media Player (part of the basic Windows CE package) can play audio files such as radio advertisements (provided that they are in a common file format like MP3). Finally, it should be noted that it is necessary to purchase software for business/multi-users since most PDAs come with individual-user software rights and since the software will be used multiple times by multiple users.

- **Lesson Three: Training of skilled PDA programmers is key.** When conducting a survey with PDAs, it is important to have one or more persons who know how to use the form building software and, generally, how to deal with all data management operations related to PDAs (before and after data collection). Because PDA programming can be pretty challenging, it is very important to identify the appropriate staff to be trained as “PDA programmers”. Even though the PDAs will be used presumably by the research department or sales team, it is often beneficial to include IT staff in the PDA training. The machines are quite technical, and PDA programming requires good IT skills, including knowledge of relational database management systems. Knowledge of programming language and of logic commands are added values for those who will be responsible for the form building. The more programming/database experience the team you are training has, the faster they will understand and be able to program the PDAs. In the case of PSI/Rwanda, it was found that it was extremely beneficial to train a mix of IT staff and research staff. Assuming you have a good IT staff, by including them, you are ensuring the capacity to not only implement what is taught during the training, but also to troubleshoot and find solutions for how to program more difficult questionnaire designs. At the same time, however, some research staff also need to be trained in programming in order to bridge the gap between research questionnaire needs and programming questionnaire needs. A researcher who has been trained in questionnaire programming will be able to organize the questionnaire in an appropriate manner for programming needs, and the research team will be less dependent on the IT staff. Standardized training materials for programmers are currently not available, but the PSI Research Division intends to develop such documentation in the near future.

- **Lesson Four: PDA form building is time consuming.** Initially, questionnaires or audit sheets are created in the traditional way (i.e., as if they were designed for printing). After the questionnaire has been developed, a corresponding form needs to be built in order for it to be compatible with a PDA. In both Madagascar and Rwanda, programming of the PDA forms for
the first time required substantially more time than anticipated. As a general rule, these first form building experiences are part of the learning process and programmers become more fluent each time they generate new forms. While in Madagascar the entire process was managed by the research team, in Rwanda the introduction of PDAs required close collaboration between research and IT staff since the latter were responsible for form building and other technical aspects. While designing the questionnaire, the research team needs to work with the programming team (if they are different) to think through how the questionnaire will be programmed. Programming skip patterns and questions that have range checks or other restrictions require more programming than simple questions, though one of the strengths of PDAs is precisely that it greatly reduces errors related to skip patterns and quality checks. The more complicated the questionnaire design and its questions, the more time it will take to develop the form. The person or team designing the original questionnaire should keep this in mind. If possible, it is best to have the questionnaire designing team work with the programming team to create the best and simplest questionnaire before programming begins. In order to avoid programming errors, it is necessary to first test each module of the questionnaire. As a general rule, program managers should also be intensely involved in working with researchers to ensure that the baseline questionnaire will answer all of their questions and respond to their donor requirements. The questionnaire should respond to the indicators that are part of the logframe as well as respond to other programmatic questions.

Box Three: Form Development in PSI/Rwanda

“Each time you program a questionnaire for a PDA, it is as time consuming and complicated as creating an Access database. Be nice to your programmers, especially the first time around!”

Due to how difficult it is to program a questionnaire, it is absolutely imperative that the questionnaire be 100% final before given to the programmers. PSI/Rwanda learned this the hard way by finalizing the questionnaire at the same time as programming. The process of learning-by-doing coupled with constant changes on the questionnaire side meant that it took us two months, working nights, days, and weekends, to program our first questionnaire. Programming a questionnaire for the first time will always be long, but it will take a significantly longer time if changes are being made to the questionnaire while it is being programmed. Thus, while the pilot of the questionnaire will always unearth some changes that need to be made, the questionnaire should not be changed once given to the programmers before the pilot.
Lesson Five: Testing of the PDA forms is needed during the entire programming phase, and its importance must not be underestimated. Because programming is difficult, a PDA form initially often contains some glitches and errors. It is, therefore, very important to schedule enough time to test the forms before and during the pilot. Testing the forms means trying out the different ways the questions can be answered to ensure that every answer pattern works correctly (in terms of skip patterns, range checks and logic tests, coherencies, etc.). Writing down all the different possible scenarios and then testing them one by one in the PDA in a detailed and logical manner was found to be very helpful. It is time consuming but very important.

