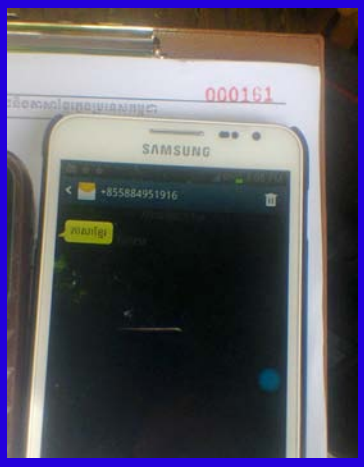
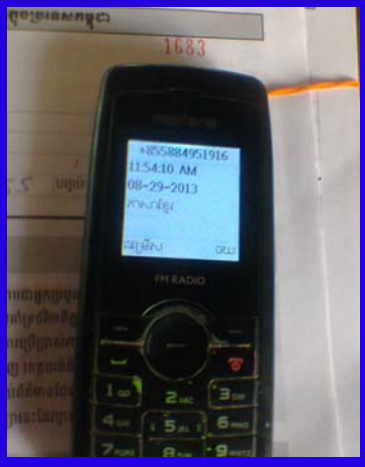
Research Report

on

Existence and Use of Phones that permit written communication in Khmer Script





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Executive Summary

This study responds to the need to understand if SMS can be used as a tool for government and civil society organizations to communicate directly with citizens and beneficiaries all over Cambodia, offering to them information and services in Khmer through mobile phones. It also attempts to understand if smart phones are or will become a key device for accessing Internet and social media in Cambodia, as these networks are quickly becoming the main source of information for youth.

The study was done in-house by the Open Institute with over 2,000 respondents randomly selected among citizens from the whole country. The results have permitted quantifying the percentage of Cambodians who own phones that are able to send and receive SMS in Khmer, also allowing the use of Internet and social media in Khmer if they are smart phones with Internet access.

The first finding of the study was that almost 90% of Cambodians claim to own their own phone, and over 99% are reachable through some phone. Only 11% use more than one phone, and one in four uses more than one operator.

The results of the study show that 29.5% of Cambodians (±2%) own phones that are capable of communicating in Khmer script. The use of these phones is more common among men (34.4% vs 24.7 for women) and also more common in urban areas (36.5% urban vs 30.3% rural).

22% of the phones examined were smart phones. Usage of Khmer was more common in smart phones than in dumb-phones (41.7% vs 30.7%). For smart phone users, the ability of displaying Khmer was more common for users with a higher level of education.

An interesting result was that only 58% of users of Khmer-enabled phones were aware of this feature, a percentage consistent with the reasons given for not using Khmer script in enabled phones: "It is not useful", "it is difficult", and "very few have phones that can receive it".

The study concludes that the number of Khmer-enabled phones does not yet constitute the necessary critical mass for communication in Khmer to take place through them at the moment, but predicts that the number will naturally grow due to the high percentage of new smart phones coming into the market (40% of new phones) and the fact that most new smart phones coming into the Cambodian market in the coming years will support Khmer script natively.

Only a few percentage of phone owners write in them in Khmer regularly (4.6%), while the number of those who write in Khmer using Latin characters is three times bigger. This rate is nevertheless changing quickly, as the Latin script users were four times bigger than Khmer script users three years ago, following with the trend of more phones being enabled for Khmer. It is believed that the main driver for new users to start using Khmer in phones will come from the need to write in Khmer in social networks, and that this ability will then be used to send SMSs in Khmer.

It is recommended to help accelerate the adoption of Khmer-enabled phones through perception-change campaigns at the time of purchase of new phones, by creating awareness for students in the last years of school, by facilitating entering Khmer text through the development of better text prediction, and to encourage long term work on speech recognition for Khmer, as the input method for the future.

List of Figures

Abbreviations & Acronyms

ICT	Information Communication Technology
KTV	Karaoke Television
MoE	Ministry of Environment
MoEYS	Ministry of Education, Youth and Sport
MPTC	Ministry of Post and Telecommunication
PPS	Probability Proportional to Size
SMS	Short Message Service
SPSS	Statistical Package for the Social Science
USAID	United States Agency for International Development

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1 Introduction[1]

It has only been in the last five years, accelerated by the KhmerOS and Open School Programs[2], that standardization on the use of Khmer script in computers has been achieved. The use of the Unicode standard has permitted the development of modern websites and blogs in Khmer, the translation of computer applications to this language, the use of social networks in Khmer, and the permanent storage of information without fear of it being lost when the legacy fonts were lost.

This change has also permitted the use of Khmer in phones. First supported by Nokia in 2006 in some of their phones (with help from the KhmerOS program), the use of Khmer did not pick up, as the mid-range models that supported Khmer were not the most popular ones, and the purchase decisions were based on either price (inexpensive) of social status (expensive).

Since then, a few manufacturers of other dumb phones have developed support for Khmer, but the number never reached a critical mass that would have permitted widespread use, and the input methods were too complicated for normal users. The use of Latin script to write Khmer became widespread, but the number of people who could understand it is limited and the vocabulary that could be used was also restricted, allowing only for poor communication among youth.

Smart phones have nevertheless started a small revolution, as they have arrived at a time that Internet was becoming popular, and in many cases have become their user's only way of accessing the Internet. Most of these smart phones (exception made of Nokia) did not support Khmer natively, but users of some of them (iPhones mostly) quickly learned how to enable Khmer on them. For users of phones that supported Android, the new system coming into the market pushed by most smart phone manufacturers to compete with Apple, it was not as easy. It was not possible to do anything to the first generations of these phones that would make them support Khmer. Only in the last year the SPICE program has been able to develop a few applications that embedded the necessary know-how to manage Khmer script, enabling all Android phones to install support for Khmer. The program has also helped enable full support for Khmer in Android 4.4, as well as provided a full translation of this system that is being distributed by Google to all phone manufacturers, opening the way for all future Android phones to support Khmer natively.

While the path for the use of Khmer in phones is now opened, with new models of smart phones and dumb phones permitting the use of Khmer, there are no

1*This study has been made possible by the generous financial support of the United States Agency for International Development (USAID) through the program "Structuring Partnerships for an Innovative Communications Environment" (SPICE).*

2*The Open Institute's KhmerOS program has worked since 2004 to help standardize the use of Khmer script in society and government by using Unicode. The Open Schools Program, also housed at the Open Institute, has supported the Ministry of Education in the standardization to Unicode and the teaching of Unicode to all students in grades 11 and 12. www.open.org.kh – www.khmeros.info*

hints to how many of the phones now being used support the use of Khmer script. This information is necessary to understand if SMS can be used as means of communication for civil society organizations and government to reach phone users with information and services. Also, knowing the penetration of Khmer-enabled smart phones would facilitate understanding the use that these phones can be given to access social networks in Khmer, the fastest growing means of communication in Cambodia among youth. Knowing the number of users that have Khmer-enabled phones also permits using this baseline to compare how this support grows with time.

