A COMPARATIVE ANALYSIS OF SURVEY METHODOLOGIES FOR THE COLLECTION OF TRANSPORTATION PLANNING DATA

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abstract: This study proposes a survey tool for a more efficient person-trip data gathering. It initially developed an enhanced questionnaire which incorporates person-trip survey into the traditional instrument used in gathering the Census of Population and Housing (CPH) in the Philippines. Administered in Baguio City, Philippines, the enhanced questionnaire served as a pilot-test questionnaire using two survey methodologies i.e., the personal interview method (PIM) and the self-administered questionnaire (SAQ). Consistent with the findings of previous studies, the research revealed that using the personal interview method (PIM) was a more favorable survey tool as it ensured data quality.

1. INTRODUCTION

1.1 Background

Person-trip data describes an area's travel demand scenario. It provides information on the major origins and destinations of the population. It offers information on travel time, the common transportation modes and their usage. The wide variety of person-trip information it offers allows for an intensive analysis of people's travel behavior-- paving the way for the development of policy-responsive transportation models. Apart from serving as vital inputs to project feasibility and impact evaluation studies, person-trip information may also serve as the best indicator for urban and rural accessibility and mobility.

Transportation planning experts express that person-trip survey is one of the most important, and considered the most difficult and expensive surveys needed in any transportation planning and development. Usually, collection of person-trip data utilizes the household interview survey (HIS) as its major data gathering tool.

In the Philippines, person-trip data is more often inadequate or unreliable. This may partly be traced from the absence of an already established person-trip data collection system. One perceived disadvantage of this constraint may result to delayed or even doubtful transportation development plans. The recently conducted Baguio and Dagupan Urban Planning Project (BDUPP) by the National Economic and Development Authority (NEDA), identified the lack of reliable data on traffic and transportation in the study area as one of its major constraints.

Another adverse effect of this problem was demonstrated in a study on the uncertainty in transportation demand forecasting. Said study revealed a glaring disparity between the observed and model-forecasted travel demand characteristics in the Philippines. Accordingly, the sources of errors in transportation demand forecasting are: 1) inadequate data; 2) inaccurate forecasting model; and 3) inherent uncertainty of exogenous variables. In addition, the reliability and relevance of the person-trip data from which these models have been formulated also seemed doubtful.

The contribution of an efficient data collection system to transportation planning and development cannot be over emphasized. An efficient data collection system that: 1) is legally based; 2) is institutionally capable of generating data on a geographically comprehensive area and on a continuing basis; 3) is well organized and stable; 4) is manned by experts in data collection and processing; 5) enables data to be kept in a centralized location for easy access and retrieval; and 6) is cost-effective, should now be established.

As one possible option for person-trip data collection system, this study aims to determine which of two survey tools would be a more efficient methodology in collecting population, housing and person-trip data.

1.2 Objectives of the Study

The objective of the study is to propose a survey tool which is perceived to efficiently generate person-trip data using an enhanced questionnaire which incorporates person-trip data into the traditional Philippine Census of Population and Housing (CPH). Specifically, the study aims to determine which of two survey tools is more efficient i.e., the personal interview method (PIM) and the self-administered questionnaire (SAQ), in terms of the following criteria: a) data quality; b) time spent in the interview process; c) number of trips reported; and d) number of persons with reported trips.

1.3 Hypotheses and Treatment of Data

To compare the survey tools, the t-test was deemed appropriate to investigate the differences of their means, in terms of the following : (1) number of correct entries; (2) interview time; (3) number of trips reported; and (4) number of persons with reported trips. As such, the following null hypotheses were tested:

1. There is no significant difference in the data quality observed for each survey methodology in terms of : a) number of correct entries; b) ratio of correct data entries to number of persons with reported trips; and c) ratio of correct data entries to number of trips reported.

2. There is no significant difference in the interview time spent in administering each data gathering methodology in terms of : a) ratio of the total number of interview hours spent to the total number of household members; b) ratio of the total number of interview hours spent to the total number of visits made; and c) number of visits made by household.

3. There is no significant difference in the number of trips reported under each methodology in terms of the: a) actual number of trips reported; b) ratio of the number of trips reported to the number of persons who reported their trips; c) ratio of the number of trips reported to the total number of household members; and d) ratio of the number of trips reported to the number of household members 7 years old and above.

4. There is no significant difference in the number of persons with reported trips observed under each methodology in terms of the : a) actual number of persons with reported trips; b) ratio of the number of persons with reported trips to the number of household members 7 years old and above; c) ratio of number of persons with reported trips to the total number of household members.

2. THE STUDY AREA

Location and Size. Situated some 251 kilometers north of Manila (Philippines), Baguio, a land-locked city is located in the northwestern section of the province of Benguet. It is bounded by the municipality of Tuba, Benguet on the south west; the municipality of La Trinidad, Benguet on the north; the municipality of Sablan, Benguet on the northwest and the municipality of Itogon on the southeast.

Topography and Climate. Generally characterized with a mountainous topography whose elevation ranges from 1,524 to 1,676 meters, the City has one of the lowest temperatures recorded in the country. It is generally 18 °F cooler than its neighboring lowland areas. The coolest months are December to February; the lowest temperature being ordinarily experienced in the month of January. The mean annual temperature in the city is recorded at 18.2 °C or 64.8 °F.

Land Area and Political Subdivision. Baguio City has a total land area of 48.9 square kilometers and a perimeter of 306 kilometers. It is comprised of 129 barangays which is divided into 20 districts.

General Land Use. As of 1985, open space account for the largest share in land use with 3,271 has. or approximately, 66.9 %. Institutional areas account for 841 has. or 17.2 %; residential areas, 699 has. or 14.3 %, commercial areas, 45 has. or 0.9 %, and industrial areas, 37 has. or 0.8 %.

Socio-economic Characteristics. As of 1990, Baguio City has a total enumerated population of 183,142 or 3,736 persons per square kilometer (one of the highest population density records in the country). Of this, nearly 180,000 lived in private households. The average household size was recorded at 4.9 persons, an observation below the norm for Filipino cities since the national urban average was accordingly 5.3.

