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# Cost-effectiveness of Computer Assisted Personal Interviewing vs paper-and-pen based interviewing methods for data collection

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## **Introduction and Motivation**

Computer Assisted Personal Interviewing (CAPI) is a computer assisted data collection method designed to replace the traditional paper-and-pen interviewing (PAPI) methods of survey data collection and is usually conducted at the home or business of the respondent using a portable personal computer such as a laptop or a tablet. CAPI allows interviewers to conduct face-to-face interviews using a portable computer. After the interviews, the interview data could be automatically transferred to a central database. The CAPI software can be installed on Android/iOS supported tablets, computers and phone devices. The surveys can be conducted offline without an Internet connection, and the results are stored on the device and can be uploaded when an Internet connection becomes available. Some programs allow the descriptive and graphical survey results to be viewed online as soon as data is entered and transferred, and the collected data can be downloaded in the appropriate file format to conduct a more detailed statistical analysis. Despite the use of CAPI in many fields, its use for data collection in international development is still very limited.

There are several recent studies that discuss the relative benefits of CAPI in comparison to PAPI. These include efficient monitoring and feedback while data collection is occurring and no data entry costs. The efficient monitoring and feedback implies that the survey results are monitored periodically and the feedback obtained is used to modify survey design and questions. The relative costs of CAPI are the high initial capital investment to buy hardware and software, programming the survey, and costs of additional time to train

enumerators in the use of CAPI as they serve multiple roles encompassing data collection, entry, storage and transfer. Given the high fixed-cost of CAPI, they may be more cost-effective for large-scale surveys and PAPI may be more cost-effective for small-scale surveys. These potential costs and benefits relative to the scale of the survey need to be quantified in order to help researchers make an informed investment decision on the use of an appropriate tool. Studies in the past provide only a theoretical overview of the two types of data collection methods. There is no study that compares the detailed costs of CAPI and PAPI.

### **Objectives and Methods**

This proposed study is aimed to examine the cost-effectiveness of CAPI in comparison to the traditional PAPI method used for data collection in the international development setting. To examine the cost-effectiveness, the relevant CAPI and PAPI users (i.e., researchers) are identified using the snowball sampling technique where the users are asked to refer to other researchers they know that have used both CAPI and PAPI. The users are surveyed using a well-designed survey instrument (see *Appendix*) asking them to elicit various fixed and variable, direct and indirect costs involved in data collection in their two most recent projects—one involving CAPI and one involving PAPI. This sampling method of including researchers that have done both CAPI and PAPI controls for researcher fixed effects in the analytical model used. Data on the characteristics of the research project (e.g., location, time of the survey, sample coverage, length of the instrument, type of survey,

complexity) and the characteristics of the researcher (age, experience, type of institutional affiliation, etc.) are also collected. Major cost differences (measured by time and money inputs) between CAPI and PAPI are analyzed for major phases that include questionnaire design, data collection, data entry and data processing. Cost difference per household surveyed using CAPI and PAPI are analyzed using a simple t-test and an econometric model to assess if the difference is statistically significant. Characteristics of the research project and the researcher are used in the model to control for confounding factors. Based on the results of this study, we draw implications on factors that are most important in determining the use of CAPI vs PAPI in data collection efforts in international development. The cost savings realized in the use of one of this survey method has implications for surveying more people for a given research budget.

