



## **ICT-601102 STP TUCAN3G**

Wireless technologies for isolated rural communities in developing countries based on cellular 3G femtocell deployments

### **D3.1**

#### *Market research*

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#### **Abstract:**

**TUCAN3G aims to develop solutions to provide 3G services in isolated rural areas of developing countries. In order to do so, an extensive market survey in these areas has to be performed in order to define positives and drawbacks of the potential market both in Peru and in Colombia, for services which will be developed in further steps under the TUCAN3G umbrella. Deliverable D3.1 investigate the needs and requirements of all different stakeholders and users both of current and potential 3G services such as final private and business users, network operators, equipment manufacturers and institutional/public actors in the area.**

**Keyword list:** Market Survey, Business Plan, research questions, research, tools, actors



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## **Executive Summary**

This deliverable can be considered as the input to the successive activity in deliverable D23 (Parameters and basic conditions for the market research and the business model), which enables the consortium to better understand, design and execute all necessary activities towards the development of the business model. For achieving the objectives mentioned above, a multi-angled market survey has been executed in selected areas with selected target groups.

Following to the above, all research activity took place both in Peruvian and Colombian districts, including stakeholders and users from both countries. Moreover, the two main target groups of this market survey are: demand and supply side target groups. Demand side target group consists of the final users of the services which, in the TUCAN3G case, are the private users, business users and institutional users. From the other hand, the supply side target group includes the stakeholders which need to be engaged, in order to provide services to the end users and are mobile network operators, equipment manufacturers and the public sector.

In order to better collect both data and needs from providers and end users of the potential services, qualitative and quantitative set of tools has been used, such as questionnaires and semi-structured interviews, always taking into account the special characteristics which the desired target groups have.

Moreover, all data collected have been assessed, analysed and presented in such way, so the complete profile of the examined areas has been shaped from a multi-perspective point of view. All different angles and views (privates and business users, institutional user, decision makers, network operators and equipment manufacturers) allowed us not only to draw a bigger and complete landscape of the regions, but also to grasp critical matters for all sides.

Last but not least, all findings and analysis of this research provide a great standing ground as an input for the design and execution of the final business model aiming to exploit and gain the maximum out of all services to be developed.



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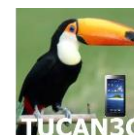
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## List of abbreviations & symbols

2G	2 <sup>nd</sup> Generation
3G	3 <sup>rd</sup> Generation
3GPP	3rd Generation Partnership Project
4G	4 <sup>th</sup> Generation
AFIN	Association for the Promotion of the National Infrastructure
APROPESCA	Association of Producers and Marketers of Aquatic and Agricultural Products
BSC	Base Station Controller
BTS	Base Transceiver Station
BUC	Block up Converter
CLARO	América Móvil Perú
CREP	CREPIC- Cauca Regional Centre for Productivity and Innovation, Colombia
EDGE	Enhanced Data Rates for GSM Evolution
EHAS	Foundation Hispano-American Health Connection
FITEL	Telecommunications Investment Fund, Peru
FONIE	Fund for Rural Economic Inclusion
GILAT	Gilat Satellite Networks Ltd
GSM	Global System for Mobile communications
HTS	High Throughput Satellites
IP	Internet Protocol
IPA	IP.Access Ltd., UK
Iuh	Iuh (Iu home)
KINNO	Kinno Consultants Ltd.- Knowledge and Innovation Consultants, Greece
KPIs	Key Performance Indicators
LTE	Long Term Evolution
Mbps	Mega bites per second
NFC	Near Field Communication
OPEX	Operating Expense
OSIPTEL	Supervisory Agency for Private Investment in Telecommunications
P-P	Microwave point-to-point links
P-MP	Microwave point-to-multipoint link
PROINVERSIÓN	Agency for the Promotion of Private Investment
QoS	Quality of Services
R&D	Research and Development
RF	Radio Frequency
RNC	Radio Network Controller
SON	Self-organizing Network
TdP	Telefonica del Peru, Co.
UCAU	University of Cauca, Colombia
UK	United Kingdom
USA	United States of America
US \$	United States Dollar
VoIP	Voice over Internet Protocol
VSAT	Very Small Aperture Terminal
WiFi	Wireless Fidelity



## **1 INTRODUCTION**

Deliverable D31 – Market Survey, is the sequential activity of Deliverable D23 (Parameters and basic conditions for the market research and the business model), which enables the consortium to better understand, design and execute all necessary activities towards the development of the business model. D31 provides a clear overview, pros and cons, of the potential market both in Peru and in Colombia, for services which will be developed in further steps under the TUCAN3G umbrella.

In order to gather and analyse information, indications and evidences regarding the market profile of the examined regions, qualitative and quantitative sets of tools have been used, such as questionnaires and semi-structured interviews, always by taking into account the special characteristics which the desired target groups have. The two main target groups of this market survey are two: demand and supply side target groups. Demand side target group consists of the final users of the services which, in the TUCAN3G case, are the private users, business users and institutional users. From the other hand, the supply side target group includes all stakeholders which need to be engaged, in order to provide services to the end users. Supply side target group consists of mobile network operators, equipment manufacturers and the public sector.

For each of the above target groups, a variety of research tools and methods have been used, in order to capture key elements and issues that will be useful in this market survey. More specifically, structured surveys have been used for collecting feedback from all private users while more flexible research tools, such as semi-structured interviews, have been used in order to gather information from the operators, manufacturers and the public sector.

Moreover, all data collected have been assessed, analysed and presented in such way so that the complete profile of the examined areas has been shaped from a multi-perspective point of view. All different angles and views (privates and business users, institutional users, decision makers, network operators and equipment manufacturers) allow us not only to draw a bigger and complete landscape of the regions but also to grasp on critical matters for all sides.

Needless to say, all the information and extracts drawn out of this study will contribute towards the design and implementation of an accurate business model aiming to fulfil and meet the demands of all stakeholders and target groups, in order to tackle the important issues which these areas are facing and improve the quality of their everyday lives.



## **2 KEY ISSUES AND PREPARATORY RESEARCH ACTIONS**

Section 2 is dedicated on the key issues and preparatory research actions that took place prior to the research implementation. More specifically, issues, such as the sample selection methodology, the development of research and methodological tools, the target groups as well as the methods of data collection and choice of research instruments, were determined and are being presented in the following sections.

### **2.1 Key issues presentation**

Prior to starting the research, a number of key research issues, such as the ultimate scope of the research, the target groups and the methods of data collection and choice of research, were determined. This section highlights the most critical issues which were taken into account, not only prior but also during the survey and the analysis of the results.

#### **2.1.1 Scope of the research**

The scope of this research was to allow the consortium to better understand, design and execute all necessary activities towards the development of the business model, by achieving a number of objectives. More specific, these objectives are:

- a) to gather information on patterns of use of telecom services amongst target groups,
- b) to identify market opportunities and barriers to be used for developing TUCAN3G telecommunication services and
- c) to understand the market profile of the targeted areas of the project.

In order to meet the above mentioned objectives, a set of actions has taken place with the engagement of all target groups. More specifically, in order to gather information on patterns of use of telecom services amongst target groups, private users' usage patterns have been assessed through a survey, which included a large number of market variables, the data of which have been used to describe existing market patterns e.g. frequency of use, where services are accessed, duration of transactions etc.

Following to the above, regarding public and business users, their respective telecommunication needs have been examined and, along with their respective expansion strategies, an adequate service fit has been sought. Moreover, in order to identify opportunities and barriers to use, similar to TUCAN3G telecommunication services, an evaluation of both opportunities and barriers has been implemented by all involved stakeholders directly. Last but not least, the analysis of all findings collected by this survey have led us towards the understanding of the market profile of the targeted areas of the project

#### **2.1.2 Identification of target groups**

The main target groups, presented in the table below, have been identified through previous activities and deliverables (such as Deliverable D23) and are relevant to the demand and supply side business models.



Supply side	Demand side
<ul style="list-style-type: none"> <li>• Mobile Network Operators</li> <li>• Equipment manufacturers</li> <li>• Public sector</li> </ul>	<ul style="list-style-type: none"> <li>• Private users</li> <li>• Business users</li> <li>• Institutional users</li> </ul>

**Table 1: Main target groups**

### 2.1.3 Methods of data collection and choice of research instruments

The two main data collection methods that have been used during this market survey are quantitative and qualitative methods. The usage of the combination of these methods has not only resulted in a multidimensional approach to our research targets, but also gave us the “freedom” to choose and adapt our research tools to the situation/stakeholder.

Quantitative data collection methods rely on random sampling and structured data collection instruments that fit diverse experiences into predetermined response categories. They produce results that are easy to summarize, compare and generalize. Here, surveys with closed-ended questions and questionnaires were used to gather data.