With respect to occupation groups, about 49,000 of the city's employed residents had occupations classified by the 1990 Census. Accounting for almost 26 %, the largest group was the elementary occupations. This included the street vendors, domestic cleaners and laborers in agriculture, construction and industry. The second largest group with a registered mark of 18.5 %, belongs to the craft and related workers. The professionals group came in third accounting for some 14.5 %. This proportion is rather higher than that of the national urban average which was placed at 9.2 %. An equally large group is represented by the sales and service workers with 11.3 %.

In terms of household income distribution, Baguio-Benguet indicated a low poverty incidence rate at 32.88 % (FIES, 1988). Average annual family income was recorded at P 44,828 or average monthly income of about P 3,800.

With respect to social development, literacy rate in Baguio is high at 85.31 %. However elementary participation rate is low at 59.70% meaning, about 40% of the elementary school-going-age population is not attending school.

Infrastructure and transportation. As of July 1993, Baguio City is made up of a total 315.87 km of road network. Of this, about 60 km or 18 % are classified as national roads; 150 km or nearly 50 % are classified as city roads; and 108 km or 34 % are classified as barangay roads.

In terms of road surface, nearly 70 % are asphalt while about 11% and 19% are concrete and gravel/earth paved, respectively. Meanwhile, to complement the city's road network, 11,389 motor vehicles are registered with the Land Transportation Office as of 1991. This brings a motor vehicle to population ratio of a little more than 60 motor vehicles per thousand population.

3. CONDUCTING THE STUDY

3.1 The Enhanced Questionnaire (Pilot-Test Questionnaire)

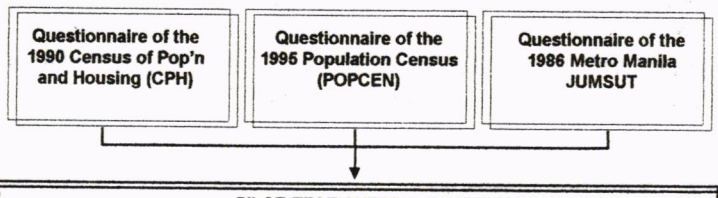
Content. The enhanced questionnaire used in the pilot-test was derived from the: 1) 1990 Census of Population and Housing (CPH); 2) 1995 Population Census (POPCEN); and 3) 1986 Metro Manila Transportation Planning Study (JUMSUT). It covered three sections dealing on: 1) population (Form 2A); 2) housing (Form 2B); and 3) person-trip (Form 2C). One set of the enhanced nine-page questionnaire contained 74 questions.

Population Questions. Structured in tabular form, this first section dealt on the characteristics of the population in a 4-page questionnaire consisting of 41 questions. It inquired some specific inputs on: a) all persons; b) persons five years old and over; c) persons 10 years old and over: and d) females aged 15-49 years old. Among the questions

asked from all persons included the names of the household members, age, sex, marital status, religious affiliation, citizenship, disability, ethnicity and mother's usual residence. For those members aged five years old and over, the questions asked included the household member's previous residence, language, literacy, school attendance, place of school and highest educational attainment.

The Labor Force Survey (LFS) was also incorporated in the 1990 CPH and 1995 POPCEN. Thus, household members aged 10 years old and over were asked about their trade skills and economic activities for the past 12 months or the previous week. Likewise, for the female household members aged 15-49, questions about fertility were also asked.

Three items were added into the usual population census questions. These were the: 1) *average monthly income;* 2) the *school address;* and 3) *usual workplace address.* Grouped together with the LFS portion of the usual census questionnaire, the average monthly income was also to be asked from all persons 10 years old and over. A separate column was provided for this question item. On the other hand, the school and workplace addresses were made sub-questions under the headings "Place of School" and "In what city /municipality does/did ___ work during the past 12 months ?"



FEATURES	PILOT-TEST QUESTIONNAIRE		
	FIRST SECTION	SECOND SECTION	THIRD SECTION
CONTENT	Population questions (Form 2A)	Housing questions (Form 2B)	Person-trip questions (Form 2C)
STRUCTURE	Tabular form	question-box type	question-box type
NO. OF QUESTIONS	41	21	12
NO. OF PAGES	4	3	2
CODING SHEETS	Combination of built-in and separate code sheets	Built-in	Combination of built-in and separate code sheets
NEW ADDITIONS	Average monthly income School & workplace address	Computer ownership No. & type of owned vehicle No. of garaged vehicles	All person-trip information
TARGET RESPONDENTS	All HH members	Household (HH)	HH mem. 7 yrs. old & above
SKIPPING PATTERNS	With GO TO Statements	With GO TO Statements	None
ARROWS/ILLUSTRATIONS	None	With arrows/explanations	With arrows/illustrations
CODE BOXES	With code boxes	With code boxes	With code boxes

Figure 1 : General Features of the Pilot-test Questionnaire

Housing Questions. The 3-page questionnaire on housing constituted the second section of the set. It inquired some 21 questions to all households, particularly, the household heads. The questions asked covered the following: 1) type of residential building; 2) area; 3) state of repair; 4) fuel for lighting and cooking; 5) tenure status of the housing unit; 6) monthly rental; 7) kind of toilet facility; 8) manner of garbage disposal; 9) presence of household conveniences; 10) number of motor vehicles; 11) garaged vehicles; 12) land ownership and language/dialect generally spoken.

Three items were added into the traditional 1990 CPH housing census questions. These were the: 1) household ownership of a computer; 2) number and type of motor vehicles owned; and 3) number of garaged vehicles. The first item did not require a separate question box because it was already included under an already existing item with a heading of "Presence of Household Conveniences". The next 2 items required two separate question boxes and were ordered one after the other.