## Appendix: Survey Instrument

### Background Information

1. Type of organization you are primarily affiliated with.
  - a. Private university
  - b. Public university
  - c. Government agency, research organization or institute
  - d. International research organization
  - e. Non-governmental organization
  - f. A research 'think-tank' based in a developing country
  - g. Aid/donor agency
  - h. Other (Please specify)
2. Country where your organization is located (headquarters)
3. Country where you are based, if different from the location of your organization.
4. How many years have you been affiliated with this organization?
5. Highest academic degree you have completed.
6. Discipline/area of your highest degree.
  - a. Agricultural/Applied Economics
  - b. Economics
  - c. International Development
  - d. Sociology
  - e. Statistics
  - g. Other (Please specify)

7. Year when you completed your highest academic degree.
8. Country where you completed your highest academic degree.
9. In your research career, approximately how many research projects involving the collection of primary data using survey methods have you undertaken or have been a part of as a collaborator?
10. In research projects that involved primary data collection through personal interviews, what type of data collection methods have you used in research projects where you were a principal investigator or a collaborator?
  - a. I have only used Paper and Pen based Personal interview (PAPI)
  - b. I have only used Computer Assisted Personal Interview (CAPI) method involving the use of tablets/laptops in the field
  - c. I have used both PAPI and CAPI

Your past survey experience and future plans

11. You have indicated (in Q10) only using Paper and Pen based Personal Interview (PAPI) method in the past. We would like to know if you have ever considered using Computer Assisted Personal Interview (CAPI) method for your international development research projects?
  - a. Yes
  - b. No
12. If yes, what were the reasons why you were not able to use CAPI?
13. If no, why you have never used or considered using CAPI method to conduct surveys?
14. Do you have plans to conduct any data collection using personal interview methods over the next 12 months?
15. If yes, do you plan to use CAPI or PAPI method for this next survey and the main reason for that choice?

Your experience with CAPI Survey

16. When was the first time you used CAPI method to conduct survey (year)?
17. What was the main motivation for you to use the CAPI method?
- a. I wanted to test the CAPI
  - b. I had the resources (financial and human) to use CAPI
  - c. Other researcher in my group had already decided to use CAPI
  - d. I'm always up to date with new technologies and wanted to use CAPI
  - e. Other (Please specify)
18. How many surveys you have conducted using CAPI to date?
19. In your experience what are the major advantages of using CAPI?
20. Will you recommend the CAPI method to other researchers involved in international development?
- a. Yes
  - b. No
21. Why will you recommend or not recommend the CAPI method to others?
22. Do you have plans to conduct any data collection using personal interview methods over the next 12 months?
- a. Yes
  - b. No
23. If yes, do you plan to use CAPI or PAPI method for this next survey and the main reason for that choice?

Your experience with the most recent CAPI survey

24. Please tell me the most recent year when you used the CAPI method for data collection?
25. In the year you mentioned in the previous question, how many surveys did you conduct using CAPI?



26. For the most recent survey, please list the country/countries where this survey was conducted.

27. What was the geographic scope of this survey in a given country?

- a. Nationally representative
- b. Representative at the scale of a sub-region within a country
- c. Covered a few villages/communities within a sub-region
- d. Other (Please specify)

28. What was the unit of data collection (i.e. survey units) for the last CAPI survey?

- a. Households
- b. Individuals
- c. Firms/groups
- d. Other (Please specify)

29. How would you characterize your survey as?

- a. Quantitative
- b. Qualitative
- b. Had elements of both (quantitative and qualitative)