This study has therefore collected and analyzed data to quantify the number of Cambodians who have phones that allow them to communicate in Khmer script, as well as to understanding their circumstances and the groups that they belong to. This information will serve to identify possible trends for change in the future, and the understanding of what will constitute a critical mass of users that will facilitate widespread use of Khmer script. The relationship between such support and social media is specially considered.

2 Means and Methods

2.1 Population of the Study

The study only considers Cambodians citizens between the ages of 15 and 65 who live inside the country.

A projection of the 2008 population census to 2003, corrected to include expected natural decrease, leads to estimate a present number of 9,606,450 citizens in this age group. This number is consistent with approximation to the population offered by the Cambodian Inter-Censal Population Survey 2013.

2.2 Sample Size

The appropriate sample size for a population-based survey is determined by the estimated value of the main variable, the desired level of confidence and the acceptable margin of error. A simple random sample of 2,000 participants across target provinces gives us an accurate estimate of the proportion of people who own a phone that supports Khmer with a $\pm$ 2.63% margin of error and a 99% level of confidence ($p < 0.01$).

The sample was divided in two parts: (a) population that could be found at their home at the time the data collection was taking place (office hours), and; (b) population who would be hard to find at home at that time and had to be found somewhere else, either their working place or the location where they had lunch.

The division of participants between these two parts of the sample was made according to the number of factory workers, other blue collar (.i.e. restaurant workers), white collar workers, and entertainment workers that were estimated, after requesting information from the Garment Industry Association and other studies on types of employment in Cambodia. It was estimated that 22.5% of the population could not be found at home during working hours. Based in this percentage, 77.5% of the sample was collected directly in households and 22.5% was collected in work places and lunch places (segregating factory workers, other blue collar workers, white collar workers and entertainment workers).

Respondents for the first part of the sample (in households) were recruited based on the official national census data of the population. Gender, age and location of residence of the respondents were proportionally selected in accordance with census data and with the population of each one of randomized provinces. In the case of Phnom Penh, due to the access to mobile phone in the city, the recruitment proportion changed to fit the actual proportion of rural/urban residents (estimated at 70% urban and 30% rural).

The second type of respondents were recruited based on the statistics of white collar (officials, NGOs staffs, and companies staffs) and blue collar workers (garment, restaurant and entertainment workers) mainly located in Phnom Penh, and considered as a urban area; only one group of garment workers was interviewed in garment factories in Kampong Tralach, Kampong Chhnang, considered as rural area.

2.3 Sampling

2.3.1 First Type of Respondents

Multi-stage sampling using Probability Proportional to Size (PPS) was used to select a nationally representative sample of 15-65 years old in households.

Cambodia's 24 provinces were categorized into five regions: Plain, Tonle Sap, Coastal, Plateau and mountain and capital city. Kampong Cham was selected in the plain region, Battambang was selected in the Tonle Sap region, Preah Sihanouk was selected in the coastal region, Stung Treng was selected in the plateau and mountain region, and Phnom Penh was the capital city. These provinces had the standard characteristics which matched the requirements of the study.

A total of 23 urban villages were included in the sample.

A total of 56 villages (23 urban) were selected across the five regions of Cambodia. Within each region the number of urban and rural village was calculated to match the urban-rural proportion of the province. From each village, 25 respondents were selected. Urban and rural respondents were sampled independently with the number of rural and urban villages to be determined based upon proportion of urban-rural in each region presented in the national census 2008. The cumulative population was divided by the number of villages in the categories to generate the sampling interview.

A random number between one and the sampling number was selected using Excel random number function (RAND). The first village was the village in which this random number lies. Subsequent villages were identified by adding the sampling interval to the previous random number.

Systematic sampling was used to recruit household. In each village, the data collection team leader visited the village chief to ask for the actual number of households in the village, and used the figure to calculate interval of households for the data collectors to look for households. At village level, purposive sampling was applied in the data collection to process to choose the respondents. Interviewers visited the households, interviewed the persons they meet, screening the respondents that did not meet the age requirements or did not have a phone.

2.3.2 Second Type of Respondents

To collect data from respondents who could not be found at home, the interviewers were required to stand near the garment factories and wait for workers. At restaurants, owners were explained and asked for permission to interview employees and customers. Massage shop, beer garden and Karaoke workers were interviewed after getting approval from the managers. Workers and customers of restaurants were randomly selected, and so were workers from massage shops, beer gardens and karaokes.

2.4 Questionnaire and observation data sheet

The survey questionnaire – attached as appendix A - was constructed to include the following:

- Demographic information
- Phone's characteristics
- Knowledge, attitude, and practices of phone users

The form also contained space for the data that the interviewer was asked to collect through observation, combining both questionnaire and observation data sheet.

The questionnaire was developed and perfected during the months of July and August, and it was improved to avoid data collection problems after a pilot test.

2.5 Data Collection

Data was collected using interviews and observation. Face to face verbal interviews based on a standardized questionnaire. Interviewers read each question to the respondent and noted the answer. Data was also collected through direct observation of the phones of the respondents, before and after sending and SMS in Khmer to them.

2.5.1 Recruitment and Training of field work staff

Each data collection team conducting fieldwork consisted of one supervisor and five data collectors. In total, there were four supervisors and 20 data collectors recruited and trained by researchers of Open Institute.

Training was prepared and conducted by Open Institute in order to familiarize field workers with the aims and objectives of the research, to improve their knowledge of the survey methodology, ethics and data collection techniques, to familiarize them with the survey questionnaire and to help build, through interactive practice sessions, interpersonal communication and field practice with the written questionnaire.

2.5.2 Fieldwork

A pilot test was conducted in a rural village in Kandal province and in Phnom Penh. The questionnaire was then reviewed for potential data collections errors detected. Suggestions and comments from interviewers and respondents were incorporated into the final survey instrument.

Data collection was then conducted over a period of two weeks in August and September 2013. Supervisors were responsible for field supervision and quality throughout fieldwork. Quality assurance was done through observation, spot checks and group meetings at the end of each working day. Supervisors conducted observations of selected interviews. The purpose of observation was to evaluate and improve interviewer performance and to look for errors and misinterpretation of questions that could not be detected through editing.

The supervisor also oversaw the field editing; every questionnaire was checked for accuracy, completeness, eligibility and consistency in the field. Spot checks were carried out by the authors, who visited the selected households to confirm that the interview was conducted and to listen to and to observe the attitude of interviewers toward household members and respondents.

2.6 Data Management

The data was checked by the supervisors before handing it to the data entry operators. Partner data entry technique and the EpiData application were used for in entering data. The combination of a good data entering frame (within the rule of consistency checks) and partner data entry guaranteed the accuracy and validity of the data.

All completed questionnaires were stored in a secure place during collection, data entry and analysis. Only people responsible for data entry and analysis had access to the questionnaire and computer file. The questionnaires were locked in a safe place and kept confidentially. They were destroyed upon completion of the analysis.

2.7 Data Analysis

The IBM SPSS Statistic version 20 and the OpenOffice 4 spreadsheet were used to analyze the data. Descriptive analysis was used for frequencies of the key variables and all the survey questions. Analysis used descriptive (frequencies) to describe the differences in number of key phone users.