Person-trip Questions. Finally, the third section of the set was the 2-page person-trip survey. This was entirely a new addition into the original questionnaire set of the 1990 CPH. It asked some 12 questions pertaining to the following: 1) presence and type of driver's license; 2) places visited during the survey day; 3) origin and destination of trips; 4) time departed / arrived; 5) purpose of trip; 6) mode of travel and place of transfer point. Said questionnaire also consisted of the following: 1) instructions for answering the questionnaire; 2) reminder box; and 3) an illustration and word meaning of a trip. Details of the pilot-test questionnaire are given in figure 1.

3.2. Sampling Strategies

A two-stage sampling strategy was adopted for the pilot-test. The eight target barangays which were the usual sample of the NSO in conducting its Labor Force Survey (LFS) in Baguio City served as the pilot barangays for this study. The first stage of the sampling was done through stratified random sampling of the barangays. The second stage, a simple random sampling at the household level was likewise performed for each of the chosen barangay. The number of pilot household samples drawn were made proportionately with the household count of a particular barangay.

Table 1
Number of Pilot Samples, By Barangay

Barangay	1990 No. of HH in Target Barangay	No. of HH for Pilot Samples	1990 Population of Target Barangay	No. of HH Member Samples
West Quirino Hill	164	2	778	12
Slaughter Compound	343	5	1,608	20
Padre Zamora	377	5	1,577	22
Pacdal	611	10	3,515	45
Bakakeng Norte	442	7	2,431	33
Camp 7	573	8	2,890	44
Fairview	847	12	4,277	67
Upper Market Subd.	71	1	363	3
TOTAL	3,428	50	17,439	246
% to Baguio Total	9.38 %	0.137 %	9.55 %	0.134 %
% to Target Total		1.46 %		1.41 %

Source of Data : NSO Report # 2-14N : 1990 CPH

Fifty household respondents, representing about 0.14 % of Baguio's 1990 household population count had been the subject of this pilot-testing activity. The distribution of the number of pilot household samples is shown in above Table 1.

The NSO Baguio-Benguet Staff performed the random selection of the 50 household respondents.

3.3 The Participating Pilot-Sample Respondents

Fifty households, 25 each for PIM and SAQ, had initially been the subject of the pilot-test. However of the 50 households, only 48 households were able to complete the series of interviews given, 29 of whom used PIM (60 percent) while 19 (40 percent) used SAQ.

Using the same household samples to whom the survey tools were administered might have perhaps been ideal, however, respondent bias for either PIM or SAQ and respondent exhaustion, resulting from the long interview process may adversely affect pilot-test results. Thus, PIM and SAQ were administered using varied household samples.

Table 2 below summarizes the general attributes of participating pilot-sample households. As shown, 206 household members aged seven years old and over were eligible for person-trip survey. Household members seven to 14 years old were considered as participants in the pilot-test to allow better perception on person-trip behavior, paving the way for better transportation policy analysis and formulation. In addition, a substantial proportion of pre and elementary school children attend school either on their own or accompanied by their parents.

168 household members or 82 percent reportedly made trips during the assigned survey days. The total number of trips they have reportedly generated was placed at 452; 292 trips or 65 percent of which, emanated from the PIM while, about 35 percent from SAQ.

The ratio of the number of members 7 years old and above with reported trips to the total household members with reported trips, was calculated at over 70 %. Using the same ratio, 69 % was observed under PIM while 72 % under SAQ.

Table 2
Participating Household Attributes, By Survey Method

HOUSEHOLD ATTRIBUTES	PIM		SAQ		TOTAL
	NO.	%	NO.	%	
TOTAL NO. OF HOUSEHOLDS	29	60.42	19	39.58	48
TOTAL NO. OF HH MEMBERS	150	63.03	88	36.97	238
TOTAL NO. OF HH MEMBERS 7 YRS & ABOVE	126	61.17	80	38.83	206
TOTAL NO. OF HH MEMBERS 7 YRS & ABOVE WITH REPORTED TRIPS	104	61.90	64	38.10	168
TOTAL NO. OF TRIPS REPORTED	**292**		**160**		**452**

Table 3
Number / Percentage of Households, By Methodology

HOUSEHOLD ATTRIBUTES	PIM	SAQ	TOTAL
% OF HH MEMBERS 7 YRS & ABOVE TO TOTAL HH MEMBERS	84.00	90.91	86.55
% OF HH MEMBERS 7 YRS & ABOVE WITH REPORTED TRIPS TO TOTAL HH MEMBERS	69.33	72.73	70.59
% OF HH MEMBERS 7 YRS & ABOVE WITH REPORTED TRIPS TO HH MEMBERS 7 YRS & ABOVE	82.54	80.00	81.55

Finally, the ratio of the number of household members 7 years old and above with reported trips to total household members 7 years old and above, was placed at over 81 %. Using the same ratio, the PIM had 82.54 % while, SAQ had 80 %. This is elucidated further in Table 3.

3.4. Procedure in Conducting the Pilot-test

Defining PIM and SAQ as Survey Tools. For households assigned under PIM, all questions from the three sections of the enhanced questionnaire were gathered solely through personal interview method. In contrast, for households assigned under SAQ, the two survey tools were employed. The personal interview method was used for the first and second sections of the questionnaire while a self-administered questionnaire was employed for the third section. In other words, in SAQ, both the personal interview method and the self-administered questionnaire were employed, that is, the personal interview method was used in gathering the population and housing sections while the person-trip section was gathered through self-administered questionnaire. This strategy was carried-out because the first and second sections of the questionnaire which come from the CPH employed the same methodology (PIM). The Table 4 clearly illustrates this.

Differentiating the Conduct of PIM and SAQ. In administering PIM for instance, after population and housing data are gathered through personal interview, the enumerator arranges and sets a day within which the enumerator will have to call back to interview eligible members of the household on their trip for the particular day agreed upon. The enumerator leaves a memory jogger for each eligible household member for them to list down all the trips they made on an agreed day. The enumerator goes back to the household and interviews all household members on their trips. While the interview is going on, the enumerator accomplishes the person-trip survey forms. The memory jogger, a form which is filled up by the household member, serves as an aide memoir on all the trips that the concerned household member made on the agreed survey day. This procedure is clearly illustrated in Figure 2.