30. Was the survey conducted in a rural or an urban setting?

- a. Rural setting
- b. Urban setting
- c. Both

31. Number of units surveyed using the CAPI method during your last survey.

32. Total number of enumerators that used CAPI technology during your last survey.

33. Average duration of one survey session using CAPI.
34. How would you characterize the purpose/objective of this survey?
35. What type of data was collected in this survey using the CAPI method.
- a. Demographic characteristics of the unit of observation
  - b. Socio-economic profile data on the respondents
  - c. Socio-economic profile data on each member of the unit
  - d. Food consumption
  - e. Expenditures
  - f. Income
  - g. Assets
  - h. Investments
  - i. Education achievements; learning outcomes
  - j. Physical characteristics of the dwelling and living standards measurement
  - k. Plot level data on agricultural inputs, technology, practices, production and outcomes
  - l. Farm level data on agricultural inputs, production, practices and outcomes
  - m. Agricultural marketing
  - n. Use of credit, participation in insurance market, financial markets
  - o. Health and nutrition indicators
  - p. Women empowerment (or gender equality indicators)
  - q. Other (Please specify)
36. Did this survey involve measurements of land area or anthropometrics?
- a. No
  - b. Yes, involved field measurements (e.g., land size)
  - c. Yes, involved anthropometrics measurements
  - d. Yes, involved other types of measurements (e.g., production, yield, collection of samples)
  - d. Other (Please specify)
37. Did your survey involve interviewing one respondent or different members of the unit of observation for different modules?
- a. Involved one respondent for the whole questionnaire
  - b. Involved interviewing different members for different sections of the questionnaire
38. Based on a scale of 1-10, with 1 = very simple and 10 = very complex, how would you characterize your survey instrument for this last CAPI survey ?

39. What 'backup' system did you use to ensure successful completion of the data collection efforts in case there was a technical difficulty?
- I did not have any backup system
  - I had hard copies of the survey instrument as a backup option
  - Other (Please specify)
40. In what aspect of the study did you play a major role in this last survey using CAPI?
- Research design (i.e., sampling method, sampling strategy, power calculation to determine sample size, etc.)
  - Designing the survey instrument
  - Programming the instrument into the CAPI software
  - Recruitment and selection of enumerators
  - Training the enumerators
  - Pilot testing the survey instrument
  - Coordinating and managing the field implementation of the survey (i.e., logistics)
  - Conducting the interviews
  - Survey supervision
  - Review of data for consistency check
  - Data cleaning
  - Data analysis
  - Other (Please specify)

41. Was this survey outsourced to a 'third party' (i.e. a survey firm or a local consultant that was only involved in data collection using CAPI and no other aspect of the research study)?

- Yes
- No

42. Was this survey conducted in partnership/collaboration with a local research organization based in the country where the survey was conducted?

- Yes
- No

Cost of the hardware used in the most recent CAPI survey

43. What hardware did you use for the CAPI survey?

- Handheld devices such as tablets
- Smartphones
- Laptop computers
- Other:

44. Please indicate the features of the hardware used for this CAPI survey.
- It was solar powered
  - It was powered by a lithium battery
  - It had a keyboard
  - It had a touch screen capabilities
  - It had capability to take pictures
  - It had capability to record GPS coordinates
  - It had capability to record time
  - Other:
45. Approximately, what was the size of the 'screen' of the device used.
46. How many devices were used during this most recent survey?
47. How did you acquire these devices?
- Devices were purchased specifically for this survey
  - Devices were purchased for a previous survey
  - Devices were rented from other sources
  - Enumerators used their own devices
  - Devices were borrowed free of cost from other sources
48. If you chose a, b or c, what was the average price you paid for either purchasing or renting the device?
49. If you chose d or e in Q47, did you pay incentives to the enumerators for the use of their own devices?
- Yes
  - No
  -
50. If yes, please tell us how much, on average, you paid to each enumerator for the use of their device for the duration of data collection?
51. What was the total cost you had to incur on other accessories and hardware items to conduct this most recent CAPI survey?

Cost of the software used in the most recent CAPI survey

52. Did you purchase this software from a vendor or was this custom built specifically for your survey?
- Purchased/licensed from a vendor
  - Custom built personally by you
  - Custom build by someone within my organization

d. Custom built by a consultant on a contractual basis

*If you chose options b, c or d, answer following questions from 53-60*

53. Which software did you purchase to program the survey?

- a. Surveybe
- b. droidSURVEY or iSURVEY
- c. PoiMapper
- d. Pendragon Forms
- e. Open Data Kit
- f. Kobo ToolBox
- g. EPICollect
- h. EPISurveyor / Magpi
- i. CommCare
- j. Blaise
- k. Freedom Fone
- l. FrontlineSMS
- m. Nokia Data Gathering
- n. OpenXdata
- o. RapidSMS
- p. Other:

54. How much did you pay to purchase this software and what was the term of the licensing agreement?

55. Length of the licensing agreement (in years):

56. Since incurring the licensing costs noted above, how many surveys have been conducted by you or your organization under the same licensing fee agreement?