The large amount of data available about each participant made data analysis a long process, as it was necessary to choose only those pieces of data that were relevant to the objectives of the study, discarding a lot of valuable information that did not lead to the conclusions. In the cases that indications of trends were found, data was analyzed much more precisely to ensure that conclusions about trends were backed by data.

2.8 Research Ethics

All interviewers and fieldwork team members were trained about ethical issues, including confidentiality and anonymity. All selected respondents were informed about the study and asked to give their consent to participate in it. Respondents were able to skip questions or withdraw from the study at any time.

There was no identification information of the respondent in the data used in the analysis. An ID number was used instead of participant name on the data sets. All completed questionnaires were stored in a secure place during collection, data entry and analysis. Only those people responsible for data entry and analysis had access to the questionnaire and computer file. The questionnaire was logged in a safe place and the computer files were kept confidential.

3 Results

3.1 Demographics of the sample

A sample of 2,000 participants was interviewed. Of these, 46.3% resided in urban areas and 53.7% in locations considered as rural. Female respondents were 59.7%, with 40.3% male. Two fifths of the respondents (40%) were single, while more than half was married. Only participants between the ages of 15 and 65 were selected for the study. Participants were chosen from three age groups: 15-24 (33.4%), 25-39 (33.8%), and 40-65 (32.8%). The average age of respondents was 34 years.

The majority of participants had completed either primary, lower and upper secondary school (31.7%, 30.3%, and 22.3%). One tenth of the respondents had completed university and a few had finished a masters degree.

The proportion of men and women interviewed does not agree with the proportion in the census, it is though closer to the reality of the areas that were surveyed, men being very hard to find in some cases due to emigration to Thailand and other countries. Female emigrants in the larger part had moved to work in urban areas in Cambodia, and were integrated in the survey through special sampling of displaced and not displaced factory workers. As this phenomenon cannot be quantified, a correction is nevertheless made in the calculation derived from the deviation in the numbers of men and women interviewed.

Regarding the urban and rural population, the study must take into account the fact that the amount of rural and urban participants surveyed does not correspond to the proportion of Cambodia. The 46.3% urban / 53.7% rural sample must be weighted to fit the reality of a 70% rural / 30% urban population, after considering that the largest part of 1,200,000 factory workers in Cambodia are censed as rural, but live in urban or peri-urban areas.

3.2 Owning a Phone

Out of the total of 2,000 respondents interviewed in this survey, 90.4% declared to have their own phone(s) and showed it(them) to the interviewer (96.7% ownership in urban areas versus 84.8% ownership in rural areas). Most of the 192 (9.6%) who did no have a phone did have a phone number they could be contacted through, in most cases belonging to a relative living in their house or near their house. Only 8 rural respondents were not able to offer a phone number they could be contacted through (0.04%). 87.1% of the women were found to own a phone, versus 95.1% of men.

When projecting this result to the population, the data must be weighted for rural and urban equilibrium correctness (for a 70/30% rural/urban mix and for a 50/50% gender mix), therefore reaching the conclusion that **89.1% of the population have their own phone.**

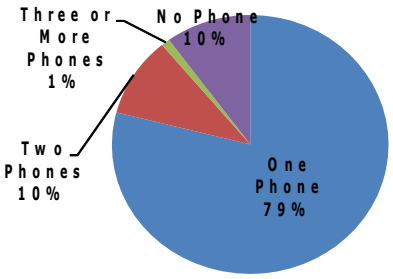
Rural/Urban correction index **RU** = 0.9779 = (96.7*0.3+84.8*0.7) / 90.4

Female/Male correction index **FM** = 1.008 = (87.1*0.5+95.1*0.5) / 90.4

Corrected amount = 89.1 = 90.4 * RU * FM

3.3 Number of Phones Used

Figure 1
Number of Phones Used



Respondents were asked how many phones they used. The majority of respondents (79%) used only one cellphone, some used two (10%) and only a few (1%) used 3 phones or more (9.6% did not have their own phone). In the cases they had more than one phone, they were asked which one was their main phone, which was the second most important and which the third most important (for those who had three or more).

It was calculated that Cambodians use an average of 0.98 phones per person. Also, almost one Cambodian out of every four (23.3%) uses more than one operator, with an average of 1.11 operators per person (1.32 in urban areas and 1.02 in rural areas). This leads to a number of 1.12 operators used for each phone (= 1.11 / 0.98).

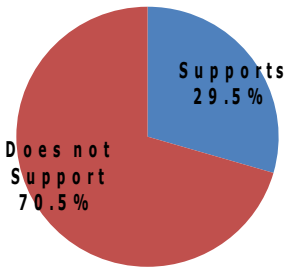
The total number of phones in Cambodia is estimated at 9,440,000.

3.4 Khmer Language in Phones

3.4.1 The Beliefs of Respondents and The Truth After Observation

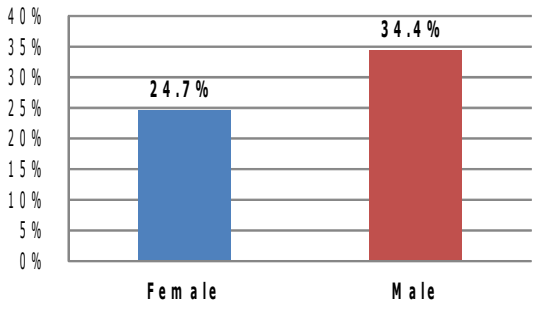
For each one of the phones that they used, respondents were asked if their phone(s) supported Khmer text (Unicode). Following their response, the interviewer sent an SMS in Khmer to each one of the respondent's phones, observing if the message was correctly displayed in the respondent's phone(s) or not.

Figure 2
Cambodians that have a phone that support Khmer



As a result of these questions it was found that 23.6% of the users thought that their main phone supported Khmer, 65.5% thought that it did not, and 10.9% admitted not knowing if it did or not.

Figure 3
Khmer-Enabled Phones by Gender



The observation of phones (after sending and SMS in Khmer to them) showed that the perception of the users was not always correct.

The study found that, after correcting for location and gender bias, 29.5% of Cambodians between the ages of 15 and 65 have telephones able to send and receive messages in Khmer.

Of these Cambodians who had Khmer-enabled phones, 41.8% were women, while 58.2% are men. Expressing it in a different way, 24.7% of women had such phones, versus 34.4% of men (after correcting for location).

Support for Khmer was found to be more extended in urban areas than in rural areas (36.5% / 30.3%).

It was also found to gradually increase with the level of education of the user, from 23.5% of those who have had no formal education to 61.5% for those who have completed post graduate studies.