Table 4
The Difference Between PIM and SAQ as Survey Tools

PORTION OF THE QUESTIONNAIRE SET	SURVEY TOOL	
	PIM	SAQ
A) POPULATION CENSUS QUESTIONS	Personal interview	Personal interview
B) HOUSING CENSUS QUESTIONS	Personal interview	Personal interview
C) PERSON-TRIP SURVEY QUESTIONS	Personal interview	Self-administered

PROCEDURE IN CONDUCTING THE PIM

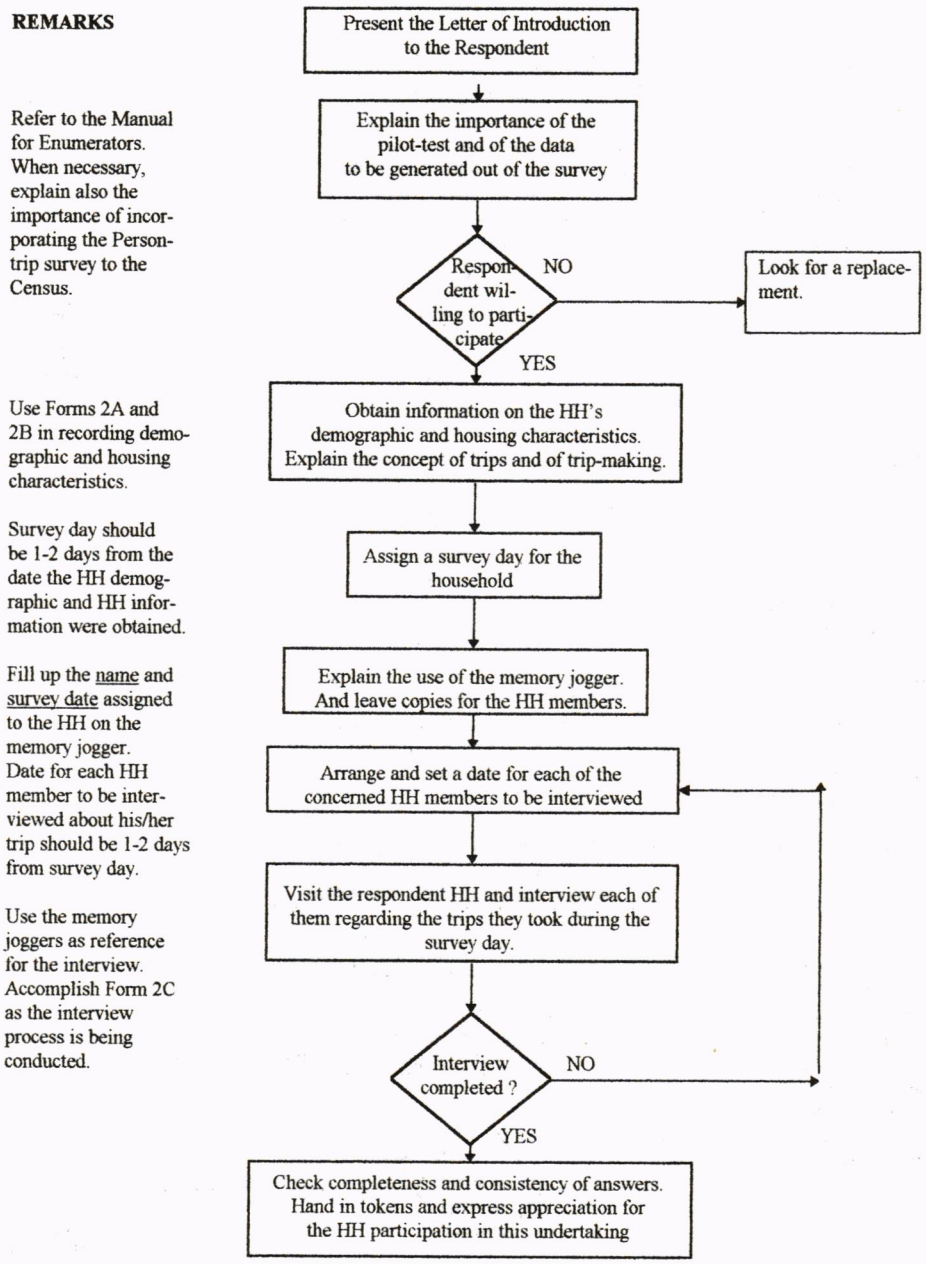


Figure 2 : Conducting the PIM

PROCEDURE IN CONDUCTING THE SAQ

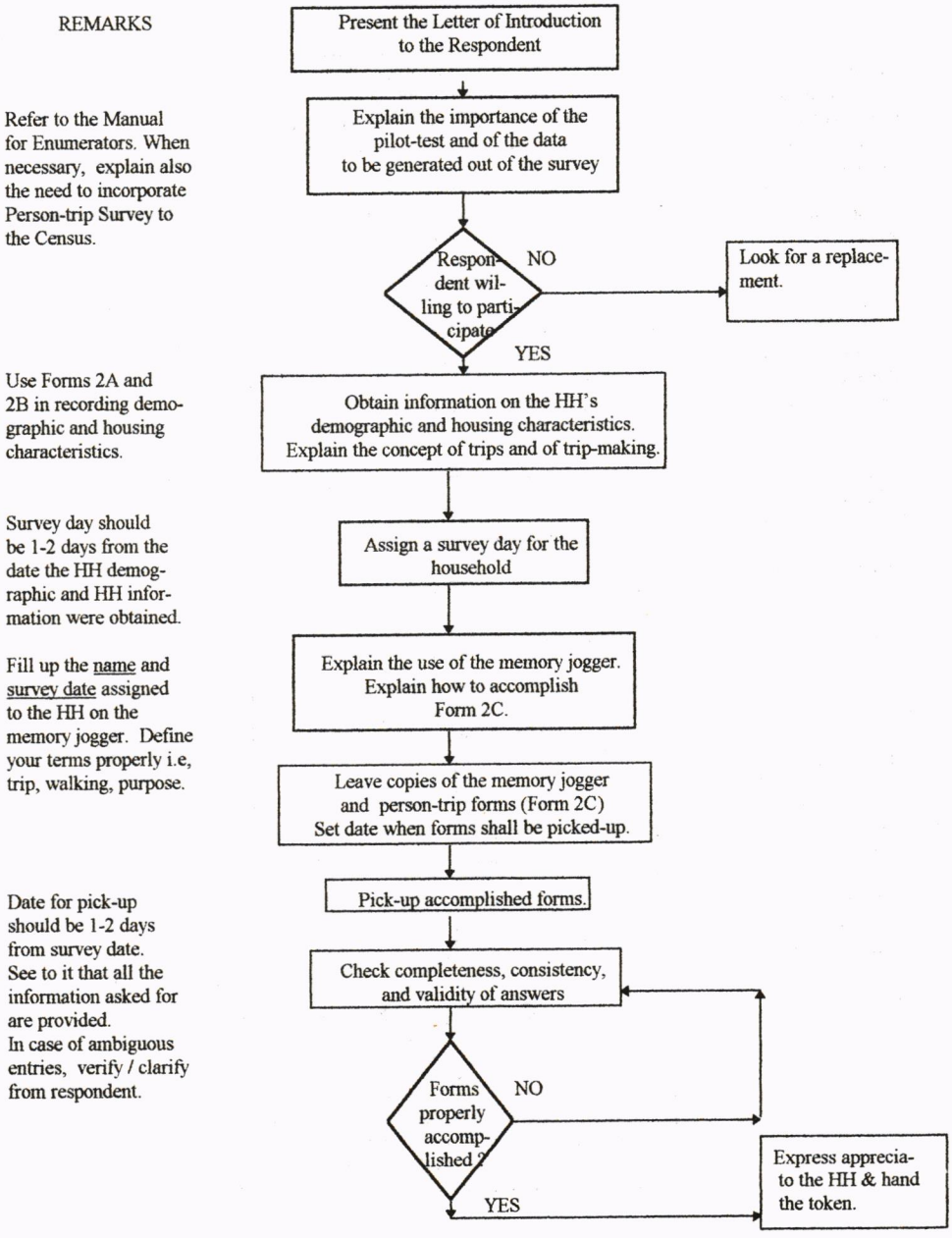


Figure 3 : Conducting the SAQ

On the other hand, in conducting the SAQ, after population and housing data are obtained through personal interview, the enumerator arranges a particular day on which all eligible household members would have to record the trips they made on the memory joggers issued them. The enumerator explains the use and procedures in accomplishing the memory jogger and the person-trip survey forms. The enumerator goes back to the household and pick-up the already accomplished forms. The household members themselves accomplish the person-trip survey forms, during their convenient time, using the memory jogger as the basis for information. Figure 3 illustrates how the SAQ was administered.

4. COMPARING THE PIM AND THE SAQ AS SURVEY TOOLS

4.1 Evaluation Criteria for Comparing PIM and SAQ

PIM and SAQ were compared on the basis of the four major criteria shown in Table 5. These were: 1) data quality; 2) interview time; 3) number of reported trips; and 4) number of persons with reported trips.

In order to precisely evaluate the differences between the two survey tools, it was deemed necessary to analyze the data gathered, not only on the household level, but also on a per household member level of analysis such those found in Table 5. As such, there were thirteen more specific indicators analyzed, these included the correct data entry per person, correct data entry per number of trips, interview time per household members, trips reported per person with reported trips, trips per household member, persons per reported trips per household member seven years old and over, to name a few.

Data Quality. For obvious reasons, data quality was used as a criteria in evaluating the difference between the two survey methodologies due to the needed accuracy and reliability of information in any transportation planning and development endeavor. The number of correct entries made on the questionnaire was made an attribute of d*ata quality.* It should be made clear however that data quality analysis was made solely for the entries on the person-trip survey questions alone in order to determine the level of accuracy of entries made by the enumerator, for PIM and the respondent himself/herself for SAQ.