On the other hand, qualitative methods provide information useful to understand the processes behind observed results and can be used to improve the quality of survey-based quantitative evaluations, helping to generate evaluation hypothesis by strengthening the design of survey questionnaires and expanding or clarifying quantitative evaluation findings. Generally, these methods tend to be open-ended and have less structured protocols.

As analysed in Deliverable D23, the following research tools have been recognized as the most efficient for each target group.

Group	Type	Tools
Research Tools for Public Sector (Officials)	Qualitative	Open Interviews
Research Tools for Public Sector (Institutions)	Qualitative and Quantitative	Semi – structured Interviews
Research Tools for Business Users	Qualitative	Semi – structured Interviews or Focus Groups
Research Tools for Private Users	Qualitative and Quantitative	Participant observations, Structured Questionnaires
Research Tools for Operators	Qualitative	Semi – structured Interviews
Research Tools for Manufacturers	Qualitative	Semi – structured Interviews

**Table 2: Research tools for each target group**

The choice of the research tools presented above has been altered according to circumstances that have arisen during the research.



## 2.2 Preparatory Research Actions

Before conducting the actual research survey, a number of preparatory actions have been implemented in order to establish the appropriate framework for a successful implementation. The key preparatory actions are presented in the section: the sample selection methodology, the development of research tools, the development of methodological tools, the testing and localisation of these tools.

### 2.2.1 Development of methodological tools

The section presents an overview of the research and methodological tools needed for the execution of the market survey. Regarding detailed explanation of questionnaires, ANNEX 1 may be read.

#### 2.2.1.1 Types of research tools used per sample size

According to the specification of research methodology in D23 and the discussions on the second project consortium meeting, the research tools presented in the following table and the sample size have been selected. Moreover, based on the discussions held among all project partners, the initial sample size defined can be found in Table 3.

Group	Sample Size
Research Tools for Public Sector (Officials)	5 Officials
Research Tools for Public Sector (Institutions)	5 Interviews, 15 structured Questionnaires
Research Tools for Business Users	2 Focus groups in different areas
Research Tools for Private Users	400 Questionnaires
Research Tools for Operators	3 Semi – structured Interviews
Research Tools for Manufacturers	6 Semi – structured Interviews

**Table 3: Summary of research tools per sample size**

The usage of a combination of methods and tools has provided different data sets that were able to better capture the different views and aspects of the project and thus increase the validity and generalizability of the research results. The analysis, however, has been executed with caution in order to avoid misperceptions or extraction of biased results.

#### 2.2.1.2 Key questions and elements per target group

There are a number of specific questions and elements that have been answered and collected by each target group in order to achieve the desirable objectives of this survey. In addition, even though the aim was the understanding of the main interest, customization was needed considering interests of the target group. More details regarding the questionnaires for each target group can be found in ANNEX 1.

##### 2.2.1.2.1 Private Users

The information that needed to be obtained from potential private users in rural areas in order to give the overview of the users profile in these sensitive areas were:  
 TUCAN3G\_D31KiNNOF.doc



- Device Ownership
- Internet access relevance
- Communication needs
- Usage – Type/Duration
- Usage - Location
- Mobile advertising

The themes mentioned above, provided the consortium with the overall picture regarding the needs, profiles and patterns of the private users located in our areas of interest.

#### ***2.2.1.2.2 Public sector & institutional Users***

Key critical issues for public sectors and institutional users, coming from different sectors such as public or national administration that are being exploited in more details within the questionnaires were:

- The main stakeholders engaged in telecommunication activities in these areas and their characteristics
- The benefits of 3G mobile telephony service deployment in a rural area
- The obstacles of 3G mobile telephony service deployment in a rural area
- What is the usage of mobile telephony and internet service in these areas, etc

#### ***2.2.1.2.3 Business Users***

Regarding the business users, the targeting sectors with greater presence and projection in rural areas can be resource companies (mining, oil, gas and agriculture), utilities (transportation, tourism), marketing companies, banking and finance sectors (banks, rural banks). Adding to the above, the key issues that needed to be captured by the questionnaires were:

- Current access to internet service
- Existing challenges that need to be bypassed in the rural market
- Level of investment and willingness to invest for covering their telecommunication business needs.
- Difference between home needs and business needs in terms of telecommunication service,

#### ***2.2.1.2.4 Mobile Network Operators***

Regarding Mobile Network Operators, information on what is their current strategy and what are the existing opportunities in the rural market, the regional based challenges, the technical/business obstacles they have to deal (or confront) with, in order to extend their business in the rural areas, has been collected through this survey. More specific, examples of themes that were included in the questionnaire are:

- Operators' current strategy
- Operators' expansion strategy
- Operators' concerns

#### ***2.2.1.2.5 Equipment Manufacturers***

Last but not least, regarding the equipment manufacturers, specific information has been gathered which provided evidence to the consortium regarding the nature of the market, the relations between





manufacturers and network operators, completion status, etc. An example of the themes covered by the questionnaire can be found below:

- Supplier Forces
- Barriers to entry
- Customer Forces
- Substitutes
- Competition
- Segment Accessibility and Identification
- Profitability and Costs
- Actionable / Effective

### ***2.2.1.3 Testing and localization of methodological tools***

Testing and localization of methodological tools are critical for the success of any survey. The importance of customization of some parts of the survey, according to the needs of the local target group, was essential. Also, the importance of using local language and not a universal language, such as English, was crucial to be able have the best approach to the local population with their mother tongue.

#### ***2.2.1.3.1 Development phases of testing and localization of methodological tools***

The objective of this task was twofold. The first was the effective approach and communication with the respondents and the customization with respect to regional conditions, since cultural and geographic differences occur between the countries under examination.

The development of testing and localization of methodological tools followed three phases:

1. Evaluation of initial material and target group: The research questions and groups were analyzed.
2. Translation: The translations in different versions were developed.
3. Testing and adjustments: Review and adjustment of final questions were made.

#### ***2.2.1.3.2 Evaluation of initial material and target group***

For each one of the target groups a specific set of questions has been produced, tested, evaluated and delivered. Each group of questions contains the following structure:

<b>Target</b>	<b>Sections</b>	<b>Total Questions (Per section)</b>
Public Sector Interviews	4	30(11+6+7+6)
Business Users Focus Groups	5	26(6+3+9+4+4)
Private Users Questionnaire	7	39 (9+4+4+6+9+4+3)
Operators Interviews	9	33(6+3+4+5+1+7+1+2+4)
Manufacturers Interviews	8	43(5+7+2+3+3+13+6+4)

**Table 4: Total questions per section**



The material is based on questions in English, so translation and a brief analysis of each target were needed.

Target	Possible characteristics and considerations
Public Sector Interviews	Experts in different fields
Business Users Focus Groups	Both professional and non-professional business users, some of them could need to be more specific and detailed about the questions.
Private Users Questionnaire	Both professional and non-professional business users, some of them could need to be more specific and detailed about the questions.
Operators Interviews	Technicians or professionals that could understand generic questions in Spanish or probably in English. This task was translated by EHAS.
Manufacturers Interviews	Technicians or professionals that could understand generic questions in Spanish or probably in English

**Table 5: Possible characteristics and considerations for each sector**

#### 2.2.1.3.3 Translation

Each question has been evaluated by the following cycle:

- a) Direct translation of the questions to Spanish.
- b) Adjustment to each question, according to the possible characteristics of each group.
- c) Analysis of particular terminology, especially for business users and private users. As the localization is done for two different places (Colombia and Peru), specific terminology has been analyzed specifically for business and private users in order to have a generalized approach to a wide range audience

#### 2.2.1.3.4 Testing and adjustments

The questions were reviewed in two ways:

- Review one: A member of UCAU team with experience on working with local communities that were not part of previous phases has reviewed the questionnaires for comprehensibility and accessibility of the questions.
- Review two: A translation expert reviewed the questionnaires in order to identify any grammatical errors and give feedback about the generalization of some the questions.

### 2.2.2 Sample selection methodology

In order to be able to capture the correct results of the survey from these different communities and users, with respect to usage of TUCAN3G services, the consortium sought to identify each location in terms of:

- Size of population,
- Existence of communication services



- Types of business activities.

#### ***2.2.2.1 Sampling Methodology for Private Users***

To understand and gather information about the need of private users and potential usage opportunities of TUCAN3G services, a structured questionnaire has been used. In order to improve the data collection process and to complete the questionnaire in the main focus of the survey, an experienced researcher has been assigned to conduct the survey in each case.

Responders were expected to observe and determine the kind of innovative approaches being used in terms of telecommunication services and, at the same time, observe other factors related to the survey that the respondents were likely to find hard to respond to, especially in the section of economic indicators.

The questionnaires that have been used in this survey are both closed and structured. This method gives the researcher an advantage to get detailed understanding of the research subject.