Figure 4
Khmer-Enabled Phones
by Location of Residence

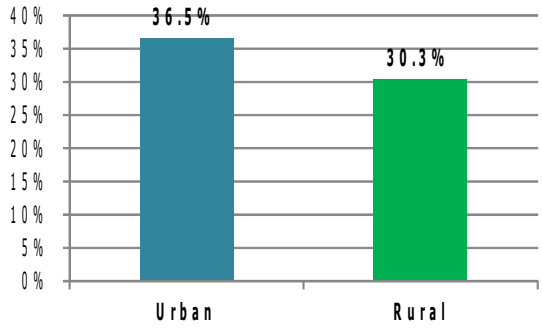
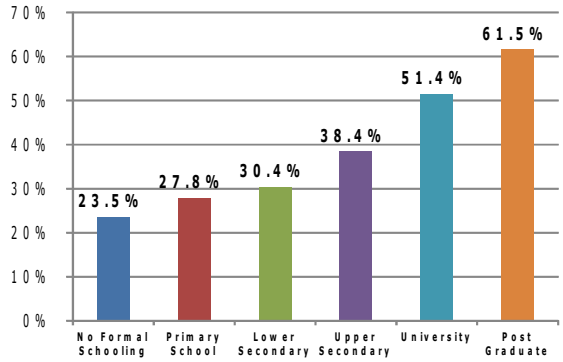


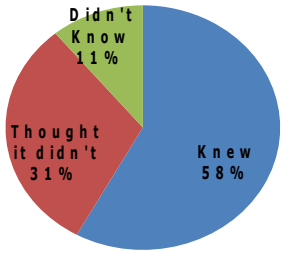
Figure 5
Khmer-Enabled Phones
by Level of Education



The discrepancies between the perception of the users and the actual ability of the phones to display Khmer went in both directions: some user thought their phones could support Khmer when the phones could not, and thought that they did not when the phones actually displayed Khmer. In particular:

- 19.2% of those who thought that their main phone could receive Khmer Unicode messages were wrong; their phone could not receive such messages. In this cases the confusion was due to their phones being able to receive picture messages (bitmap SMS) that contained Khmer text.
- 14.3% of those who thought that their phone did not support Khmer were also wrong, as their phone did show to support it. The phones of 30.5% of those who did not know if their main phone supported Khmer actually supported it.

Figure 6
Phone Supports Khmer
Does users know it does?

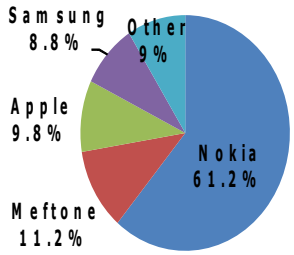


It was found that of those whose main phone supported Khmer, only 58% knew it for sure, 31% thought it did not and 11% didn't know it. For smart phones, the number of those who knew that their phone supported Khmer was as high as 66.9%, while for dumb phone users it was only 54.5%.

There was a huge difference in awareness depending on the brand of the smart phones. The lowest was for Nokia smart phones, where only 34.5% of the users were aware of their phones being able to support Khmer. For Samsung the number went up to 81%, and for Apple to 88.5%.

3.4.2 Manufacturers of Phones That Support Khmer

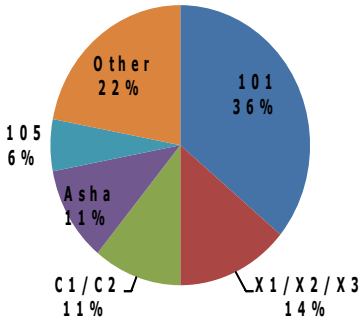
Figure 7
Support For Khmer by Phone Manufacturer



Nokia phones are 58.7% of all phones in Cambodian. The only two other significant brands are Samsung (9.6%) and Apple (4.8%).

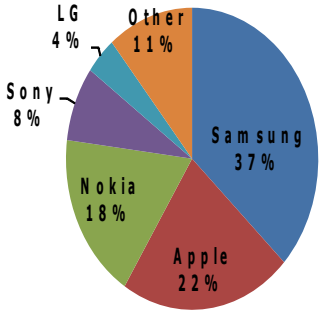
Nokia phones represent 61.2% of all phones that support Khmer. It is followed by Metfone (11.2%), Apple (9.8%), and Samsung (8.8%). The remaining 9% was distributed among a large number of manufacturers.

Figure 8
Nokia Phones that Support Khmer



Within Nokia phones, only a few models accumulate most of the support for Khmer script. The Nokia 101 model accounted for 36% of the Nokia Phones that supported Khmer, followed by several variations of X1/X2/X3 (totaling 14%). They were trailed by Asha (the only significant Nokia smartphone, as very few Lumia were found) and the C1/C2 series, at 11% each. Nokia 105 was the last significant one, accounting for 6%.

Figure 9
Smart Phone by Phone Manufacter



22% of the phones found were smart phones. The highest concentration of smart phones is found in urban youth under age 25 who have finished high school (48%).

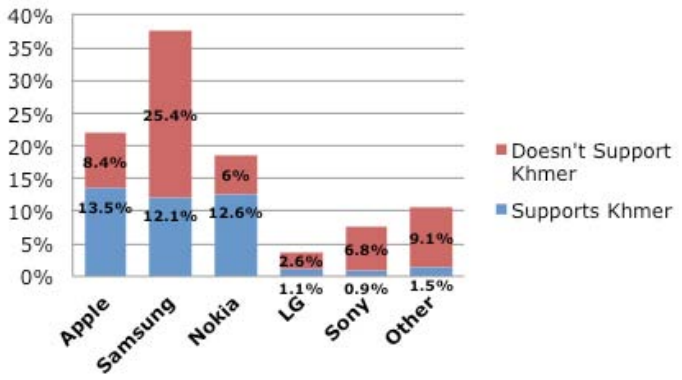
41.7% of the smart phones were found to support Khmer script (versus 30.7% of non smart phones).

Within the 61.6% of Apple smart phones that supported Khmer, iPhone 4 accounted 27.9% of them, iPhone 5 represented 26.2%, iPhone 4s accounted for 16.4%, iPhone 3Gs for 13.1% and iPhone 3G for 6.6%.

67.9% of Nokia smart phones supported Khmer, most of them being different version of the Asha phone (73.7%).

For Samsung, one out of three smart phones supported Khmer. Galaxy S accounted for 25.5%, followed by Galaxy Note (18.2%), Galaxy S II (10.9%).

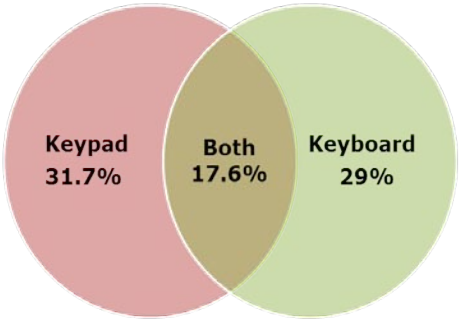
Figure 10
Distribution of smart phones by brand and their support for Khmer script



3.4.3 The Ability to Write Khmer Script in Phones

In this section the term *user* refers to phone owners between the ages of 15 and 65 who have at least one phone that can send and receive SMS in Khmer.