Table 5
Specific Criteria Analyzed by Methodology

BASIS FOR COMPARISON	CRITERIA
Quality of Data	Number of correct data entries Correct data entries per person with reported trips Correct data entries per total number of trips reported
Interview Time	Interview time per household member Interview time per visit No. of visits per household
Number of Trips Reported	No. of trips reported Trips reported per person with reported trip Trips per household member Trips per household member 7 years old and above
Number of Persons with Reported Trips	Number of persons with reported trips Persons with reported trips per HH member 7 years old & over Persons with reported trips per HH member

In determining data quality, the observed trips for each survey methodology were classified into three. These were the: 1) number of correct and/or complete entries; 2) number of incorrect and/or incomplete entries; and 3) number of missing entries.

Data quality analysis involved the process of logically checking each entry made in the person-trip survey questionnaire. An entry was classified as correct when a complete and logical answer was made. Apart from consistency of answers, the correctness and logic of each entry was determined using the: 1) respondent's demographic, socio-economic and trip characteristics; 2) entries of the members of the same household where the respondent belonged; or 3) entries of the same community/barangay where the respondent lived.

Likewise, entries which appeared to be incomplete but were not necessarily incorrect were also deemed correct/complete entries. For instance, *Baguio Cathedral* as an entry to TRIP ORIGIN ADDRESS appears to be incomplete and incorrect. However this entry was deemed correct and complete because Baguio Cathedral's actual location and address was distinctively clear and specific.

An entry was categorized as incomplete and/or incorrect if when the respondent chose "others" as his/her INSTITUTION OF ORIGIN, but fails to specify in the space provided, the type of institution where he/she originated. Hence, even it appeared logical such entry was still classified as incomplete/incorrect.