Testing is preferably done in two stages: (1) during the PDA form development process and (2) during the pilot field test. In order to save time, testing during PDA form development should be done by a person other than the programmer so that the latter has feedback after the testing of each module. A pilot in the field will also help unearth some final glitches in the electronic questionnaire. Before the team goes to the field for the actual data collection, you want to ensure that enough testing of the questionnaire has happened to feel comfortable that the interviewers will not find themselves blocked by the machine due to programming errors. Such blocking, if not corrected, forces interviewers to purposefully input incorrect data to avoid the block, which ruins the quality of the data. So, it is very important to uncover all the programming errors before sending the teams to the field. It may be wise to include the supervisors and data collectors in the pilot and to do the test in a single area. After each module is checked at least once during the programming phase, the complete PDA form needs to be checked. It may take one or two days to identify and subsequently correct programming errors in the final forms. If this is done along with the supervisors, then this process will also improve their PDA skills, including their knowledge about backup procedures since these are also part of the testing phase. It is indeed essential that supervisors know how to avoid losing data.

Lesson Six: Training of interviewers requires more time than traditional interviewer training. Due to the very different nature of PDA forms as compared to paper questionnaires, it is absolutely essential that data collectors are provided with sufficient training before starting field work. Unlike paper-based surveys, PDA-based surveys require use of expensive, technically complicated machines. Many interviewers will probably be unfamiliar with PDAs and probably have never seen one. Training these interviewers, therefore, requires time and patience and must not be underestimated. In addition to the “traditional” training on the contents of the questionnaire or audit sheet on respondent selection criteria and other typical topics, the interviewers need to learn how to manipulate a new tool. It will be important to continue to train
assistants on the objectives of each question in the questionnaire before introducing the PDA so that the PDA does not take center stage in the training. In other words, the training for field staff must be as comprehensive as possible to include all major components: methodology, questionnaire, translations, pre-test logistics, and PDA/GPS (equipment, operations, troubleshooting). The use of PDA/GPS does not in any way reduce training time; rather the opposite is true since you probably need to spend more time on training as participants need to practice in a group. They also need to have time to go home and practice and discover where they have difficulties so that they are fully up to speed by the time data collection in the field starts. We recommend a full training for not less than one and half weeks. Over time, this can be reduced to one week. Furthermore, it is important that field work commence immediately after the training.

Box Four: Training of Interviewers in PSI/Rwanda

“Plan enough time to properly train your interviewers on how to use their PDA as many of them will probably be unfamiliar with PDAs.”

PSI/Rwanda spent a full five days training the interviewers and gave them a couple of nights to practice inputting data into the PDAs on their own. While letting the interviewers take the PDAs home to practice posed a possible risk to the security of the PDAs, PSI/Rwanda felt the benefit of having the interviewers practice on their own outweighed the possible risk, assuming everyone was required to sign out the PDA and that they had already paid the PDA deposit money. Keep in mind that your data is only as good as your interviewers, so if they are not sufficiently trained, they risk having trouble correctly inputting the data. While the data entry process may seem easy to you, you would be surprised how long it takes the interviewers to feel at ease manipulating the PDA. They need to feel at ease by the time they go out into the field to ensure that they are paying attention to their interviewee during the interviews and not just to the PDA. PSI/Rwanda trained them in four days and found that that was not enough. We then added another day of training and several days for them to practice at home.

Lessons Learned: Using PDAs in the Field

Using PDAs for data collection in the field is significantly different from using paper questionnaires or audit sheets; hence, a number of issues which are specific to the PDA-based approach were highlighted. These relate to the required field logistics, the need for close supervision and for backup PDA safety...
procedures, the advantages of PDAs during the actual data collection procedure, and the availability of troubleshooting documentation.