Figure 11
The Ability to Write Khmer Script in Phone

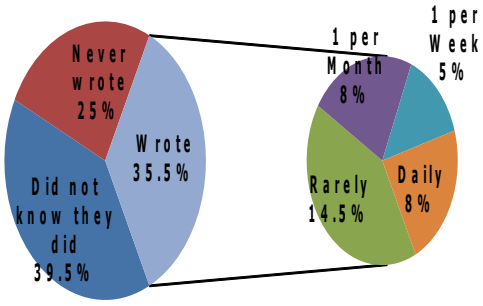


31.7% of these users claimed to how to use the keypad of a dumb phone to type Khmer Unicode (in Khmer script); 29% declared that they knew how to use a smart phone keyboard. 17.6% reported knowing how to type on both types of keyboards.

55.61% of the users who had at least one **smart phone** that could operate in Khmer declared knowing how to type Khmer Unicode. Inside this group, those who had finished high school stood out, as 69% of them did know how to type Khmer. If only those who had finished school and lived in urban areas were considered, the percentage went up to 77%. If on top of that the users were single females, the percentage of urban single females smart phone users who had finished high school and declared to know how to type Khmer unicode increased to an amazing 94.44%.

3.4.4 Writing Khmer using Khmer Script

Figure 12
Writing Khmer Using Khmer Script



We have seen above that only 58% of those who had phones that supported Khmer actually knew that their phones had such capability.

Looking at the problem from the opposite angle, we see that 39.5% of those who had phones that supported Khmer did not know that they did, and 25% responded that they never actually wrote Khmer Unicode in their phones. Only 35.5% did write Khmer at some point or another.

BIAS

Of those who responded that they wrote Khmer in their phones with one frequency or another, 18% actually did not have phones in which they could do it. The same happened with 21% of those who said that they read Khmer in their phones. They did think that their phones were able to do it, but they were wrong and answered something that was not possible.

This means that **11.4% of the users** (35.5% of 32.1%) - equivalent to 10% of the whole population - **declared to type Khmer script on their phones.** Only 4.6% of users typed daily or weekly.

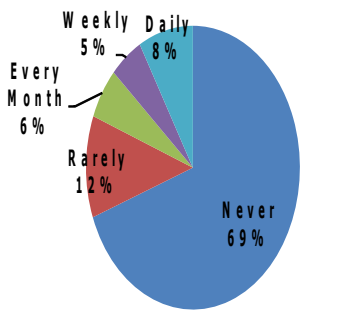
Looking into the age groups in which typing Khmer script is more frequent, it was found that 15% of those under 25 used it

(4.8% daily or weekly). For those between 25 and 35, the percentage was reduced to 6% (with only 2.7% declaring to do it daily or weekly), and for those older than that it became almost non existent (1.9%, an less than 0.5% daily or weekly).

3.4.5 Writing Khmer using Latin script

It was found that 69.3% of the phone users never write in Khmer using Latin characters, versus 30.7% who had done at some point (27.6% of the total population). 13.3% of the users (12% of the respondents) claim to write Khmer with Latin characters either daily or weekly.

Figure 13
Writing Khmer Using Latin Script



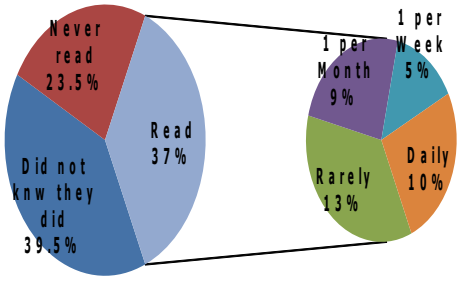
Looking into the age groups in which typing Khmer in Latin characters is more frequent, it was found that 50.6% of those under 25 used it (26.2% daily or weekly). For those between 25 and 35, the percentage dropped drastically to 14.46% (with only 4.71% declaring to do it daily or weekly), and for those older than that it became almost non existent (4%, an less than 1% daily or weekly).

3.4.6 Reading in Khmer

Again, only 58% of those who had phones that supported Khmer actually knew that they did. Looking again at the problem from the opposite angle, we see that 39.5% of those who had phones that supported Khmer did not know they did, and 23.5% responded that they never actually read Khmer Unicode in their phones. Only 37% did read Khmer at some points or another.

This means that **11.89% of the users** (37% of 32.1%) - equivalent to 10.4% of the whole population - **declared to read Khmer on their phones.**

Figure 14
Reading in Khmer



3.4.7 Reasons not to use Khmer script in phones

The main reasons offered by respondents for never writing in Khmer script, even if their phones supported Khmer and they knew how to type Khmer Unicode were, by order of importance:

- It was unnecessary for them to write in Khmer.
- Writing Khmer script was difficult and time consuming.

- Non of their relatives or friends used Khmer in phones.

It was also found that respondents preferred to make a phone call rather than typing a message in Khmer. This is consistent with the fact that in Cambodian in many cases it is cheaper to call than to send an SMS.

Respondents declared that what would encourage them most to use Khmer script would be:

- To have their friends and relatives use it.
- To have simpler input methods, allowing them to type faster in Khmer.
- To have a Khmer user interface of the phone.

3.4.8 Use of Khmer in Facebook in Phone

19.9% of the respondents declared that they used or had used Facebook. This percentage raised to 33.1% for urban users and was as low as 8.6% for rural users. After weighting for urban/rural, it was concluded that **15.9% of the population had used Facebook at some points**.

9.9% of the respondents claimed to use Facebook and also had a phone that supported Khmer, but only 7.2% used Facebook in their phone. This 7.2% group was divided in four parts: those who claimed to write in Facebook in both Khmer and Latin characters (50%), 13.2% only wrote only in Khmer characters, 24.3% only in Latin characters and 12.5% never wrote in Khmer.

As a result of these numbers, we can deduct that 26.7% of Facebook users in Cambodia use it through their cell phones. Seven out each eight of these Facebook users through the phone claim to interact and write in Facebook in their phone, half of them using both Khmer and Latin script, with the number of users of only Latin script being double the number of those who use only Unicode.

Additionally, looking at the data from different points of view, it was found that:

- 90% of all Facebook users who use Facebook in their phone have smart phones. While it is possible to use Facebook in other types of phones, there could be some bias in these answers, but it should be relatively low.
- 55% of smart phone users use Facebook in their phones.
- 57% of Facebook users who use it in their smart phone actually have phones that support Khmer.
- 63% of smart phones that support Khmer are used for accessing Facebook.

3.5 *Conclusions for results*

The results of the study can be expressed either with a 95% or 99% security (Confidence Level). Depending on the chosen Confidence Level, the possible variation of the results (Confidence Interval or margin of error) will be different.

The Confidence Interval (m) is calculated using the formula:

$m = \text{sqrt}((t^2 \times p(1-p))/n)$

n = sample size
t = confidence level (standard value of 2.58 for 99% or 1.96 for 95%)
p = proportion of the sample who uses Khmer phones
m = Confidence Interval

Considering that the weighted percentage of users that have phones that support Khmer is 29.5% of phone users, with a sample of 2,000, we can calculate the interval for both confidence levels.