Moreover, a *7:30* entry was classified as incomplete or incorrect because of the failure of the respondent to indicate whether he/she left his/her trip of origin in the morning or in the afternoon. However, if there was a way of checking and determining the exact time the trip was made, then this entry was classified as correct or complete.

Finally, the classification of missing entries occurred when a respondent failed to answer a question or series of questions and he /she made no entries on the questionnaire.

Interview Time. The time spent for data gathering in terms of the total number of hours was also considered because the length of interview time had obvious implications on the cost of the survey particularly, in terms of the enumerator's wage. *Interview time* was operationally defined as the total number of hours spent in interviewing the household members. For the PIM for instance, it covered the total time: 1) in gathering the population, housing and trip characteristics of each household; 2) in giving the instructions to be adopted in carrying out the interview process; 3) spent by the enumerator in checking the completed questionnaire; and 4) in gathering the trip information of each qualified household member. In the case of SAQ, interview time included the : 1) total number of hours spent in gathering the population and housing characteristics of the household; 2) time spent in giving the instructions on how to accomplish the forms; 3) length of stay of the enumerator in the respondent's residence when picking-up the accomplished forms; and 4) time spent by the enumerators in checking the completed questionnaire.

Number of Trips Reported. Determining the *number of reported trips* entailed the counting of actual trips made by household members during the assigned survey day. This criteria was likewise used to evaluate PIM and SAQ for the reason that the type of survey tool employed might affect the number of trips reported by households members.

Number of Persons with Reported Trips. The *number of persons with reported trips* was also taken by actually counting the number of members of the household who made trips during the assigned survey day.

The survey methodology which generated the greater number of trips reported and greater number of persons who reportedly made trips is considered the more favorable methodology, also due to needed data accuracy and reliability. For example, a household where PIM was employed might generate a greater number of trips reported than where the SAQ was employed. In such case, the PIM can be considered the more adaptable or favorable method as far as the respondents were concerned because they were more inclined to report the trips they made or that the household members were more comfortable to report that they took trips during the assigned survey day. These criteria were deemed very important in transportation planning as under reporting of trips actually made may adversely impact on the reliability of the data from which transportation planning and development are based.

4.2 Summary of the Results of the T-Test Analysis

T-test was used as the tool for analysis in this study. The t-value distribution is the most effective formula for the test of hypothesis because this involves a decision parameter on population means. The formula using the differences of the population means becomes effective when the variances are pooled and considered as divisors to the differences. These pooled variances are corrections to possible errors in the derivation of the means. The t-value formula emphasizes these possible decision parameters. If the computed t-value is less than the tabular value at a computed degree of freedom, the null hypothesis is accepted. If the t-value is greater than the tabular value at the computed degree of freedom, the null hypothesis is rejected.

Data Quality. Table 6 presents a summary of the results of the t-test analysis comparing the quality of data gathered using either PIM or SAQ. On all of the three criteria, the null

Table 6
Statistical Summary of Difference Between the PIM and SAQ For Quality of Data by Household Member

CRITERIA	T-VALUE Two-tailed Test	CRITICAL VALUE at 95 % Confidence Level at 46 DF	INFERENTIAL CONCLUSION
Correct Data Entries	1.76	+ or - 1.684	Reject Ho : There is a significant difference between PIM and SAQ in terms of correct data entries.
Ratio of Correct Data Entries to No. of Persons with Reported Trips	2.37	+ or - 1.684	Reject Ho : There is a significant difference between PIM and SAQ in terms of correct data entries per household member
Ratio of Correct Data Entries to the No. of Trips Reported	3.00	+ or - 1.684	Reject Ho : There is a significant difference between PIM and SAQ in terms correct data entries per trip reported

hypotheses formulated were rejected meaning, in so far as quality of data was concerned, there was a significant difference between the PIM and SAQ.

Table 7 explains the differences of the PIM and SAQ through the correct data entry means. In addition, Table 8 below explains further the significant differences between the PIM and SAQ. In terms of missing entries, the PIM registered a zero on all items asked in the person-trip survey while the SAQ registered 2.64 %.

Likewise, in terms of completeness, the PIM manifested an overall percentage of 99.47 % with a negligible proportion of 0.53 % accounting for incomplete or incorrect entries. A look at how the SAQ fared on this aspect revealed that some 92.15 % had been classified as correct entries while 5.21 % was categorized as incorrect / incomplete entries.

Table 7
Correct Data Entry Mean, By Survey Methodology

CRITERIA	PIM	SAQ
Number of correct data entries	90.13	69.84
Correct data entries per person with reported trips	25.63	20.71
Correct data entries per total number of trips reported	8.94	8.43

Table 8
No. / Percentage of Correct, Incorrect & Missing Entries, By Methodology

INDIVIDUAL TRIP INFORMATION	PIM				SAQ			
	Correct Entry	Incorr Entry	Miss Entry	Total	Correct Entry	Incorr Entry	Miss Entry	Total
Institution of origin	291 99.66 %	1 0.34 %	0 0.00	292	146 91.25 %	7 4.38 %	7 4.38 %	160
Origin address	287 98.29 %	5 1.71 %	0 0.00	292	152 95 %	6 3.75 %	2 1.25 %	160
Time departed	291 99.66 %	1 0.34 %	0 0.00	292	142 88.75 %	16 10.00 %	2 1.25 %	160
Institution of destination	290 99.32 %	2 0.68 %	0 0.00	292	147 91.88 %	6 3.75 %	7 4.38 %	160
Destination address	289 98.97 %	3 1.03 %	0 0.00	292	146 91.25 %	12 7.50 %	2 1.25 %	160
Time arrived	291 99.66 %	1 0.34 %	0 0.00	292	142 88.75 %	16 10.00 %	2 1.25 %	160
Trip purpose	292 100 %	0 0.00	0 0.00	292	149 93.13 %	5 3.13 %	6 3.75 %	160
Mode of travel	292 100 %	0 0.00	0 0.00	292	154 96.25 %	1 0.63 %	5 3.13 %	160
Address of location point	291 99.66 %	1 0.34 %	0 0.00	292	149 93.13 %	6 3.75 %	5 3.13 %	160
TOTAL	2614 99.47 %	14 0.53 %	0 0.00	2680 100 %	1327 92.15 %	75 5.21 %	38 2.64 %	1440 100 %