The sample size has been chosen considering not only the number of households but also total population. However the head of the family has not been necessarily interviewed on behalf of the household. The sample also consisted of individuals who use the Internet found in other places.

#### ***2.2.2.2 Sampling methodology for Public Sector & Institutional Users***

In order to gather information from institutional users, two primary target groups have been identified. The first group consists of government officials that are responsible for telecommunications planning in rural areas and officials of business and policy-making sectors with presence in the isolated rural locations.

To this end, both in the cases of Colombia and Peru, a significant stakeholder and decision maker has been contacted in order to express its opinion on the deployment and business model of TUCAN3G services. Moreover, officials in telecommunications planning have been interviewed in order to avoid a single perspective on the relevant issues.

The second group consists of responsible personnel of public institutions with presence in isolated rural areas, such as responsible personnel of health posts, directors of schools, responsible for police stations and local authorities.

In this case, a number of responsible personnel of public institutions -at least two in each location identified-, have been interviewed in order to understand their view on possible benefits and drawbacks of telecommunication services deployment, such as TUCAN3G.

#### ***2.2.2.3 Sampling Methodology for Business Users***

In terms of business users, it was important to identify their business needs and examine their involvement with the TUCAN3G service. To better capture the opinion of business users, a focus group methodology has been applied allowing them to exchange opinions regarding their business needs.



To this end, at least five different business users from each location selected, had to participate in each focus group. At least two focus groups had to be conducted, mainly according to the business activities sectors identified in each selected area.

#### ***2.2.2.4 Sampling Methodology for Network Operators and Manufacturers***

In order to examine the possible involvement of service and equipment providers, semi-structured questionnaires have been chosen as a research tool.

To this end, operators with either worldwide deployment of services or intention to expand to these areas in the near future (3 years) have been selected, in order to identify possible opportunities and drawbacks of a service, such as TUCAN3G.

Similarly, equipment manufacturers, targeting in providing equipment suitable for penetration in such target locations, have been selected.

In both cases, organizations of different sizes have been selected in order to be able to provide various opinions on the usage and development of the service.

#### **2.2.3 Selection of Sample for Peru**

According to the methodology specified above, the following sample has been selected for each research group: Regarding the officials to be engaged, based on the methodology proposed in Section 3.1, institutional users of qualitative type have to be engaged, so only a minimal yet reasonable number of officials to be required.

In the case of Peru and according to the above, we get the following list of officials who will develop the qualitative study, according to the selected institutions:

- a) Officials responsible for the telecommunications sector in rural areas (related to use and policy development in telecommunications):
  1. Representative of the Telecommunications Investment Fund (FITEL).
  2. Representative of the Supervisory Agency for Private Investment in Telecommunications (OSIPTEL).
  3. Representative of the Agency for the Promotion of Private Investment (PROINVERSIÓN).
  4. Representative of the Ministry of Development and Social Inclusion.
  5. Representative of the Health Ministry.
  6. Representative of the Education Ministry.
  7. Representative of the Interior Ministry.
  
- b) Officials responsible for public institutions with a presence in isolated rural areas:
  1. Representative of the health post of the locality "i".



2. Representative (director) of the local school "i"
3. Responsible for the police station of the locality "i".
4. Local Government Authority of the locality "i".

These four officials, proposed for the qualitative study, should be verified in the field and interviewed. It was expected not to find some of them in isolated rural localities, to be visited in the field work<sup>1</sup>.

Field work will include the following isolated rural localities of Loreto department:

N°	Department	Province	District	Locality (i)
1	Loreto	Alto Amazonas	Balsapuerto	San Juan de Armanayacu
2	Loreto	Alto Amazonas	Balsapuerto	San Gabriel de Varadero
3	Loreto	Maynas	Napo	Huitotos de Negro Urco
4	Loreto	Maynas	Napo	Santa Clotilde
5	Loreto	Maynas	Napo	Tutapishco

**Table 6: Isolated rural localities of Loreto department affected by TUCAN3G project**

Considering the above, it can be summarized that there was a sample size of 27 institutional users, composed in the following way:

- a) 7 Officials responsible for the telecommunications sector in rural areas (related to use and policy development in telecommunications) and officials responsible for sectors with a presence in isolated rural areas.
- b) Officials representing 20 public institutions with a presence in isolated rural localities.

Business users have been selected based on a small sample in the areas of interest that could provide responses relevant to the TUCAN3G project.

To consider a sample for private users, giving enough information and comply with the objectives, we should specify “population” and “sample size” in such a way that the sample provides sufficient information for the targets of the survey. In the proposed design, it has been considered a confidence level of 95% and a precision error of 5%. In addition, it has been considered a non-response rate in rural forest survey of 3.2%.

### **2.2.3.1 The population**

The population for the study of private user market consists of all people currently (2013) living in the five isolated rural localities of Loreto (San Juan de Armanayacu, San Gabriel de Varadero, Huitotos de Negro Urco, Santa Clotilde and Tutapishco):

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<sup>1</sup> This is due to the fact that there is no updated information on the presence of public institutions in isolated rural localities.



Nº	Department	Province	District	Locality (i)	Population 2007
1	Loreto	Alto Amazonas	Balsapuerto	San Juan de Armanayacu	47
2	Loreto	Alto Amazonas	Balsapuerto	San Gabriel de Varadero	780
3	Loreto	Maynas	Napo	Huitotos de Negro Urco	263
4	Loreto	Maynas	Napo	Santa Clotilde	2,685
5	Loreto	Maynas	Napo	Tutapishco	287
<b>Total</b>					<b>4,062</b>

**Table 7: Population of Localities**

### 2.2.3.2 Determination of sample size

To calculate the sample size of the target population with statistical representation at the district level, it was considered appropriate to calculate the sample size in two stages:

#### Stage I

The sample size was estimated using the formula for simple random sampling for proportions.

$$n = \frac{N \times Z_{\alpha/2}^2 \times P(1 - P)}{(N - 1)e^2 + Z_{\alpha/2}^2 \times P(1 - P)}$$

where:

$n$  : Total number of people to be interviewed

$N$  : Total number of inhabitants

$Z_{\alpha/2}^2$  : Tabular value of the statistic for a confidence level of  $(1 - \alpha) \times 100\%$ , where “ $\alpha$ ” is the probability of making a type I error, taking the value of 0.05

$P_i$  : Expected proportion of population (0.50)

$e^2$  : Margin of sampling error. We considered a value of 0.05

The estimated sample was adjusted with the non-response rate (tnr = 3.2%).

$$n^* = \frac{n}{(1 - tdr)}$$

After applying the formula, the final sample size of 363 surveys that would run on the field work was obtained.

#### Stage II

The redistribution of the sample was calculated. For this, we used stratified random sampling, which applies when the population is not homogeneous with respect to the feature under study: social class, region, gender, age groups. In this case, the population are divided into strata or groups and sampling should be done so that all these groups remain represented.



To determine the sample size in each stratum, especially if stratification is by income levels and region, two methods are available:

- Calculation proportional to stratum size
- Calculation disproportionate to the size of the stratum

For our case, we have used the second, since this type of calculation is used to avoid excessively large samples in larger strata and samples too small to allow further analysis in smaller strata.

The stratification variable used is the locality. And, therefore, the calculated sample size was laminated between the numbers of localities to interfere with the study (benefited localities).

After evaluating and optimally weighted sample distribution computed, the following table occurred:

N°	Department	Province	District	Locality (i)	Surveys size by Locality
1	Loreto	Alto Amazonas	Balsapuerto	San Juan de Armanayacu	13
2	Loreto	Alto Amazonas	Balsapuerto	San Gabriel de Varadero	60
3	Loreto	Maynas	Napo	Huitotos de Negro Urco	40
4	Loreto	Maynas	Napo	Santa Clotilde	206
5	Loreto	Maynas	Napo	Tutapishco	44
<b>Total</b>					<b>363</b>

**Table 8: Survey size by Locality**

Finally, both operators and equipment manufacturers were selected according to needs of the research. All relevant operators in Peru operating in rural areas were contacted as well as all relevant equipment manufacturers as specified by the research group relevant partners.

#### **2.2.4 Selection of Sample for Colombia**

The selection sample for Colombia is not available as the responsible Colombian partner (CREPIC) had not had the resources neither to elaborate a selection methodology nor to increase the number of private users who took part in the survey (53).



### 3 COLLECTION OF DATA

Section 3 is dedicated on presenting the users and actors which actually participated in our surveys and interviews, both from Peru and Colombia. The data have been collected by using the tools already mentioned in previous chapters and cover both demand and supply side users and stakeholders. More specifically, data cover both demand and supply side users as well as the stakeholders. Adding to the above, the final number of participants shown in the table below shows a deviation from Table 3 (initial planning) due to practical reasons or denials of participation.