The interval will be 2.63 if we choose 99% confidence level. For 95% it will be 2.00. We can therefore express the result as either:

- With 99% certainty ($p < 0.01$), 29,05±2.63% of Cambodians between the ages of 15 and 65 have phones that support Khmer Unicode messaging, or;
- With 95% certainty($p < 0.05$), 29.5±2% of Cambodians between the ages of 15 and 65 have phones that support Khmer Unicode messaging.

This implies that we are 99% certain that between 2,583,974 and 3,089,603 Cambodians between the ages of 15 and 65 have at least one phone that supports Khmer.

4 Discussion

4.1 Owning or having access to a Phone

The findings of 90.4% of respondents having their own phone, and 99.6% having access to a phone, can be contrasted with similar data mentioned in different reports, but most of the reports found (Bullen 2013, USAID, 2012) usually name other sources and have not actually done their own research on the Cambodian population. Only one public primary source of information is available on this topic: the Ministry of Environment 2011 study (MoE, 2011), which reported three years ago that 60% of the users had their own phone. The growth on the number of owners from 60% to 90.6% in three years is consistent with the deep economic change that is taking place in Cambodia during the last years, with over 180.000 new phones declared as being bought every month (a figure used by phone operators). From our results, we estimate that 9,440,000 phones are in use in Cambodia, covering most of the market that can afford them; most of the new phones will replace existing phones. 180.000 per month (2,160.000 per year) indicates an average life of phones of house, playing the role of a land-line. In our study the question about owning a phone was asked at the respondents' house, and they were able to produce a phone that they claimed to own (maybe their husband or wive would have made the same claim about the same phone). In the experience of other NGOs, asking female patients who attend a clinic if they had and carried their own phone, the numbers were much lower. Even if the sample of these reports was not big enough to establish anything, it became obv four years and four months, probably too long, even for a slow economy as Cambodia, signaling that the number of new phones per year will most probably grow significantly in the future, reducing the life of phones.

It seems that in rural and remote areas sometimes cellphones are kept in the house, playing the role of a land-line. In our study the question about owning a phone was asked at the respondents' house, and they were able to produce a phone that they claimed to own (maybe their husband or wive would have made the same claim about the same phone). In the experience of other NGOs, asking female patients who attend a clinic if they had and carried their own phone, the numbers were much lower. Even if the sample of these reports was not big enough to establish anything, it became obv four years and four months, probably too long, even for a slow economy as Cambodia, signaling that the number of new phones per year will most probably grow significantly in the future, reducing the life of phones.

ious that the difference between asking the question at home or at another pious that the difference between asking the question at home or at another place might produce different data.

Phones have become part of everyday life. The only reason for not having one seeming to be economic. Often we found that those who did not have a phone did not have it temporarily, because they could not afford it at this time. The mobility of the younger generation to work in garment or other factories, or to

work in other countries has led them to push phones onto their parents as means for communication. We see how operators who address mostly the market of young users also have a niche in much older people (but not the age-group in between), pointing at sons and daughters bringing their own parents into the telephone network with the operator that they use mostly, or that they consider less expensive.

The group of those who do not have their own phone is mostly composed of rural women. The 0.4% of Cambodians who are not accessible by phone see to be those extremely poor or who are quite old and do not have close young relatives.

At the same time, Mobile coverage has reached almost all of Cambodia, with few reasonably inhabited areas not being covered. This coverage is facilitated by the fact that, as most of Cambodia is flat, a smaller number of towers are required to cover the same territory as it would be necessary in in other countries.

4.2 *Types of phones*

The cost of owning a new phone in Cambodia is low. A new Nokia 1280 handset (a model owned by roughly one Cambodian out of every three) is $18, and the cost of maintaining an operational line is as low as $1 or $2 per month. The Nokia 1280 also includes a flashlight, a killer application in rural Cambodia, and it only needs to be recharged once a week.

Nokia is still the leading supplier of phones, covering 58.8% of the Cambodian market, but phones are changing quickly. While only 22% of users have a smart phone, it seems, by comments made to the press and personal communications with operators, that 40% of the 180.000 new phones that come into the Cambodian market each month are smart phones, and this percentage should increase with time. The usage of smart phones is much more dense among the educated urban youth.

4.3 Number of phones used by a person

The findings show that only 11% of respondents use more than one cellphone , quite different from the common perception of many Cambodians carrying with them two or three number phones ("we are social", 2012).

Dividing the total number of operator/person used by the respondents by the aggregated number of phones, we found that 1.06 operators were used in the average for each phone. That is, in the average only in 6 out every 100 phones the user systematically used SIMs from more than one operator. Even more, this 6% includes a number of dual-SIM phones. This leads to considering that there is more faithfulness to a given operator than previously expected, even if it is perceived by many sources that numbers are often changed by users when this change carries an economic advantage.

4.4 Owner Awareness and Reality on Whether Phones Supports Khmer

One of the most surprising findings is the fact that a large part of the **29.5% of the population** who **own Khmer enabled phones** did not know that they could use these phones to send and receive messages in Khmer. Only 58% of these owners were aware of these capabilities. Others just denied it or said that they did not know. For us, this indicates that **this feature is not so important to a large part of the population**. Even only a part of the 58% who knew that they could use Khmer actually writes or read in Khmer in their phones. This lack of interest implies that **most respondents did not appreciate the value of using Khmer script.**

Not surprisingly, a larger percentage of smart phones (41.7%) that non smart phones (30.6%) support Khmer. These phones belong to more educated users who are also further aware of the capability of their phones to send and receive messages in Khmer (66.9% for smart phones users versus 54.5% for dumb phone users).

It is interesting to see that there are a similar number of Nokia, Samsung and Apple smart phones that support Khmer, in spite of having many more Samsung smart phones in the market. This is due to the fact that only the latest versions of the Android operating system support Khmer, while the Nokia Symbian phones (mostly Asha) did support Khmer (developed with support from the Open Institute in 2005) and the Apple phones can be easily programmed to support Khmer, after being jail-broken.

While most of the Android (system used by Samsung) phones in the country do not and will not support Khmer natively, this trend will change quickly now, as the upcoming versions of the Android operating system support Khmer natively.

There is an important difference among awareness between owners of different brands of phones. This is probably due to the fact that the support for Nokia phones is native (low awareness), while for Apple and Samsung phones the must make the effort of having the support installed, thus becoming aware of its existence.

4.5 Writing in Khmer using Khmer script or Latin Script

MoE (2011) found that of those who use a mobile's messaging function, most (82%) use it to send SMS using English characters. More than 2 in 10 send messages in Khmer. This meant that a that time for every four users of Latin script there was one user of Khmer script.

Our results show that for every three users who use Latin script weekly or daily, one user will do the same type of communication using Khmer script, reducing the ratio from 4:1 to 3:1, and therefore marking a percentile increase in the use of Khmer script in phones in relation to Latin script.

5 Conclusion and Recommendation

As a first important result, the findings point to the fact that almost all Cambodians between the ages of 15 and 65[3] can be reached through phones, with nine out of every ten being reachable through their own personal phone when they are at home. We cannot assure that this coverage is the same when the users are not at home; some studies point at the fact that this is not the case, as some phones stay at home when their users leave, acting as home phones, and not as personal phones.