Table 9
Number of Correct Entries, By Questionnaire Item

INDIVIDUAL TRIP INFORMATION	TOTAL					
	Correct Entry	%	Incorr Enrty	%	Miss. Entry	%
Institution of origin	437	96.68 %	8	1.77 %	7	1.54 %
Origin address	439	97.12 %	11	2.43 %	2	0.44 %
Time departed	433	95.80 %	17	3.76 %	2	0.44 %
Institution of destination	437	96.68 %	8	1.77 %	7	1.54 %
Destination address	435	96.24 %	15	3.32 %	2	0.44 %
Time arrived	433	95.80 %	17	3.76 %	2	0.44 %
Trip purpose	441	97.57 %	5	1.11 %	6	1.32 %
Mode of travel	446	98.67 %	1	0.22 %	5	1.10 %
Address of location point	440	97.35 %	7	1.55 %	5	1.10 %

Another observation which seemed to indicate that the PIM was a more efficient tool was the non-accomplishment of person-trip survey forms of two households on the SAQ side. Of the said two households, one returned the whole person-trip survey forms empty, while the other haphazardly accomplished the forms; the entries made were voided due to extreme ambiguity of the information provided. An investigation on where the most number of errors was made is given in Table 9. As shown most errors were committed on questions regarding time departed and arrived where correct entries accounted for 95.80 % for both methodologies. This was predominantly observed in SAQ responses.

Institution of origin and destination addresses came in next with a total reported correct entries of 96.68 %. Again, most of these errors were commonly committed under SAQ responses. With respect to which questionnaire item accounted for the most number of errors, incorrect entries on origin and destination addresses were commonly observed under PIM, while incorrect entries on the time departure and arrival questions were commonly committed under SAQ.

To sum up, there were marked differences between the PIM and SAQ as given by the t-test analysis; the discussions above seem to indicate that PIM is a more favorable methodology compared to the SAQ.

Interview Time. In assessing the interview time by household, three indicators were reviewed and analyzed. These were the: 1) ratio of the total number of interview hours spent per household to the total number of household members; 2) ratio of total number of interview hours spent per household to the total number of visits made; and 3) total number of visits made.

Table 10 reveals an acceptance of all the null hypotheses formulated, meaning, on all of the three criteria examined, PIM and SAQ do not significantly differ in terms of interview time per household. In other words, whether PIM or SAQ was utilized in the interview process, the time spent for each method does not significantly differ.

Table 10
Statistical Summary of Difference Between the PIM and the SAQ Interview Time By Household

CRITERIA	T-VALUE Two-tailed Test	CRITICAL VALUE at 95 % Confidence Level at 46 DF	INFERENTIAL CONCLUSION
Ratio of Total No. of Interview Hours Spent to the Total No. of Household Members	0.54	+ or - 1.684	Accept Ho : There is no significant difference between PIM and SAQ in terms of the total interview time per total number of household members
Ratio of Total No. of Interview Hours Spent to the Total No. of Visits Made	0.79	+ or - 1.684	Accept Ho : There is no significant difference between PIM and SAQ in terms of interview time per visit
Number of visits by household	0.62	+ or - 1.684	Accept Ho : There is no significant difference between PIM and SAQ in terms of the number of visits per household

Table 11
Mean Interview Time , By Survey Method

CRITERIA	PIM	SAQ
Interview time per household member	0.20	0.187
Interview time per visit	0.408	0.378
No. of visits per household	2.448	2.316

Table 12
Comparative Review of Interview Time Indicators by Survey Methodology

Time Indicators	PIM	SAQ
Average interview duration (minutes)	58.02	48.24
Average number of visits	2.45	2.32
Average number of days	2.41	2.32

A closer examination of the means obtained for each method is shown in Table 11. The slight differences in means probably explains the insignificant difference between the two survey methodologies. For example, in the ratio of total number of interview hours to the total number of household members, PIM registered 0.20 compared to SAQ's 0.18. For the second and third gauges, PIM got 0.40 and 2.44, respectively, while SAQ had 0.37 and 2.31.

Moreover, the positive t-values observed indicate that indeed longer time was needed to administer the PIM. This contention is corroborated by Table 12. On the whole, although it appears that SAQ consumed lesser time, there were insignificant differences of PIM and SAQ in this regard. Thus, whether PIM or SAQ was utilized as survey methodology, the observed time spent in administering each survey methodology was not substantial. Hence, the PIM or SAQ can either be utilized as far as this criteria is concerned.

Table 13
Statistical Summary of Difference Between the PIM and the SAQ No. of Trips Reported by Household

CRITERIA	T-VALUE Two-tailed Test	CRITICAL VALUE at 95 % Confidence Level at 46 DF	INFERENTIAL CONCLUSION
No. of Trips Reported	1.217	+ or - 1.684	Accept Ho : There is no significant difference between PIM and SAQ in terms of the no. of trips reported
Ratio of the No. of Trips to the No. of Persons with Reported Trips	1.62	+ or - 1.684	Accept Ho : There is no significant difference between PIM and SAQ in terms of the no. of trips reported to the no. of persons with trip
Ratio of Trips Total Household Members	0.509	+ or - 1.684	Accept Ho : There is no significant difference between PIM and SAQ in terms of the no. of trips reported
Ratio of Trips per Household Member 7 Years Old and Above	1.37	+ or - 1.684	Accept Ho : There is no significant difference between PIM and SAQ in terms of the no. of trips reported

Table 14
Mean of Trips Reported , By Survey Method

CRITERIA	PIM	SAQ
No. of trips reported	292	160
Trips reported per person with reported trip	2.81	2.50
Trips per household member	1.95	1.82
Trips per household member 7 years old and above	2.32	2.00

Number of Trips Reported. There were four criteria analyzed to compare the PIM and SAQ in terms of the number of trips reported. Table 13 below gives a summary of the results. As demonstrated, the null hypotheses formulated were all accepted at 0.95 probability. This indicates that there were no significant differences between the PIM and SAQ in terms of the number of trips reported. Subsequently, the type of survey methodology utilized does not affect the number of trips reported by household members.