Group	Type	Tools	Final Participants
Research Tools for Public Sector (Officials)	Qualitative	Open Interviews	4 participants
Research Tools for Public Sector (Institutions)	Qualitative and Quantitative	Semi – structured Interviews	18 participants
Research Tools for Business Users	Qualitative	Semi – structured Interviews or Focus Groups	8 participants
Research Tools for Private Users	Qualitative and Quantitative	Participant observations, Structured Questionnaires	419 interviewees
Research Tools for Operators	Qualitative	Semi – structured Interviews	3 operators
Research Tools for Manufacturers	Qualitative	Semi – structured Interviews	5 companies

**Table 9: Participants in Research Activities**

#### 3.1 Demand side

Data coming from the demand side are related to private users, business users and institutional users. Users from a large pool of locations, with different backgrounds and occupations, participated in our survey in order to better understand their needs and expose their characteristics and profiles.

##### 3.1.1 Private Users

Data collected from private users come from a variety of locations, covering both Peruvian and Colombian areas. In total, 419 people participated in the survey, out of which 363 are from Peru and 56 are from Colombia. Below you may find detailed information regarding the procedure of collecting data from these users.

###### 3.1.1.1 Peru

Private Users in Peru were visited in a number of locations in order to collect accurate information from a disperse group of users, covering a wide area in the greater Amazon District. All surveys took place in the following municipalities: San Juan de Armanayacu, San Gabriel de Varadero, Tutapishco,





Huitotos de Negro Urco and Santa Clotilde. The total number of surveys that took place in the above-mentioned areas were 363 in total.

N°	Department	Province	District	Locality	Number of Surveys
1	Loreto	Alto Amazonas	Balsapuerto	San Juan de Armanayacu	13
2	Loreto	Alto Amazonas	Balsapuerto	San Gabriel de Varadero	60
3	Loreto	Maynas	Napo	Tutapishco	44
4	Loreto	Maynas	Napo	Huitotos de Negro Urco	40
5	Loreto	Maynas	Napo	Santa Clotilde	206
<b>Total number of Surveys</b>					<b>363</b>

**Table 10: Survey to Private Users – Peru**

At this point, it is worth mentioning that the local population has showed great interested to our project's scope and objectives, as they were persuaded that TUCAN3G project will contribute to their socio-economic development by improving social welfare.

### 3.1.1.2 Colombia

Regarding the survey which took place in Colombia, 56 persons – private users – were interviewed in four municipalities of the department of Cauca, specifically municipalities of Silvia, Jambalo, Purace and Popayan.

N°	Department	Municipality	Villages	Survey Site	
1	Cauca	Silvia	Ambalo	APROPESCA	16
2			Chuluambo		
3			Kizgo		
4			Miraflores		
5			Pitayo		
6			Quuchata		
7			Vallenuevo		
8			Guambia		
9	Cauca	Jambalo	Jambalo	Cabildo Coconuco	40
10	Cauca	Purace (Coconuco)	Coconuco		
11			Chiliglo		
12			San Baartolo		
13			Aguativia		
14			Cobaló		
15	San José Bajo				
16	Cauca	Popayan	Popayan	<b>Total number of Surveys</b>	
					<b>56</b>

**Table 11: Survey to Private Users – Colombia**



The first cycle of interviews was carried out in the city of Silvia, 59 kilometres from the capital city of the department Cauca. Although all interviews were conducted in the municipality of Sylvia, the focus was on inhabitants of smaller villages of rural area of the department. The study was carried out with the assistance of APROPESCA (Association of Producers and Marketers of Aquatic and Agricultural Products). A second cycle of interviews was carried out in the municipality of Purace, 30 kilometres from the capital city of the department.

### **3.1.2 Business Users**

Data collected from business users come from a variety of locations covering both Peruvian and Colombian areas. In total, 8 business users participated in the survey, out of which 5 are from Peru and 3 are from Colombia. Participants are mainly operating in the restaurant and transportation business while some of them are operating in the field of handcrafting and tourism. Below you may find detailed information regarding the procedure of collecting data from these users.

#### **3.1.2.1 Peru**

Regarding Business Users in Peru, 5 small business owners were interviewed, all of them located in Santa Clotilde, a town located by the Napo river in Northeastern Peru. At this point it is worth mentioning that all interviews were carried out through telephone.

<b>N°</b>	<b>Name of the Company</b>	<b>Business Activity</b>
<b>1</b>	La llegada del forastero	Restaurant
<b>2</b>	Rápido Río Napo	River transportation company
<b>3</b>	Manuel Grandez	Carpentry workshop
<b>4</b>	Fenit Congunche	Store that sells prepaid cellphone credit
<b>5</b>	Princesa 1	Motel

**Table 12: Business Users in Santa Clotilde, Peru**

#### **3.1.2.2 Colombia**

Regarding Business Users in Colombia, 3 small business owners were interviewed, all of them located in Coconuco. Coconuco has roughly a population of 950 inhabitants and is the head of Puracé municipality.

<b>N°</b>	<b>Name of the Company</b>	<b>Business Activity</b>
<b>1</b>	Chiliglo Fish farming Station	Fish farming
<b>2</b>	Coconuco – Comfandi Inn	Motel
<b>3</b>	Transporte Transtimbio	Public Transportation

**Table 13: Business Users in Coconuco, Colombia**

At this point, it is worth mentioning that the main business activity in the area is agriculture - main crops are corn, cabbage and beans. This limitation narrowed down the sample for conducting the interviews.



### 3.1.3 Institutional Users

Data collected from institutional users come from a variety of locations covering both Peruvian and Colombian areas. In total, 18 institutional users participated in the survey, out of which 16 are coming from Peru and 2 are coming from Colombia. Interviewed institutional users operate in areas as schools, police stations, health centres and community centres.

#### 3.1.3.1 Peru

In Peru, the 16 interviews took place in 5 different localities such as San Juan de Armanayacu, San Gabriel de Varadero, Huitotos de Negro Urco, Santa Clotilde and Tutapishco in order to get a better sample of the institutional users of the whole area.

Province	District	Locality	Authorities found and interviewed			
			School	Police station	Health centre	Community centre
Alto Amazonas	Balsapuerto	San Juan de Armanayacu	1	Doesn't exist	1	1
Alto Amazonas	Balsapuerto	San Gabriel de Varadero	1	Doesn't exist	1	1
Maynas	Napo	Huitotos de Negro Urco	1	Doesn't exist	1	1
Maynas	Napo	Santa Clotilde	1	1	1	1
Maynas	Napo	Tutapishco	1	Doesn't exist	1	1
<b>TOTAL</b>			<b>5</b>	<b>1</b>	<b>5</b>	<b>5</b>

**Table 14: Institutional Users in Peru**

#### 3.1.3.2 Colombia

From the other hand, the limitation of the area in Colombia allowed us to conduct interviews with only 2 of the most important institutional users based in Coconuco.

Department	District	Locality	Authorities found and interviewed	
			Police station	Health centre
Cauca	Puracé	Coconuco	Policía Nacional de Colombia	Coconuco Health Center
<b>TOTAL</b>			<b>1</b>	<b>1</b>

**Table 15: Institutional Users in Colombia**

### 3.2 Supply Side

Data coming from the supply side are related to public sector stakeholders, mobile network operators and equipment manufacturers, coming mainly from Peru or outside South America. These actors and stakeholders presented us the overall picture of challenges, boundaries and opportunities related to the examined area and how these could affect the services developed throughout TUCAN3G project.



### **3.2.1 Public Sector Stakeholders**

Officials responsible for the telecommunications sector in rural areas (related to the use and development of policies in the field of telecommunications) and officials responsible for from other sectors which carry on business in rural areas were interviewed only in Peru in order to collect all relevant data.

The interviews were conducted between July 18th and 28th October, 2013, with the following officials:

- Representative of the Telecommunications Investment Fund (FITEL).
- Representative of the Supervisory Agency for Private Investment in Telecommunications (OSIPTEL).
- Representative of the Ministry of Education.
- Representative of the Agency for the Promotion of Private Investment (PROINVERSIÓN).

### **3.2.2 Mobile Network Operators**

Regarding Mobile Network Operators, the methodology for collecting information in relation to the rural market was based on semi-structured interviews with the main operators working in rural areas of Peru. Firstly, a list of the main operators in these zones was collected from *AFIN* (Association for the Promotion of the National Infrastructure). According to this list, following 4 operators carry on their mobile activity in related areas are: *Telefónica del Perú (TdP)*, *América Móvil Perú (CLARO)*, *Nextel del Perú* and *GILAT*.

Even though people in charge of rural market in all operators were contacted for the survey, *Nextel del Perú* and *GILAT* rejected to be involved in the research because of their privacy policy. However, both operators have a limited activity of mobile telephony in these zones (*GILAT* only provides land phone based on satellite networks), so the absence of these companies was considered as not prejudicial for the results of the study. Therefore, the survey focused on the main operators working in Peruvian rural market, as *TdP* and *CLARO*. On the other hand, *AFIN* was also interviewed on the public sector development point of view, as they are working with operators on promotion of telecommunication services.