With only 11% of Cambodians using more than one phone, the myth of many of them using several phones is debunked. It was also found that only one Cambodian in every four uses more than one operator, and that only 12.8% of phones are used with SIMs from different operators (either dual SIM phones or SIMs being exchanged).

The main result of the study is that **almost one Cambodian in every three among the ages of 15 and 65 has a phone that can be used to send or receive SMS in Khmer (29.5%)[4]**. This support is more important in smart phones than in dumb phones. The trends in the market (40% of new phones bought in November 2013 are smart phones) seem to point to a quick growth in the percentage of smart phones being used, from the present 22%. The fact that new versions of Android will support Khmer natively, and that companies such as SAMSUNG and LG are providing support for Khmer in other versions of Android makes us believe that the percentage of Cambodians who can receive SMS in Khmer will grow naturally in the coming year. Also, the present average life of a phone in Cambodia, over four years, should be reduced through an acceleration of the number of phones coming into the market, increasing the rate of change.

As it could be expected, the support for Khmer in urban-area phones is more widespread than in rural areas with 137 phones supporting Khmer in urban areas for every 100 in rural areas. As gender is concerned, men own 140 Khmer-enabled phones for every 100 owned by women. As rural areas will come later into the world of smart phones, many more of the smart phones going to rural areas will have native support for Khmer, and this will naturally reduce the urban/rural gap. As far as the gender gap is concerned, the 140 male to 100 female ratio is reduced to 125/100 for ages under 35, and to 113/100 for ages under 25 (vs 182/100 for the 35-44 age group). This numbers show that the gap will be reduced naturally with time, as these younger people assume their roles in the professional world and the new generation now finishing high school taking their place.

An impressive 29% of phone owners claim to be able to write in a Khmer Unicode Keyboard in a phone (when only 22% have smart phones). Even if we have to consider a prestige bias, with respondents answering what they think would make them look good in the interviewers eyes, this number lead us to think that there is an interesting percentage of the population that - even if they

3 All information in this study only makes reference to Cambodians between the ages of 15 and 65.

4 With a confidence level of 99%, the technical result is 29.5±2.63%

do not have the means to buy or operate a smart phone - are prepared to use it in Khmer as soon as they acquire one.

When it comes to actually writing Khmer script in a phone periodically (daily or weekly), the number is only 4.6% of all users, compared to 13.3% of users declaring to write Khmer in Latin script. It is clear that the lack of technology has pushed users to use Latin script because it was the only available solution. The increase in the number of Khmer enabled phones will probably help change the trend, but it will not be the only factor that will lead to widespread use of Khmer script; the simplification of the input method will also play an important role. On the short run very good text prediction will probably be the most important factor in getting Cambodians to actually type Khmer. In the long run voice input should the final solution, but it would be unrealistic to expect this in less than five years.

An important finding was also that only 58% of those who had Khmer-enabled phones were aware of this fact. The rest either did not know or claimed that their phone did not support Khmer. For us this is a sign of the little importance that most users give to the ability of their phones to support Khmer script, and it is consistent with the answers given by users on why they did not type in Khmer: they consider it unnecessary, it is difficult, and there are not enough people that they would write to who can receive SMS in Khmer. The first point reflect a special case in Cambodia, where calling is often cheaper than sending an SMS, so there is not financial incentive to sending SMSs. The third point shows the perception (which so far also agrees with reality) of not being a critical mass of Khmer script users in phones.

More than half of the smart phone owners use their phones to access Facebook, but only half of these have smart phones that support Khmer. The other half are probably phones that do not have native support for Khmer and installation of Khmer support in them has so far not been easy (in spite of the Open Institute developing support for them), as it is expected that Facebook users will see the value of using Khmer, as the percentage of text in Khmer script grows everyday.

We can conclude that one phone in three supporting Khmer is not yet the necessary critical mass for communication in Khmer through phones to develop, but the trend seems to be towards having such critical mass in the coming years. For the use of Khmer to develop, input methods will have to be simplified through predictive text and easier-to-use keyboards; users will have to become aware of the value of written communication through phones. The use of new forms of more advanced communication through smart phones (social networks) will further encourage youth to use their phones to communicate in Khmer, driving the change towards the demand for phones that support Khmer and the use of Khmer script, which will then spill to simpler forms of communication such as SMS.

Based on these conclusions, **it is recommended to**:

- Undertake a perception change campaign together with phone vendors and operators that will raise the awareness of phone buyers about the possibility of buying a phone that supports Khmer or not (at the time they plan to purchase a new phone). The campaign could include activities such as Khmer script typing contests.

- Work with the education system to promote the use of Khmer script in phones to high school students in grades 11 and 12, as the curriculum for these grades includes IT classes in which students are trained on the use of Khmer Unicode in computers.
- Encourage the use of applications developed by the Open Institute and others that will enable Khmer support for SMS and Internet in old smart phones using the Android system.
- Work on the development of better predictive text for Khmer, allowing users to type quickly in Khmer in their phones.
- Encourage long term work on Khmer language speech recognition.

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Appendix A: The Questionnaire Instrument

KAP Survey on usage of mobile phones and Khmer language in Cambodia

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Tel: 023 224 821
Website: www.open.org.kh

Interview No.		
Interviewer Name		
Interviewer No.		
Date of Interview	/ / 2013	
Interview Length	From:	To:

Introduction

Hello, my name is .....I work for Open Institute as data collector. The Open Institute is conducting the "Study on usage of mobile phones and Khmer language in Cambodia" funded by USAID. The study aims at determining the knowledge of Cambodians,their habits and their attitude towards using the Khmer language in their cell phones, as well as the ability of their cellphone to display and enter Khmer Unicode.The selected-sites of this study are Phnom Penh, Kampong Cham, Battambang, Kratie and Sihanouk Ville. The target group of the study is the Cambodian cell phone users aged from 15 to 65 years old. All information you provide will be highgly kept as confidential. This interview will be taken approximately 15 minutes. So, would you please give me 15 minutes to interview with you?

Section I: Demographic Information

D	1	Vilage:	Village Code (2 digits)	D1	☐☐
D	2	Commune/Sangkat:.....	Commune Code (2 digits)	D2	☐☐
D	3	District:.....	District code (2 digits)	D3	☐☐
D	4	Province.....	Province Code (2 digits)	D4	☐☐
D	5	Code combined:	D5		☐☐☐☐☐☐☐☐
D	6	Urban / Rural	1 = Urban 2 = Rural	D6	☐
Q	1	Repondent name: ☐			
Q	2	Age:		Q2	☐☐
Q	3	Sex:	*0 = Male 1 = Female*	Q3	☐
Q	4	Marital status:	*1 = Single – Never married* *2 = Married /living with someone as married* *3 = Widowed* *4 = Divorced/separated* *5 = Other.....*	Q4	☐
Q	5	Level of Education:	*1 = No formal schooling* *2 = Primary School (K1-6)* *3 = Lower Secondary (G7-G9)* *4 = Upper Secondary (G10-G12)* *5 = University (Undergraduate)* *6 = Post Graduate* *7 = Technical / Vocational* *8 = Other (specify) .....* *99 = Don't know (spontaneously)*	Q5	☐☐
Q	6	Do you have a mobile phone?	*0 = No 1 = Yes*	Q6	☐

If the answer is yes, go to question 8

Q 7 If somebody asks you to which phone they can call you, whose phone number do you tell them to call?