- **Lesson One: PDA data collection requires detailed logistical and field planning.** Unlike paper questionnaires, PDAs require electricity for charging the devices and secure places to be kept in order to avoid theft or damage. First and foremost, the security of the PDAs while in use must be considered. It is too risky to have interviewers walking around with PDAs in their hands, especially if they are in slippery, muddy rural areas. For this reason, it is recommended that programs not only invest in lanyards and require the interviewers to wear the PDAs at all times while in use, but also that they invest in bags that the interviewers can wear on their backs and in which they place the PDAs when they are not in use. Beyond the physical security of the PDAs, the bags also provide an added benefit which is that all their accessories can be kept together in one place. For ease of verifying that all pieces are kept together and that none are lost, a bag kit should be created and inventoried with the same number for each item in the bag. The PDA, all its accessories, and the GPS should be kept in the bag together. This ensures that each PDA stays with its accessories, and it also assures that the accessories are not treated as less important than the PDA and are not as easily lost. Beyond basic logistics, PDAs also require detailed field planning. Whereas paper-based surveys only require interviewers to have a place to sleep at night, PDA-based surveys not only require places with electricity where the PDAs can be charged, but also require secure places where there is not a great possibility of the supervisors or interviewers being robbed at night and the PDAs being stolen. If your survey will take you to places without electricity for more than two days or with highly unreliable electricity supply, it is best to bring both generators and surge protectors. When designing the field plan, these needs must be taken into account.

- **Lesson Two: Interviewers need to overcome fear of technology among respondents.** When using PDAs in the field, the best way to make your interviewee feel at ease is to explain the purpose of the PDA before beginning the interview. When people see an interviewer approach with a machine, they often fear that their voice is going to be recorded, that there is a hidden camera, or even that you are some kind of spy. Their fears make them ill at ease, and thus make them less likely to accept the interview and to honestly answer the questions. The best way to make your interviewee feel at ease, therefore, is to have the interviewers introduce themselves and the study (similar to paper-based studies) and then right away explain what the PDA will be used for during the interview. By just showing the interviewees that there is no microphone and that it is being used to simply input their responses, they relax.
Box Five: Dealing with Local Authorities and Government Officials in Rwanda

“In many places, especially in rural areas, people fear machines.”

Sometimes local authorities and government officials also require an explanation of why you are using PDAs instead of paper. They too might fear that you are doing some kind of undercover reporting or that you are haphazardly wasting money on such expensive machines when you could just use paper. As with the respondents, the best approach is to visit the local authorities, present the PDA, and explain its purpose. It is recommended that an explanation of PDA use be included in the study design if this is to be approved by the government and maybe to promote PDA-based research to the relevant ministry. If a ministry supports the use of PDAs, you most likely will not have problems with local authorities or other government officials (note that in many countries the same applies to the use of GPS units). One of the best explanations to give in promoting PDA use is that PDAs are cost effective. Whereas a paper questionnaire is only used once and then is thrown away, a PDA is used over and over again. In Rwanda, when asked why we were using such fancy, expensive machines by local authorities and government, it was found that this cost effectiveness explanation worked well.

- Lesson Three: The comfort of data collection is greatly improved. With paper questionnaires, enumerators tend to make mistakes with skips and consistency. We observed that with PDAs, and the aid of a well written program this ceases to be a problem. Automatic filters and question skips help the interviewer to run through the interview fast, and if there is a certain inconsistency between two answers, then a warning message will prompt the interviewer to verify and correct these answers. It is also possible to program automatic calculations or unit conversions (e.g., monetary units). On the other hand, it can be pretty easy for data collectors to forge an interview and complete it from their hotel (except if they need to record the geographic coordinates) though this is also often the case when using paper questionnaires. Monitoring interviews and providing feedback would help the interviewers to sharpen their skills. It is important to include interactive comments and questions to help interviewers review their work before saving it. Provided that the forms are designed in an intelligent way, PDAs should speed up the recording of answers during an interview.
Box Six: Some Advantages of PDA Data Collection in Madagascar

“Feeling comfortable with the forms allows for the interviewer to concentrate on the interview itself rather than on the tool.”

- The questionnaire has a user friendly layout and is easily readable. The PDA screen will show one or two questions along with possible answers and if necessary additional instructions for the interviewer. The next screen (i.e., the equivalent of a page) shows the next question and so on.
- Skip patterns are followed automatically; those questions that are not relevant to a given respondent will not be displayed. If a question appears on the screen, then the interviewer needs to record the answer to this question before he/she can continue with the next questions.
- Calculations that need to be done during the interview can be automated so that the result is given immediately. If this result is needed in order to determine skip patterns, the interviewer no longer needs to use a calculator or calculate manually.
- Less time is spent verifying the coherence of the answers and more attention can be paid to recording the responses.
- A PDA can contain a very large number of interviews; interviewers no longer need to carry around large amounts of paper.
- Respondents can see video and/or listen to audio files, such as radio/TV ads or programs that are relevant to the study. They do not need to imagine these, and interviewers no longer need to describe them to the respondent.