*TdP* was interviewed with the presence of 2 main representatives: the Manager of Rural Business and the Head of rural projects in Social responsibility area. In the case of *CLARO*, the interview was conducted with the Corporate Affairs Manager and the Director of Regulatory Affairs. *AFIN* participated in the survey through its General Manager.

Questions were designed with the collaboration of *TUCAN3G* partners considering the main regional issues. Although the respondents were expected to answer these questions, they could also speak freely on company expectations with respect to their strategies.

The interviews were transcribed (in Spanish) and analyzed to identify the relevant information for the market study and possible business model. As the result of this analysis, a report was prepared, drawing up the main lines identified by operators at each stage of the interview.



### 3.2.3 Equipment Manufacturers

Equipment manufacturers are critical for the overall success of the project. For the scope of TUCAN3G, a number of worldwide manufactures have been selected to participate in our survey. These manufactures cover the whole range of equipment needed for the distribution of services, relevant to the ones to be developed within TUCAN3G activities. The manufacturers selected for interview were SiRRAN Communications Ltd, Altobridge, Sistelnetworks, iDirect and ip.access. Below, you may find brief description for each company.

- a) **SiRRAN Communications**, is a software & services company specialized in mobile networks and global solutions for telecommunications. SiRRAN is based in Dublin, Ireland and has presence in the UK, US, Liechtenstein, Philippines, Australia, Mexico, Chile, Peru and Panama.
- b) Founded in 2002, **Altobridge** develops wireless network solutions that reduce network operating costs in delivering mobile voice, mobile broadband and big data services. Central to this lie a series of patented and patent-pending technologies namely; Altobridge Data-at-the-Edge™ (intelligent mobile broadband data optimization and delivery across wireless networks), Hierarchical Network Caching™, Meshed Cache, Self-Learning Content Prepositioning, Local Connectivity™ (local voice switching) and Split Architecture™ (transmission and power optimization), all of which drive down communications delivery costs for mobile network operators by reducing backhaul and power consumption costs. Altobridge is based in Ireland and has other offices in USA, China and Malaysia covering sales, R&D and customer support.
- c) **Sistelnetworks** is a company located in Valencia, Spain, which provides high added value products and solutions for wireless industry, to improve the user experience and profitability of the services. They are committed to bring innovative solutions on LTE and NFC markets. Sistelnetworks has extensive experience on working with telecom operators, solution providers and distributors from all over the worlds
- d) **iDirect** is based in Virginia, USA and is the leading IP-based satellite communications company providing technology, hardware, software, and services that enable VSAT service providers to optimize their networks and profitably expand their businesses.
- e) **Ip.access** is based in Cambridge, UK and is the leading small cell systems vendor and manufacturer. They deliver solutions to all around the world to tier-1 and tier-2 service providers through both direct connections and via major business partners.



## 4 PRESENTATION AND ANALYSIS OF RESEARCH RESULTS

Section 4 is dedicated on presenting the results that have been elaborated through the research by all involved stakeholders. The most important issues resulting from the surveys have been highlighted and are presented, both from Peruvian and Colombian institutional actors, private and business users. Moreover, a preliminary analysis of these findings is presented in order to discover and exploit the most critical key issues which will feed and determine future actions and activities.

### 4.1 DEMAND SIDE

Data coming from the demand side are related to private users, business users and institutional users of the services to be developed and implemented throughout the TUCAN3G project.

#### 4.1.1 Private Users

Data collected from private users come from a variety of locations covering both Peruvian and Colombian areas. As already mentioned in previous sections, 419 people participated in the survey, out of which 363 are coming from Peru and 56 are coming from Colombia.

##### 4.1.1.1 Peru

###### 4.1.1.1.1 Sample size and gender and age stats

The distribution of the sample size according to the localities can be found in the table below.

Nº	Department	Province	District	Locality	Number of Surveys
1	Loreto	Alto Amazonas	Balsapuerto	San Juan de Armanayacu	13
2	Loreto	Alto Amazonas	Balsapuerto	San Gabriel de Varadero	60
3	Loreto	Maynas	Napo	Tutapishco	44
4	Loreto	Maynas	Napo	Huitotos de Negro Urco	40
5	Loreto	Maynas	Napo	Santa Clotilde	206
<b>Total of Surveys</b>					<b>363</b>

**Table 16: Sample distribution according to locality - Peru**

Moreover, over 88.71% of the surveyed stakeholders are between 13 and 50 years old, where the most important age range is from 13 to 40 years old, with emphasis given to people between 21 and 40 years old respectively. The remaining 11% consists of people who are over 50 years old. Last but not least, 72% of the people who took part in the survey are male.



Age	Frequency	Percentage	Accumulated Percentage
Between 13 and 20 years old	75	20.66	20.66
Between 21 and 30 years old	93	25.62	46.28
Between 31 and 40 years old	92	25.34	71.63
Between 41 and 50 years old	62	17.08	88.71
Between 51 and 60 years old	28	7.71	96.42
Over 60 years old	13	3.58	100.00
<b>Total</b>	<b>363</b>	<b>100.00</b>	

**Table 17: Population composition by age - Peru**

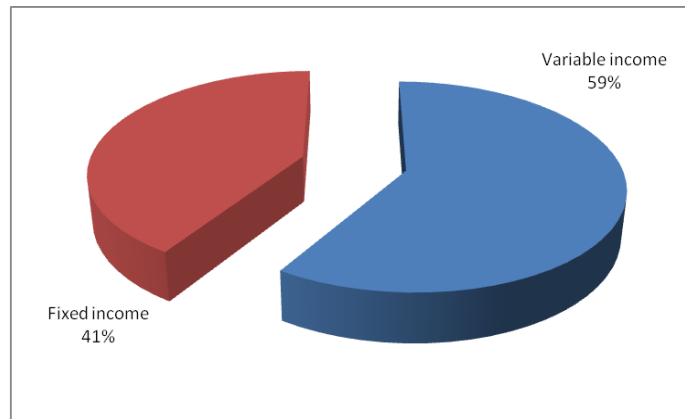
#### 4.1.1.1.2 Work activity and incomes

Related to the work activity and the income of the surveyed population, 54.82% is occupied in the farming sector while sectors such as fishing, commerce etc have minor impact. At this point, it is worth mentioning that the majority of the working force are male according to collected samples.

Sector	Male	Female	Total
Agriculture	59.39%	43.14%	54.82%
Wood	3.07%	3.92%	3.31%
Animal husbandry	0.77%	0.98%	0.83%
Hunting	0.38%	1.96%	0.83%
Fishing	0.77%	0.00%	0.55%
Commerce	3.07%	4.9%	3.58%
Handicrafts	0.38%	0.00%	0.28%
Services	3.45%	4.9%	3.86%
Transport	0.77%	0.00%	0.55%
Industry	0.38%	0.00%	0.28%
Construction	0.77%	0.00%	0.55%
Others	26.82%	39.22%	30.3%
Not working	0.00%	0.98%	0.28%
<b>Total</b>	<b>100.00%</b>	<b>100.00%</b>	<b>100.00%</b>

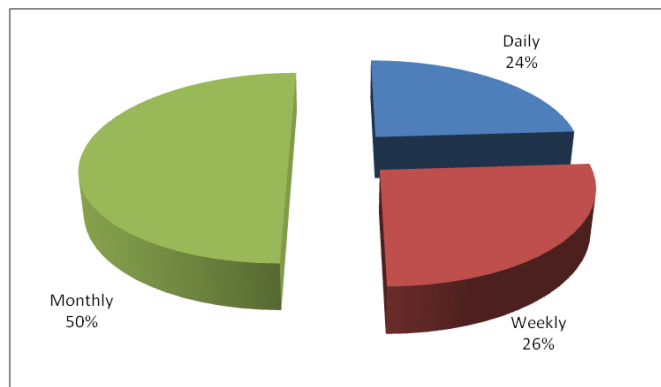
**Table 18: Sector in which the population works - Peru**

Since over the 50% of the population, including both men and women, are working in the agricultural sector, it is evident that the agricultural sector is the main source of income for the population. This feature is reflected also in the fact that 59% of the population has a variable income, while only 41% of the population has a fixed income, as presented in Figure 1.



**Figure 1: Stability of income of the population - Peru**

Regarding the periodicity of receiving incomes, 50% of the population has a monthly income while 26% and 24% have weekly and daily income, respectively.



**Figure 2: Frequency of income of the population - Peru**

Adding to the above, the income is relevant to the age ranges:

- 42% of younger people (less than or equal to 20 years old) have income less than or equal to US \$ 140 a month. A significant 41% of younger people have income above US \$ 250 a month.
- 40% of the population between 21 and 60 years old have income above the US \$ 250 a month.
- 54% of the population that is over 60 years old have income above the US \$ 250 a month.