0 = I do not give them a phone number 1 = Spouse 2 = Neighbour Relative
3 = Neighbour not-relative 4 = Friend 5 = P{hone Booth 6 = Other (specify) .....

Most usually	Q7 a ☐
Second most usual	Q7 b ☐
Thrid most usual	Q7 c ☐

After this answer the questionnaire is finished.

Section II: Characteristics of Phone

Q 8 How many phones do you use? (number of phones) Q8 ☐☐

Q 9 Which network/mobile phone company(s) do you use most?

1 = Cellcard, 2 = Metfone, 3 = SMART
4 = Beeline, 5 = Qb, 6 = Excell
7 = Other (specify).....
0 = Not applicable

Q9 a	Most used	
Q9 b	Second most used	
Q9 c	Third most used	

Q 10 What is the phone number that you use most ?

Q10	
Others	

Q 11 How much money do you usually spend per month on cell phone credit? US Dollars Q11 ☐

Q 12 For how long have you been using cell phones? Year(s) Q12 ☐

Q 13 What are the characteristics of the cellphone(s) do you use?

	Brand	Model	Smart / Non Smart	Input method
Phone 1	Q13a1	Q13a2	Q13a3	Q13a4
Phone 2	Q13b1	Q13b2	Q13b3	Q13b4
Phone 3	Q13c1	Q13c2	Q13c3	Q13c4

Q13a1	
Q13a2	
Q13a3	
Q13a4	
Q13b1	
Q13b2	
Q13b3	
Q13b4	
Q13c1	
Q13c2	
Q13c3	
Q13c4	

Brand
Original
1 = Apple
2 = LG
3 = HTC
4 = Nokia
5 = Beeline
6 = Smart
7 = Cellcard
8 = Metfone
9 = Motorola
10 = Samsung
11 = Sony Errickson
12 = BlackBerry
13 = Copy of original phone: copy of.....
14 = Other (specify).....

Type
1 = Smart
2 = Non-Smart

Input Method
1 = Numberpad
2 = keyboard

Section III: Knowledge, Attitudes and Practice

Q 14 Do you know how to write Khmer script in a phone that has a numeric pac *0 = No* *1 = Yes* Q14 ☐

Q 15 Do you know how to write Khmer script in a phone with a real keyboard? *0 = No* *1 = Yes* Q15 ☐

Q 16 Can your cell phone(s) display or write in Khmer script?
0 = no, 1 = yes, 99 = Dont know

Q8a	Phone 1	☐☐
Q8b	Phone 2	☐☐
Q8c	Phone 3	☐☐

If non of phones can display or write in Khmer script, please go to Q25

Q 17 Please indicate how often you write Khmer script in your phone(s) Q17 ☐

	N	R	EM	EW	ED
I write in Khmer using Khmer characters	1	2	3	4	5

1 = Never (N), 2 = Rarely (R),
3 = Every Month (EM), 4 = Every Week (EW)
5 = Every Day (ED)

If the answer is different from 1 (Never) please go to Q20

Q 18 If you do not write Khmer script in your mobile phone, would you please tell the reason why?

.....

.....

.....

Q 19 If you do not write Khmer script, what factors will encourage you to write it in your phones?

.....

.....

.....

If you have answered question Q 17, skip to Q21

Q 20 If you are writing Khmer script in your phones, would you please tell the reason why?

.....

.....

.....

Q 21 Please indicate how often you read SMS or email or news in Khmer script in your phone(s) ☐

	N	R	EM	EW	ED
I read SMS or email or news in Khmer script	1	2	3	4	5

1 = Never (N), 2 = Rarely (R),
3 = Every Month (EM), 4 = Every Week (EW)
5 = Every Day (ED)

If the answer is different from 1 (never), please go to Q25

Q 22 If you never read SMS or email or news in Khmer script in your phones, plese tell the reason why?

.....

.....

.....

Q 23 If you never read SMS or email or news in Khmer script in your phones, what factors will encourage you to do it?

.....

.....

.....

If this question is answerws, skip to Q25

Q 24 If you are reading SMS or email or news in Khmer script through your phones, would you please tell the reason why?

.....

.....

.....

Q 25 Please indicate how often you write Khmer language in your phone(s) using Latin characters Q25 ☐

	N	R	EM	EW	ED
write in Khmer using Latin characters	1	2	3	4	5

1 = Never (N), 2 = Rarely (R),
3 = Every Month (EM), 4 = Every Week (EW)
5 = Every Day (ED)

Q 26 Do you know what Facebook is? ***If No, please go to Q31*** *0 = No 1 = Yes* Q26 ☐

Q 27 Have you ever used Facebook ***If No, please go to Q31*** *0 = No 1 = Yes* Q27 ☐

Q 28 Do you use Facebook on your phone? *0 = No 1 = Yes* Q28 ☐

Q 29 Do you ever write in Khmer in Facebook with Khmer script? *0 = No 1 = Yes* Q29 ☐

Q 30 Do you ever write in Khmer in Facebook with Latin characters? *0 = No 1 = Yes* Q30 ☐

Q 31 Do you know what Internet is? ***If No, please go to Q33*** *0 = No 1 = Yes* Q31 ☐

Q 32 Do you use Internet on your phone? *0 = No 1 = Yes* Q32 ☐

Q 33 What applications do you use in your phone/s?

		Using	Q33
1	Sending and Receiving SMS in Khmer		1
2	Sending and Receiving E-mail		2
3	Camera		3
4	Internet		4
5	Reading the news		5
6	Facebook		6
7	Skype		7
8	WhatsApp		8
9	Viber		9
10	Line		10
11	Listen to Music		11
12	Watching movies		12
13	Game		13
14	Radio		14
15	Other (Specify).....		15

0 = No
1 = Yes

Q 34 Among the phone applications in the picture, which one is more interesting to you in a phone?

Use the categories in the above question
show respondent the card of images of the applications of mobiel phone

		Q34
Q34 a	First Choice	
Q34 b	Second Choice	
Q34 c	Third Choice	

Q 35 What are your main sources of news about Cambodia

1 = TV 2 = Radio 3 = Newspapers 4 = Internet 5 = Facebook 6 = From SMS 7 = From telephony voice service 8 = Mobile phone applications 9 = Other

Most important	
Second	
Third	

Observation of Interviewer

Q 36 After sending a Khmer script SMS to each one of the phones, are you able to see the Khmer SMS correctly?

0 = No, 1 = Yes, 2 = Some, but incorrect, 99 = Don't Know

Q36 a	Phone 1		
Q36 b	Phone 2		
Q36 c	Phone 3		

Q 37 Did you take a picture of the phones laying on top of this questionnaire showing also the questionnaire number (1 picture with all phones). *0 = No 1 = Yes* Q37 ☐

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