However, an investigation of the means of the criteria seemed to indicate that although there were no significant differences between the PIM and SAQ, a household appeared to be more inclined to report a higher number of trips made by its members when PIM was utilized. This is validated by the greater means obtained for the PIM against that of the SAQ as seen in Table 14.

Number of Persons with Reported Trips. This indicator used three gauges as bases for comparison: 1) number of persons with reported trips; 2) ratio of number of persons with reported trips to the number of household members 7 years old and above; and 3) ratio of the number of persons with reported trips to the total number of household members.

On all of the above indicators, the null hypotheses formulated were accepted at 95 % confidence level. This means that there were no significant differences between the PIM and SAQ. Hence, either survey methodology could be used. The Table 15 pictures the general outcome of the statistical tests made.

Table 15
Statistical Summary of Difference Between the PIM and the SAQ No. of Persons with Reported Trips

CRITERIA	T-VALUE Two-tailed Test	CRITICAL VALUE at 95 % Confidence Level at 46 DF	INFERENTIAL CONCLUSION
No. of Persons with Reported Trips	0.478	+ or - 1.684	Accept Ho : There is no significant difference between PIM and SAQ in terms of the no. of persons with reported trips
Ratio of the No. of Persons with Reported Trips to the No. of HH Members 7 years old and above	0.64	+ or - 1.684	Accept Ho : There is no significant difference between PIM and SAQ in terms of the no. of persons with reported trips to the no. of HH members aged 7 years old and above
Ratio of No. of Persons with Reported Trips to the Total No. of Household Members	-0.339	+ or - 1.684	Accept Ho : There is no significant difference between PIM and SAQ in terms of the no. of persons with reported trips to the no. of HH members aged 7 years old and above

Table 16
Mean of Persons with Reported Trips, By Survey Method

CRITERIA	PIM	SAQ
Number of persons with reported trips	3.58	3.36
Persons with reported trips per HH member 7 years old & over	0.82	0.78
Persons with reported trips per HH member	0.69	0.72

A further look at the observed means for each criteria set however seemed to indicate that a household was apparently more inclined to report higher number of persons with reported trips if PIM was utilized. Table 16 supports this earlier contention.

5. CONCLUSIONS, RECOMMENDATIONS AND FURTHER DIRECTIONS OF THE STUDY

5.1 Conclusions and Recommendations

As far as data quality is concerned, it was found out that there was a significant difference between the PIM and SAQ, with the PIM appearing to be a more favorable methodology.

With respect to interview time, it was found out that there is no significant difference between PIM and SAQ. This means that either PIM or SAQ can be used in the interview process because the difference in the time spent in administering each tool was insignificant. Albeit, the SAQ seemed to be a more efficient methodology as it consumed lesser time compared to PIM.

The other criteria used for comparing the two survey methodologies were the : 1) number of trips reported; and 2) number of persons with reported trips.

Table 17
Summary of Differences of PIM and SAQ, By Specific Criteria

SPECIFIC CRITERIA	DIFFERENCE BETWEEN PIM AND SAQ
QUALITY OF DATA	
Number of correct data entries	Significant, (+ t)
Correct data entries per person with reported trips	Significant, (+ t)
Correct data entries per total number of trips reported	Significant, (+ t)
INTERVIEW TIME	
Interview time per household member	Insignificant, (+ t)
Interview time per visit	Insignificant, (+ t)
No. of visits per household	Insignificant, (+ t)
NUMBER OF TRIPS REPORTED	
No. of trips reported	Insignificant, (+ t)
Trips reported per person with reported trip	Insignificant, (+ t)
Trips per household member	Insignificant, (+ t)
Trips per household member 7 years old and above	Insignificant, (+ t)
NUMBER OF PERSONS WITH REPORTED TRIPS	
Number of persons with reported trips	Insignificant, (+ t)
Persons with reported trips per HH member 7 years old & over	Insignificant, (+ t)
Persons with reported trips per HH member	Significant, (- t)

Table 18
Matrix of Advantages / Disadvantages of Survey Methodologies

METHODOLOGY	ADVANTAGE	DISADVANTAGE
PIM	• data quality is assured • more number of trips reported and more number of persons with reported trips appeared to be an advantage	• appears to consume more interview time
SAQ	• appears to require lesser interview time	• data quality is not assured • lesser number of trips reported and lesser number of persons with reported trips appeared to be a disadvantage

Generally, there were no observed significant differences between the PIM and SAQ regarding these two criteria.

That means, whether PIM or SAQ was utilized in a survey, the difference of the number of trips reported and the number of persons with reported trips resulting from each methodology was insignificant. Notwithstanding, the PIM appeared to be a more favorable methodology over the SAQ due to the higher means attributed to the PIM. In summary, Table 17 paints a full picture of the difference between the PIM and SAQ.

The following table enumerates the apparent advantages and disadvantages of each methodology as gathered from the above discussions.

In conclusion, the personal interview method (PIM) of gathering data has apparently more advantages than disadvantages. Hence, considering the necessity for reliable data in any transportation planning and development activity, using PIM is therefore highly recommended.

5.2 Further Directions of the Study

1. For a more comprehensive evaluation of the two survey tools, the actual operational costs required in each survey methodology should also be studied.

2. The results of this study could have been even more valid with additional number of households. Thus, a revalidation of this study's findings should also be made by conducting a similar pilot-test in another area, preferably, by employing a larger number of household sample respondents for each PIM and SAQ.

3. Finally, to improve further the enhanced questionnaire developed, other options/strategies for appropriately incorporating person-trip survey into the CPH should also be explored, and further piloted.

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