Lesson Four: Supervision and safeguarding systems are essential. Because a PDA-based survey revolves around “virtual” data and not hard data on paper, it requires very specific monitoring systems that allow supervisors to quickly check and verify the work done by each interviewer every day and to ensure that the data is safely backed-up and secure. It is recommended that each supervisor has a PDA unit for backing-up, checking questionnaires, for doing interviews as needed, and for assisting with mapping if relevant. Since the number of supervisory tasks is larger than during paper-based surveys, it may be wise to create a checklist of tasks to be performed every evening and to hand out this list to the supervisors. The following lessons learned are related to the supervision of PDA data collection:
i. Ensure that **every** PDA has an accompanying additional memory card. Data must be backed-up daily on the additional memory card, so both the supervisors and interviewers must be trained in data backup techniques.

ii. Create checking sheets that both the interviewers and supervisors are required to sign. In the case of a household survey, the checking sheets would compare the TRaC and household visit sheets to the number of questionnaires found completed in the PDA to the number of questionnaires transferred to the additional memory. The numbers should be the same across the board.

iii. Require the supervisors to constantly circulate within the research area throughout the day. They should be required to assist with a certain percentage of interviews, but at the same time they should also do a certain amount of double checking that is inline with the type of survey. For example, in a household based survey, they should check for chalk markings on assigned houses to compare to what the interviewers say they did, and they should talk with household members of chalked houses to ensure that the number of eligible members they find is the same number found on the sheet of the interviewer.

iv. Make one of the outstanding interviewers an assistant supervisor. Such a “promotion” requires an increase in pay for that interviewer, but it is worth it for the supervisor. PSI/Rwanda found that the verification process that has to take place every night was a very time consuming two hours when done alone. By including an assistant supervisor who has clear guidelines as to what he or she has to do, the two can more quickly verify the work done each day.

v. If your office has the budget and the capacity, it should be considered whether each supervisor can be given a laptop during fieldwork. A laptop will allow the supervisor to upload the data from the PDAs on a daily or weekly basis to ensure that it is secure in yet a third place. This additional piece of expensive equipment would, however, further increase security needs and possibly also the overall cost of equipment. If laptops are not possible, all the data should be uploaded and backed-up on a computer the day or so after the team arrives back from the field or each time a team passes through the office.

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**Lesson Five: PDAs require trustworthy, responsible interviewers, and a specific security system.** Unlike paper-based data collection, PDA equipment is expensive, and as a result it is necessary to set up proper systems to ensure the safety of the pocket PCs. First and foremost, you must choose supervisors who you can trust to watch out for the safety of the PDAs. Many studies require a large number of interviewers having access to PDAs in places that are hard to monitor on a daily basis. For this reason, it is very important to have supervisors who will rigorously check-in and check-out PDA equipment every night. The supervisors should be held responsible for the PDAs. If they are PSI employees, it is best to make them sign a contract of responsibility specifying what will happen regarding their job and/or salary if the PDAs are lost, broken, or stolen while in their care. If the supervisors are not PSI employees, it is possible to make them sign a contract of responsibility and to require them to make a monetary or material deposit significant enough to motivate them to be careful with the equipment. It is also possible to use other forms of motivation. PSI/Madagascar uses interviewers that are recommended by PSI employees who are then willing to act as guarantor for the interviewers. Whichever form of
motivation/guarantee is chosen, it is recommended that programs using PDAs put in place a proper system to ensure that the equipment is taken care of by supervisors and interviewers and to avoid theft. Finally, the supervisors and interviewers contracts should be extremely detailed in their explanations of the supervisors’ and interviewers’ responsibilities in terms of PDAs, and these should also be part of the interviewers training curriculum.

Box Seven: PDA Finance and Contracting System in PSI/Rwanda

“Take time to put in place the proper finance and contracting systems to ensure the security of the PDAs.”

In the case of PSI/Rwanda, the finance department took a monetary deposit from each interviewer before the start of the data collection. The deposit was large enough to be meaningful, but it was not so large that it was impossible. In order to make the deposit amount something affordable, we had to accept something that was not enough to cover the cost of the PDA. We took 100,000 FRW, which is the equivalent of $180. In reality, however, the PDAs actually cost around $400. The interviewers did not know this and since it was a meaningful amount to them, they all respected the rules.