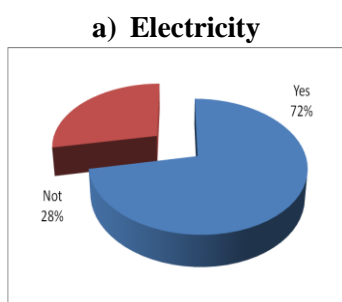
Income Range	1st age range between 13 and 20 years	2nd age range between 21 and 30 years	3rd age range between 31 and 40 years	4th age range between 41 and 50 years	5th age range between 51 and 60 years	6th age range over the 60 years	Total
Less than US \$ 35	21.33%	8.60%	10.87%	11.29%	14.29%	15.38%	12.95%
Between US \$ 35 and US \$ 140	21.33%	34.41%	29.35%	29.03%	32.14%	23.08%	28.93%
Between US \$ 141 and US \$ 250	16.00%	8.60%	17.39%	20.97%	14.29%	7.69%	14.88%
Between US \$ 251 and US \$ 355	20.00%	21.51%	16.30%	20.97%	10.71%	30.77%	19.28%
More than US \$ 356	21.33%	26.88%	26.09%	17.74%	28.57%	23.08%	23.97%
<b>Total</b>	<b>100.00%</b>	<b>100.00%</b>	<b>100.00%</b>	<b>100.00%</b>	<b>100.00%</b>	<b>100.00%</b>	<b>100.00%</b>

**Table 19: Monthly income of the population by age range - Peru**

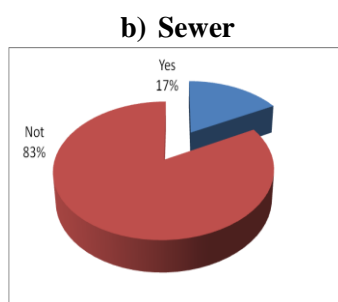
In general, 42% of the population has a monthly income that is less than US \$ 140, 34% of the population has an income ranging from US \$ 141 to US \$ 355 and 24% of the population has an income over US \$ 356.

**4.1.1.1.3 Household equipment and access to basic services of the population**

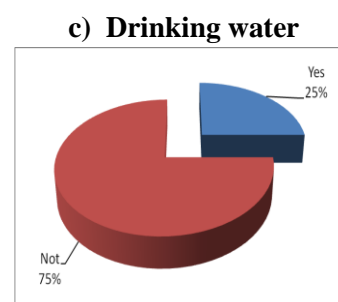
Access to basic services such as electricity, sewer and water is of great importance to the welfare state of the population. Thus, access to electricity allows people to have lighting and electrical equipment such as fans, audio-visual equipment, cooling equipment of low-power, mobile charging, among others. The sewer service and the water service have reduced the risks of health problems in villages, allowing people to live a better quality of life. According to this study, 72% of the sample population has restricted access to electricity in their home, i.e. only accessible between 6 pm and 11 pm. The remaining 28% of the population still has no access to electricity. The exact opposite is observed regarding to access to sewerage and drinking water, with 83% and 75% of the population not having access to these services, respectively.



**Figure 3: Access to electricity - Peru**

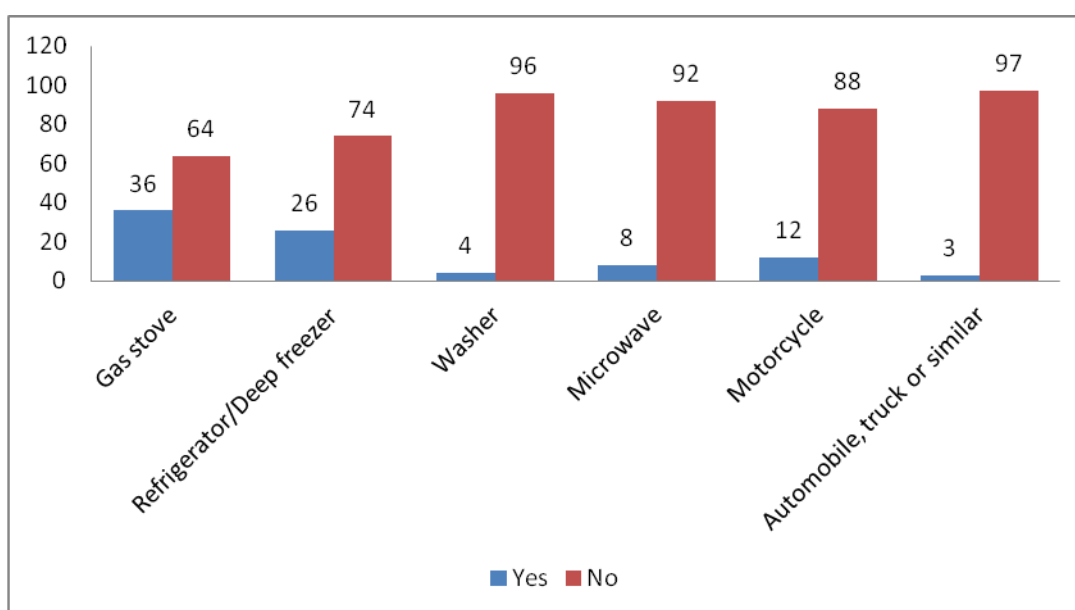


**Figure 4: Access to sewerage - Peru**



**Figure 5: Access to drinking water - Peru**

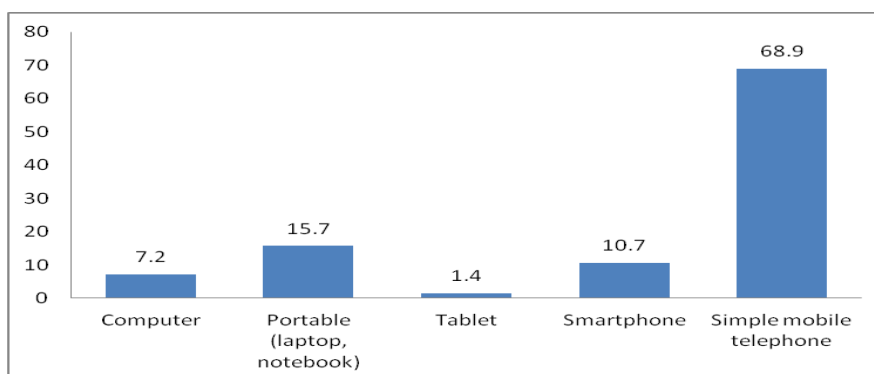
Also, the figure below shows that the level of equipment of households is very low (no more than 36%). According to the participants of our survey, the electronic devices with "greater presence" in houses are: the gas stove (36% of households), refrigerator and freezer (26% of households), motorcycle (12% of households), microwaves (8% of households) and washer (4% of households).



**Figure 6: Electronic devices in homes - Peru**

**4.1.1.1.4 Population access to computer and mobile equipment**

People have access to different media and portable devices such as mobile phones and laptops, however the numbers are limited, as their purchasing cost is relatively high. The main telecommunications equipment that has greater penetration among people is the mobile phone (68.9% of households have at least one household member with a simple mobile phone).



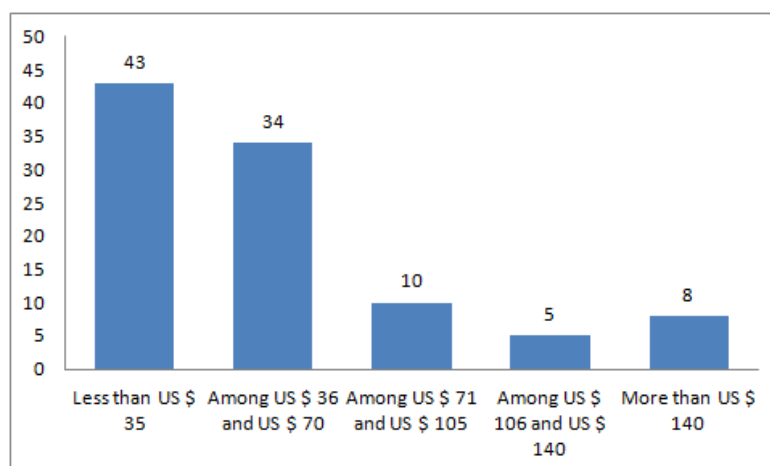
**Figure 7: Access of mobile and computing equipment at home - Peru**

Regarding high-end mobile devices that are most frequently used among the population, 12.95% of the population use portable computers (laptop, Notebook) and 10.53% use smartphones, while 1.66% use tablets.