57. Approximately how much time was spent programming the survey instrument using this software (please include the time spent testing the beta version and revision based on those tests).

58. Who programmed the survey instrument using this software?

- a. Myself
- b. One of our research team members
- c. It was contracted to someone outside our research team
- d. Other:

59. Approximately how much did you pay to program the survey instrument?

60. Were there any additional costs you had to incur towards the programming of the survey instrument (that are not included above)?

- a. Yes
- b. No

*If you chose options b, c or d, answer following questions from 61-63*

61. Approximately how much time was spent developing the software and programming the survey instrument using that software (include the time spent testing the beta version of the survey and revisions based on those tests).

62. Approximately how much did you spend in the development of the software and programming the survey instrument?

63. Do you consider these time and money investments reported in previous two questions as fixed costs spread across several CAPI survey or variable costs for each CAPI survey you plan to conduct (or have conducted)?

- a. Variable costs for each survey
- b. Fixed costs spread across several CAPI survey

Your assessment on the time spent on different aspects of the most recent CAPI survey

I. Questionnaire development

64. Did you first develop the questionnaire on paper?

- a. Yes
- b. No

65. If yes, approximately, how many days did you spend developing the paper questionnaire for this survey?

66. If you were to conduct this survey using PAPI method, would you have required less, more or same amount of time to develop the questionnaire on paper?

II. Installing the survey instrument in the devices used by enumerators for data collection

67. In how many devices was the survey instrument installed?

68. Approximately, how much time was spent to prepare the devices (hardware) and install the survey instrument in all the devices designated for data collection?

### III. Enumerator training

69. How many people participated in the training for the CAPI survey (include enumerators, supervisors, coordinators, etc.)?

70. What percentage of these participants had prior experience using CAPI survey?

71. Did the survey programmer also participate in the training?

- a. Yes
- b. No

72. Did the training include field testing (pilot testing) of the survey instrument using CAPI?

- a. Yes
- b. No

73. How many days were required to complete the whole training session?

74. If you were to conduct this survey using PAPI method, would you have required less, more or same amount of time for enumerator training?

75. If you were to conduct this survey using PAPI method, would you have required less, more or same number of enumerators to implement the survey?

76. If you were to conduct this survey using PAPI method, would you have required less, more or same number of survey supervisors to implement the survey?

### IV. Revising the survey instrument after pilot testing

77. How many days were spent revising and finalizing the survey instrument after pilot testing in the field?

78. If you were to conduct this survey using PAPI method, would you have required less, more or same amount of time to revise/finalize the survey instrument?

### V. Data collection

79. How many days were spent for data collection (i.e. actual field work to complete the survey)?

80. If you were to conduct this survey using PAPI method, would you have required less, more or same amount of time in the field for data collection?
81. What were the major issues faced by the survey team in using CAPI during the data collection phase?
- a. There were no major issues
  - b. Battery run-off issues
  - c. No access to electricity to re-charge the batteries
  - d. Hardware technical problems
  - e. CAPI software problems
  - f. Data transmission problems
  - g. Data security issues
  - h. Enumerators were not comfortable with the CAPI method that slowed down the process
  - i. Supervisors were not able to do quality checks in the field
  - j. Enumerator safety issues (increased risk of thefts and personal harm to the enumerators)
  - k. Other:

#### VI. Data review and Data cleaning

82. Once the data collection was initiated, how often was the data transmitted to or was accessible to the supervisors for review?
- a. It was transmitted instantly
  - b. Once a day
  - c. Once every other day
  - d. Once a week
  - e. Only after the end of the survey
  - f. Other:
83. How was the data transmitted?
- a. Through Internet
  - b. Through 3G or GPRS or LTE
  - c. Other:
84. How much did you spend in total for data transmission costs for the method you used?
85. How was the data transmitted from the field used by the survey team?
- a. It was used to modify the questions, response options or to make other changes in the instrument
  - b. It was used for quality control and follow up (i.e., for data errors,



- inconsistencies, incomplete responses, etc.)
- c. Other:

86. Once the data collection phase was completed, how much time did it take to assemble the data in a database format, to process the data for data review and cleaning, and to have the data ready for analysis?

87. What were the main issues encountered during the data review and data cleaning phase?

88. How many days after the completion of the last survey in the field, did it take to have the survey data ready for analysis?

89. If you were to conduct this survey using PAPI method, would you have required less, more or same amount of time to assemble the data, clean the data and process it for data analysis?

90. Please share any thoughts on lessons learnt from your most recent CAPI survey experience or suggestions you have to improve the CAPI method of data collection. What is the most you like about using CAPI as a method of data collection?

#### Your experience with PAPI survey

91. How many surveys you have conducted using PAPI to date?

92. Please tell me the most recent year when you used the PAPI method for data collection?

93. In the year you mentioned in the previous question, how many surveys did you conduct using PAPI?

*To answer the following questions, please refer to the most recent PAPI survey within that year where you took an active role.*

94. For the most recent survey, please list the country/countries where this survey was conducted.

95. Number of units (households, individuals etc.) surveyed using the PAPI method.

96. Total number of enumerators that used PAPI method during your last survey.

97. Average duration of one survey session using PAPI.

98. What type of data was collected in this survey using the PAPI method?

- a. Demographic characteristics of the unit of observation
- b. Socio-economic profile data on the respondents
- c. Socio-economic profile data on each member of the unit
- d. Food consumption
- e. Expenditures
- f. Income
- g. Assets
- h. Investments
- i. Education achievements; learning outcomes
- j. Physical characteristics of the dwelling and living standards measurement
- k. Plot level data on agricultural inputs, technology, practices, production and outcomes
- l. Farm level data on agricultural inputs, production, practices and outcomes
- m. Agricultural marketing
- n. Use of credit, participation in insurance market, financial markets
- o. Health and nutrition indicators
- p. Women empowerment (or gender equality indicators)
- q. Other (Please specify)

99. Based on a scale of 1-10, with 1 = very simple and 10 = very complex, how would you characterize your survey instrument for this last PAPI survey?

100. Was this survey outsourced to a 'third party' (i.e. a survey firm or a local consultant that was only involved in data collection and no other aspect of the research study)?

- a. Yes
- b. No

101. Was this survey conducted in partnership/collaboration with a local research organization based in the country where the survey was conducted?

- a. Yes
- b. No

102. Approximately, how many days were spent developing the paper questionnaire for this survey?

103. How many people participated in the training for this PAPI survey (include enumerators, supervisors, coordinators, etc.)?

104. Did the training include field testing (pilot testing) of the survey instrument?

- a. Yes

b. No

105. How many days were required to complete the whole training session?

106. How many days were spent in revising and finalizing the survey instrument after pilot testing in the field?

107. How many days were spent for data collection (i.e. actual field work to complete the survey, including week-ends)

108. When did you start the data entry process?

- a. As and when the surveys were completed
- b. After all the surveys were completed
- c. Several days/weeks after data collection started but before data collection ended
- d. How many people were involved in data entry?

109. Once the data collection phase was complete, how much time did it take to complete the data entry?

110. Average duration of transferring the data from a questionnaire to the computer.

111. After the data entry was completed, how much time was spent for data review and cleaning, and to have the data ready for analysis?

112. What were the main issues encountered during the data review and data cleaning phase?

113. How many days after the completion of the last survey in the field, did it take to have the survey data ready for analysis?