- **Lesson Six: Interviewers and supervisors need access to an appropriate user guide.** It is vital that PDA users have sufficient troubleshooting documentation with them while they are out in the field so that they do not loose time due to technical problems. They should have a PDA/data collection manual which includes a section on problem solving. The manual provided by the PDA manufacturer may also be given to the supervisors/interviewers although it is preferable to develop a customized, reduced manual which only contains those items that are relevant to supervisors/interviewers.
Box Eight: PDA Troubleshooting During the Kenya Survey

“It is important that field teams carry with them a troubleshooting document in order to rectify these and other problems immediately so that time is not wasted.”

Generally the interviewers experienced few hiccups with the use of PDAs while in the field. Some enumerators had difficulties solving minor PDA problems such as obtaining a consistent position signal (e.g., GPS signal disappearing without the operator changing their position, the GPS signal not appearing when the operator is in a valley, GPS signal remaining unavailable for long periods of time during mapping, etc.). The PDAs freezing during mapping was equally a problem. There were a couple that were anticipated such as non-receipt of satellite communication, slowing down of PDAs, and hanging up while taking GPS readings. Because these were common problems that had been previously experienced, the organizers had prepared a handout on what to do in case one encounters the problems, which came in handy in the field.

Lessons Learned: PDA Data Management

A third set of lessons learned are specific to the data management that takes place after field data collection has been completed. Data management includes the data transfer, merging, and validating processes in order to prepare for the analysis stage. The lessons learned relate to the various advantages related to the fact that manual data entry of paper questionnaires is no longer necessary and to their suitability for multi-round surveys such as those that are conducted by PSI.

- **Lesson One: Data collected in the field is rapidly available for analysis.** Since manual data entry of questionnaires is no longer required, the time required for preparing the data for analysis is greatly reduced. The only steps that are to be performed by the PDA programmer are first the transfer of records from each PDA to a central desktop computer and second the merging of the individual data tables (one for each PDA) into a single database. The time that is required for downloading is minimal and may only take a few minutes per PDA. Data cleaning only takes minimal time since the various quality checks and skip patterns are done automatically during data collection. As stated earlier, Visual CE can convert databases to Access from which it is easy to export to SPSS or Excel for analysis purposes.
• **Lesson Two: PDA-based data collection improves the quality of the dataset.** As explained earlier, the built-in coherence tests and automatic skip patterns reduce errors during the interviews. In addition, the adoption of PDAs eliminates the errors that are usually induced during data entry since the data is directly input into the PDA and then transferred to the computer. Whereas paper questionnaires require a human to fill out the questionnaire and another person to enter the data, a PDA only requires data to be input once. This reduces the chance of human error in the data entry process by half. PDA programming and direct upload reduce the possibility for human error and thus improve the overall quality of the data received.

• **Lesson Three: PDAs are best suited for multi-round research applications such as TRaC, MAP, FoQus, exit interviews, etc.** The PSI Dashboard, as a multi-round research approach, requires the same questionnaire and research design to be periodically applied to the same research area to monitor and track changes in behavior and in product availability over time. When repeated over several years, the dashboard illustrates the change over time in its segmentation, evaluation, and exposure tables. The dashboard methodology is not as effective if the same research tools are not used over and over again. As a result, PDAs are not as time saving and cost effective if the same (or almost the same) questionnaire is not used over and over again. As described above, PDAs are challenging and time consuming to program, and so they are best suited for multi-round surveys that will use the same questionnaires over and over again. Since it is so important to use the same questionnaire repeatedly, it pays off to put a lot of time and effort into designing, developing, and programming the baseline questionnaire for such a survey. In subsequent rounds, questions can be added as they just add new data to the dashboard and require minimal time to be programmed, but the base should remain as unchanged as possible. What is imperative, however, is that as few internal cuts and skip pattern changes are made to the questionnaire since this is what will require a lot of time reprogramming the questionnaire and changing the dashboard comparison indicators. The idea here is that if the baseline questionnaire is properly prepared from the start, you will only have to invest once the time in programming the PDA in order to get out many outputs of data over time for your dashboard. Once programmed, the PDA can be easily reused for each round of the survey and for easy upload and analysis of the data. PDA and dashboard-based research go hand-in-hand in ensuring time saving, high quality data.
Collective Advantages and Disadvantages

The costs that are associated with the use of PDAs are an important factor to be considered when implementing PDAs in a country office. It is important to monitor the costs of implementation because the initial setup costs are high due to the high price of the equipment and because there is a need for extensive initial technical assistance and training. Costs were monitored closely in both Madagascar and in Rwanda, allowing for a comparison between PDA-based and paper-based data collection.