	People who use their equipment as internet mobile getaway (%)	Average of Equipment for person
<b>a. Portable (laptop, Notebook)</b>	12.95	1
<b>b. Tablet</b>	1.66	1
<b>c. Smartphone</b>	10.53	1
<b>d. Simple Mobile Telephone</b>	39.06	2

**Table 20: Mobile equipment with most frequent use - Peru**

Figure 8 shows that, even though people want to upgrade their phone model, their willingness to buy a new model decreases while the price of the device increases. This is completely understandable, considering previously given incomes and basic service conditions. For a price among US \$ 36 and US \$ 70 (second price range) the expected demand for a new mobile phone is 34%, however, for a price among US \$ 71 and US \$ 105 (third price range) the expected demand for a new mobile phone is 10%.



**Figure 8: Willingness to pay for a new mobile phone or Smartphone - Peru**



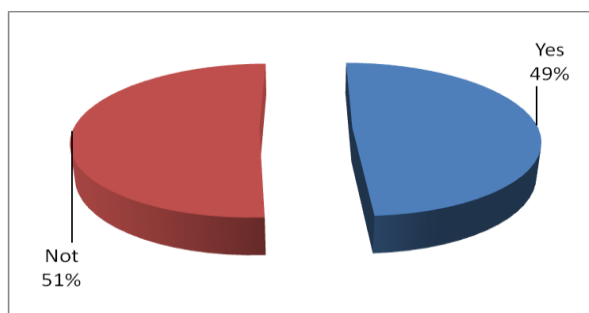
Given the willingness to purchase an upgraded mobile phone/smartphone, the majority of potential users (who represent a potential demand) of a mobile Smartphone are seeking to acquire the device by the following two ways: by seeking an economy brand model or by credit.

	Male	Female
a. I would buy the device if I could buy it on credit and pay the value of the phone in 12 months.	36.92%	29.41%
b. would rather buy an older model of this type of phone at an affordable price, and not have all the data services and features	6.54%	9.80%
c. I would rather look for a model of an economy brand that has similar features but at a lower cost	30.38%	44.12%
d. I would buy the device because it's something I aspire to have	5.77%	3.92%
e. I would look for a smaller version of the same device or economic but in the same brand	6.92%	2.94%
f. None of the above	13.46%	9.80%
	<b>100.00%</b>	<b>100.00%</b>

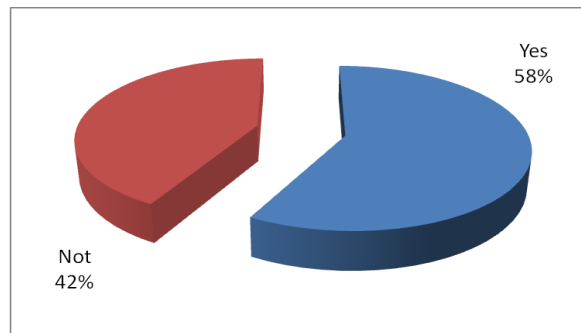
**Table 21: User considerations on buying a mobile telephone - Peru**

#### 4.1.1.1.5 Importance of the internet access

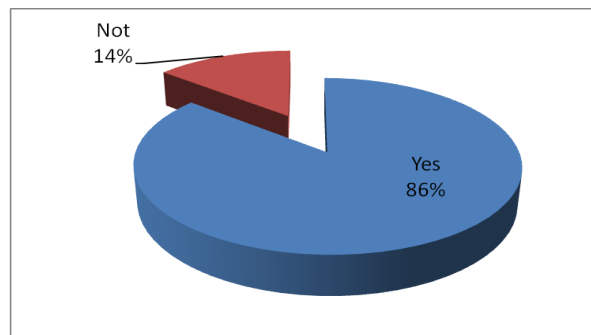
Analyzing the responses of the population regarding the benefits offered by the internet service, more than half of the population is unaware of the advantages offered by its use. Only 49% of the population are aware of the benefits of using the Internet service. Adding to the above 86% of the population believes that the continuous access and use of the Internet could benefit their families.



**Figure 9: Knowledge of the advantages of using Internet - Peru**



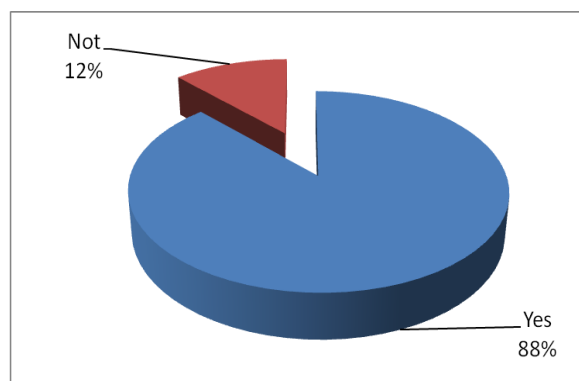
**Figure 10: Internet use of at least one household member - Peru**



**Figure 11: Interest for continuous access to the Internet - Peru**

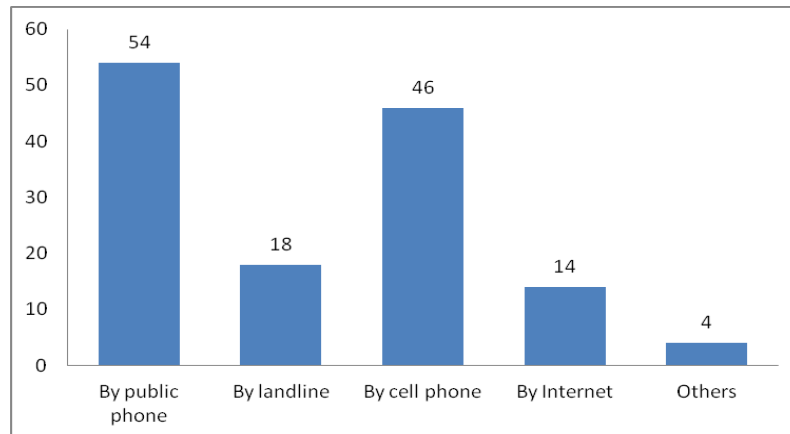
#### **4.1.1.1.6 Communication needs**

Due to various changes affecting society in general, populations have expanded and moved to other areas and regions. This affects the communication needs of local population, especially for communicating with families and friends living abroad or to other cities (According to Figure 12, 88% of the population has relatives living in other cities or countries).



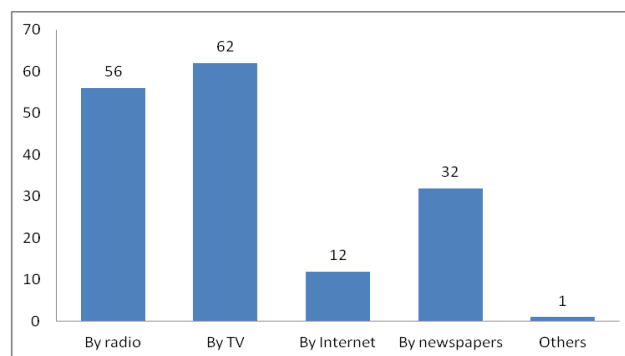
**Figure 12: Have relatives in other cities or countries - Peru**

As presented in Figure 13, a large percentage of the population is using either payphones (54%) or mobile phones (46%) for communication with their relatives, while internet and landlines follow with lower percentages.



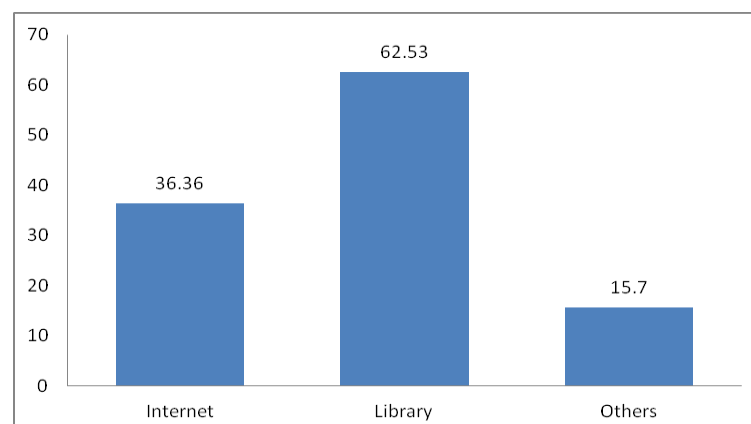
**Figure 13: Means to communicate with relatives - Peru**

As given in Figure 14, 98% of the population over 12 years old finds traditional means, such as radio (56%) and television (62%), very important for accessing the local and international news.



**Figure 14: Means to access local and international news - Peru**

Moreover, access to information and library materials is one of the main problems which students and youngsters confront with. 62.5% of the population is using physical libraries to gain access on academic material, while only 36% is using low quality internet for accessing relevant information. Adding to the above, it is obvious from the findings that there are students that use more than one means to access information for library material and academic such as internet, library, post etc.