It was found that over time, PDAs are a much more cost effective research tool than paper and pen. One of the major advantages of opting to do a PDA-based research survey is that in the long run your surveys will be more cost effective than if done with paper and pen. Paper-based surveys require large amounts of printing and photocopying. The budget used to cover these costs is a “lost” cost in the sense that once the survey is over the paper is useless. The next survey will require another input of paper and pens, printing, and photocopying costs. A PDA-based survey, however, requires one budget input of a large fixed cost – the cost of the equipment. Once bought, however, the equipment should be able to be used for future surveys for years to come. In addition to the cost savings on materials, PDA-based surveys are more cost effective than paper-based surveys in terms of the time and money spent on data entry. Paper-based surveys require two teams of temporary help: a data collection team and a data entry team. PDA-based surveys only require the data collection team. Paper-based surveys usually also require computers to be rented for the data entry team to use in entering the data. PDA-based surveys do not require computer rentals and only require the simple maneuver of syncing the PDA and the computer in order to transfer the data to the computer. Whereas the paper-based data entry can take weeks, the PDA-based data upload takes minutes or at the most a few hours. PDA-based surveys, therefore, not only save money on temporary help costs and equipment rental but also on time. In the case of PSI/Rwanda, the overall cost savings was found to be about $15,000 per TRaC survey over time. An example from Madagascar can be found below, and PSI/Rwanda’s “Illustrative One-time PDA/GPS TRaC/MAP Budget” is available in the appendix.
Box Nine: Cost Estimate for a TRaC Survey with a Sample of 2000 Respondents in Madagascar

“The use of PDA technology as opposed to paper-based data collection results in a reduction of both financial and human resources.”

PSI/Madagascar compared estimates of the time and funds that are related to the management of a TRaC dataset with 2000 respondents and 400 variables (excluding training, data collection, and data analysis activities). It found that the cost and the number of person-days that are required for this are significantly lower when collecting data with PDAs. In this scenario, the processing of paper questionnaires includes the printing and copying of the questionnaire, salary of researchers, data entry clerks, and data entry supervisors. For the PDAs, it includes the salary of researchers/programmers and of an assistant for testing of the forms, the cost of the PDAs (including writing off the cost of the equipment). The estimate of time takes into account the following elements: for the paper questionnaire, it includes the copying of the questionnaire, the creation of a data entry mask (for data entry), the programming of coherence tests, preparing the questionnaire prior to data entry, data entry itself (including double data entry), and of the merging of the different data entry files; and for the PDA, it includes the form development, the programming of coherence tests and of the merging of records from the various PDAs.

<table>
<thead>
<tr>
<th>2000 interviews</th>
<th>With PDA</th>
<th>Without PDA</th>
<th>% cost reduction (with PDA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>400 variables</td>
<td>1940</td>
<td>2495</td>
<td>22%</td>
</tr>
<tr>
<td>Cost ($)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time (person-days)</td>
<td>24</td>
<td>180</td>
<td>86%</td>
</tr>
</tbody>
</table>

In summary, the experiences in the three pilot countries have shown that there are a number of advantages and disadvantages to the use of PDAs for data collection in the field. In summary, these are:

**Advantages:**

- The use of PDAs reduces the resources that are spent on data collection and data entry. There are no printing costs, and no editing or data entry costs.
- Data entry is no longer necessary, and the time that is needed for data cleaning is greatly reduced.
- The quality of data is improved since there are fewer mistakes on skip patterns and filters in the questionnaire and there are no additional errors induced during data entry. Because of the use of
such “intelligent” data entry forms, data collection is smoother and (often) faster than with paper-based questionnaires. PDAs with an integrated GPS also reduce the errors an interviewer can make when recording coordinates taken with a traditional GPS unit.

- Data are available nearly immediately after data collection.
- It is possible to replay advertisements on the unit for prompting recall of exposure.
- Programming of PDA forms is flexible; for instance, you can program the data entry structure to have different language options.
- PDAs have multiple applications and are suitable for a wide range of research activities (e.g., they can handle geographical information on households/clusters, can be linked to MAP, etc.). The use of PDAs by sales teams has not yet been piloted, but it is expected that the technology is equally appropriate to replace paper-based data collection.
- In certain settings, the combined use of PDAs and GPS units allows for a more scientific sampling and structured approach to performing the media tracking survey methodology (see also Box Eleven). There may also be a reduction in reliance on the bureau of statistics in executing certain household surveys, ending reliance on sampling of households (which are often largely unlocatable) by the bureau of statistics.

**Disadvantages**

- Initial cost of equipment is high. PDA, GPS unit, carrying box, software, charging adapters, long life batteries, extra large memory and hard drive cards, software, and other accessories add up to $500 to $600 per unit.
- There is a need for skilled people with decent database management/programming/IT experience in order to prepare for data collection and to manage data post data collection.
- The development of PDA forms is often time consuming. Every time you make a change in the questionnaire or the skip pattern, you have to load the change onto every PDA individually. This disadvantage, however, seems outweighed by eliminating the need to reproduce questionnaires.
• Need longer training time due to the introduction of technology. It is necessary to learn how to write a data entry program in Visual CE and how to troubleshoot it.

• No paper backup although one can establish an extensive set of computer backup procedures. These require additional training of supervisors who are responsible for the daily backup of survey data.

• Pocket PCs are expensive and rather fragile devices which call for extra safety measures. Unless appropriate backup procedures are in place, it is possible to lose large amounts of data in case a PDA is seriously damaged (particularly the SD memory card), lost, or stolen.

Recommendations

Based on the above advantages and disadvantages, PSI’s Research department recommends the following:

1. Implementation of PDA Technology Globally in PSI – All PSI countries should consider the adoption of PDAs as a standard tool for field data collection for all applications. As of the end of 2006, several countries are about to initiate the implementation of PDAs, and there appears to be a growing demand for information on the subject. Although the cost of initial setup is high and despite a number of other limitations, particularly in terms of capacity to operate the tools, the two main advantages – reduction of costs in the long run and increased quality of data – outweigh the disadvantages. The pilot experiences were all successful, and it is expected that most countries will be able to replicate these successes. We do however believe that there are a number of conditions which should help countries decide whether they require PDAs, which are thought to be most appropriate in the following settings:
   i. Large program with need to carry out several field surveys per year
   ii. Studies have a large sample size (e.g., TRaC)
   iii. Program conducts standard multi-round surveys
   iv. Local capacity and appropriate human resources are available

2. PDA Applications – Wherever PDAs are available, countries should use them for all their quantitative studies that require data to be collected in the field. TRaC and MAP surveys are the main studies where PDAs will be used, but other applications (e.g., media impact studies, exit interviews) will also benefit from the use of PDAs. Non-research applications of PDAs should
also be piloted over the coming year, particularly regarding the use of PDAs for the recording of information by sales agents during their routine visits to outlets in order to provide data for a program’s MIS in an efficient manner. Finally, it is important to explore how to further optimize the use of advanced PDA functionalities, such as the use of wireless internet or Bluetooth connections to upload data directly to a central server.

3. **Capacity Building** – The Research Division, through its Research to Action (R2A) program and the REsulTS Initiative (RI), is responsible for the skills building of a number of technical experts who will act as focal points for the implementation of PDAs across the PSI world. Capacity building first requires that standard training materials be developed: a curriculum for an introductory training to PDAs and a curriculum for the technical training of PDA programmers. Other documentation, such as training materials for interviewers or troubleshooting handouts, should be developed based on the outputs that are currently being produced by countries.
Box 10: PSI/Rwanda’s Conclusion on its PDA Experience

“Overall, introducing PDAs into the research process is a very rewarding and beneficial process.”

It takes time, attention to detail, and patience in the beginning, but it is sure to pay off in terms of cost efficiency and quality of data in the long run. PSI/Rwanda highly suggests that other PSI offices consider switching over to PDA-based surveys in place of paper-based surveys, but PSI/Rwanda also cautions those offices to fully consider the time and commitment required before making the switch. We would be happy to share our experience with any PSI office interested in making the switch.

Box Eleven: Future PDA Applications by PSI/Kenya

“An exciting aspect of our PDA experience was the use of an attached GPS unit, plugged into the top of the PDA”

An exciting aspect of our PDA experience was the use of an attached GPS unit plugged into the top of the PDA. The CDC wrote a PDA-linked GIS freeware program that allows one to map households in a given cluster, combine the coordinates together onto one PDA, select a desired random sample of households, and then download the location information (province, district, cluster number, household number) on the sampled households into the loaded PDA questionnaire for selection. This could be great for countries that do not have updated maps or household numbers at the cluster level, such as in Kenya. One of our plans is to start using the GPS component to make non-probability samples more rigorous. Our media TRaC uses a quick and dirty sampling method which gives us randomly selected households but no probability based sample. We think that if we can map households and the boundaries of our clusters (we use estates which have varying, unknown population sizes) using the PDA with GPS unit and then develop a systematic sampling method which could be executed by our teams that factors in the numbers of households per cluster, we could have a more rigorous sampling methodology for this type of survey that we could revisit once per year.
Appendix

*Illustrative One-time PDA/GPS TRAC/MAP Budget*

<table>
<thead>
<tr>
<th>I</th>
<th>Material / Equipment</th>
<th>Qty</th>
<th>Unit Price</th>
<th>$ US</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Dell Axim PDA and accessories (NB: this does not include cost of extra battery or additional memory)</td>
<td>30</td>
<td>460</td>
<td>13,800.00</td>
</tr>
<tr>
<td>2</td>
<td>Additional Memory</td>
<td>30</td>
<td>30</td>
<td>900.00</td>
</tr>
<tr>
<td>3</td>
<td>Additional PDA battery</td>
<td>30</td>
<td>50</td>
<td>1,500.00</td>
</tr>
<tr>
<td>4</td>
<td>Adapter for the PDA charger</td>
<td>30</td>
<td>5</td>
<td>150.00</td>
</tr>
<tr>
<td>5</td>
<td>Visual CE 9 Professional Edition</td>
<td>1</td>
<td>400</td>
<td>400.00</td>
</tr>
<tr>
<td>6</td>
<td>GPS</td>
<td>25</td>
<td>100</td>
<td>2,500.00</td>
</tr>
<tr>
<td>7</td>
<td>Batteries for the GPS machines</td>
<td>150</td>
<td>4</td>
<td>600.00</td>
</tr>
<tr>
<td>8</td>
<td>Lanyard for PDA &amp; GPS (1 per machine)</td>
<td>55</td>
<td>1.50</td>
<td>82.50</td>
</tr>
<tr>
<td>9</td>
<td>Backpack or other bags</td>
<td>20</td>
<td>10</td>
<td>200.00</td>
</tr>
</tbody>
</table>

**Subtotal Equipment** 20,133

<table>
<thead>
<tr>
<th>II</th>
<th>STTA</th>
<th>No. Days</th>
<th>Qty persons</th>
<th>Unit Price</th>
<th>$ US</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Regional Researcher Dashboard Training STTA (1 or two people) - Hotel, per diem</td>
<td>15</td>
<td>2</td>
<td>200</td>
<td>6,000</td>
</tr>
<tr>
<td>2</td>
<td>Regional Researcher Dashboard Training STTA (1 or two people) - Airfare</td>
<td>2</td>
<td>2</td>
<td>2,000</td>
<td>4,000</td>
</tr>
<tr>
<td>3</td>
<td>PDA Training STTA - hotel, per diem</td>
<td>21</td>
<td>1</td>
<td>200</td>
<td>4,200</td>
</tr>
<tr>
<td>4</td>
<td>PDA Training STTA - Airfare</td>
<td>1</td>
<td>2,000</td>
<td>2,000</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>MAP Training STTA - Hotel, per diem</td>
<td>10</td>
<td>1</td>
<td>200</td>
<td>2,000</td>
</tr>
<tr>
<td>6</td>
<td>MAP Training STTA - Airfare</td>
<td>1</td>
<td>2,000</td>
<td>2,000</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>MAP External Consultant Fee (unit = day)</td>
<td>10</td>
<td>1</td>
<td>450</td>
<td>4,500</td>
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</table>

**Subtotal STTA** 24,700

**Subtotal Equipment and STTA (one time sunk cost)** 44,833