**Figure 15: Means to access information for job related or study related matters - Peru**



#### 4.1.1.1.7 Use, type and duration of the communication service

##### a) For mobile phone users

By analysing the facts, it can be observed that a user who earns less than US \$ 140 has an average frequency of five calls per day, as given in Table 20. This frequency is maintained even among those who have a monthly income less than or equal to US \$ 35. Those who have income above US \$ 141, make, on average, more calls per day (average of six calls per day). Thus, what can be said is that an expected relationship between income and number of calls exists, i.e. the user that has greater income tends to perform in some cases a bigger number of calls per day.

Income Range	N	Average	cv.	Min	Max
Less than US \$ 35	30	4.37	0.79	1	10
Among US \$ 36 and US \$ 70	50	4.32	0.73	1	16
Among US \$ 71 and US \$ 105	31	5.13	0.77	1	18
Among US \$ 106 and US \$ 140	46	4.65	0.91	1	19
More than US \$ 141	50	6.08	0.73	1	18
<b>Total</b>	<b>207</b>	<b>4.95</b>	<b>0.79</b>	<b>1</b>	<b>19</b>

**Table 22: Average daily calls from a cell phone by income range - Peru**

Age range	N	Average	cv	Min	Max
Between 13 and 20 years	52	4.63	0.64	1	15
Between 21 and 30 years	55	5.15	0.78	1	16
Between 31 and 40 years	55	4.73	0.89	1	18
Between 41 and 50 years	24	4.88	0.93	1	19
Between 51 and 60 years	16	6.25	0.77	2	15
Over 60 years	5	4.60	0.57	1	7
	<b>207</b>	<b>4.95</b>	<b>0.79</b>	<b>1</b>	<b>19</b>

**Table 23: Average daily calls from a cell phone by age range - Peru**

##### b) Internet users

On the other hand, the expenditure made for Internet access in public booths shows that 39% of Internet users spend less or equal to US \$ 3.5. This characteristic is accentuated in the case of female users, since 43% spends less than or equal to US \$ 3.5. An important fact is that a significant 20% of male users spent in a month over US \$ 14 for Public Internet access while 76% of all Internet users in public booths spend at most US \$ 10 per month.

	Male	Female	Total
<b>Less than US \$ 3.5</b>	37%	43%	39%
<b>Among US \$ 3.6 and US \$ 7</b>	20%	25%	22%
<b>Among US \$ 7 and US \$ 10</b>	15%	16%	15%
<b>Among US \$ 10 and US \$ 14</b>	7%	3%	6%
<b>More than US \$ 14</b>	20%	13%	18%
<b>Total</b>	100	100	100

**Table 24: Distribution of monthly expenses for internet public booth - Peru**



Considering the above results and the tendency to pay for continuous internet access, 28% have a willingness to pay between US \$ 3.6 and US \$ 7 a month for a continuous Internet service.

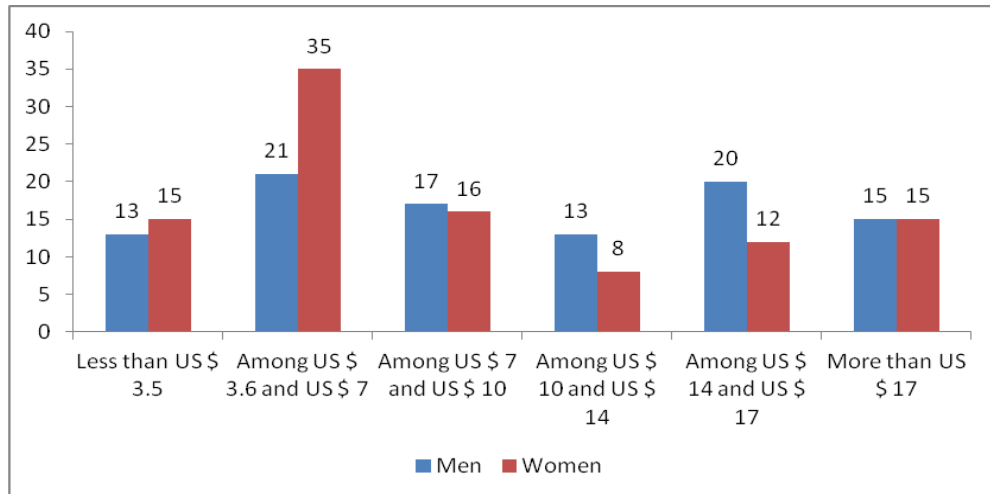


Figure 16: Willingness to pay monthly for continuous Internet access - Peru

**c) Smartphone users**

Regarding smartphone users, 36% would subscribe to two applications, 25% to one application, 16% to three or four applications and 9% for five or more applications. There is a 14% showing no more interest in subscribing to mobile applications.

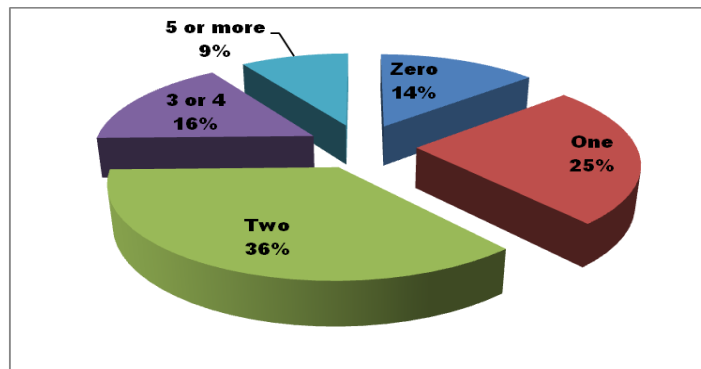
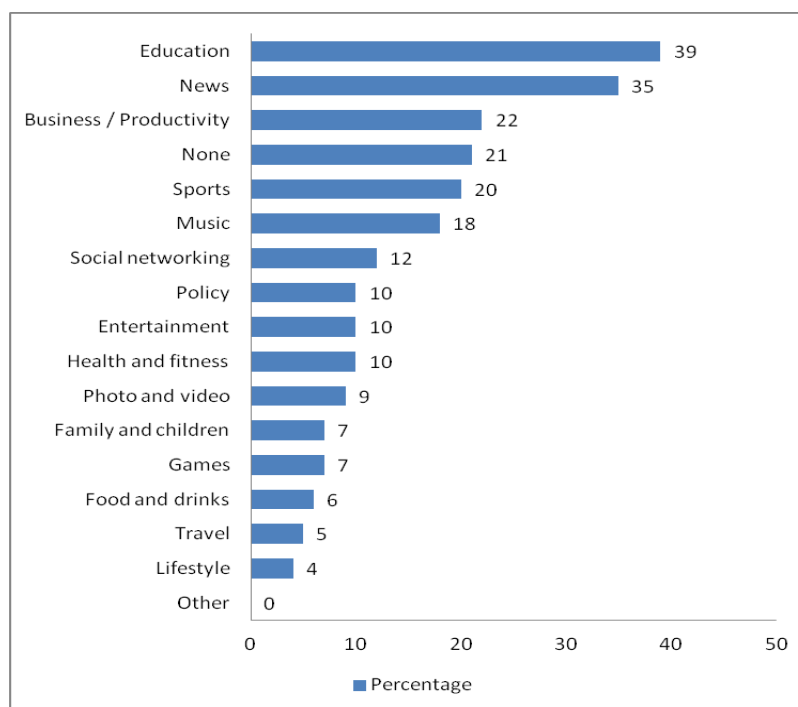


Figure 17: Subscription to free mobile applications - Peru

As for the type of content that users expect to have on their mobile devices, is mainly educational topics related content and information (news). Also, contents for business and / or productive activities, sports and music are of high interest. Other interesting topics are social networks, politics, entertainment, health and fitness, and audio-visual content. More detail can be found in Figure 18.





**Figure 18: User interests with respect to types of content of an application - Peru**

With regards to the demand for applications or updates on mobile devices, 17% prefer (or will prefer) to buy data packages when they need to access the service and, on the other hand, 17% prefer to use a free service based only on text. However, it should be noted that significant 36% of the respondents did not answer this question.

AFFIRMATIONS	N° Obs.	Percentage	Cumulative percentage
Buy data packets when I need to access the service	64	17.34%	17.34%
Using prepaid cards for data services	41	11.11%	28.46%
Use data options included in my prepaid contract	32	8.67%	37.13%
Use an inexpensive version of the service but with restrictions or limitations	33	8.94%	46.07%
Use free services based only on text	64	17.34%	63.41%
Other	2	0.54%	63.96%
N.A	133	36.04%	100.00%
Total	<b>369</b>	<b>100.00%</b>	

**Table 25: User preferences on service purchases - Peru**

Regarding the payment methods for access and use of the content on their mobile device or smartphone, 47% of users prefer to use prepaid payments through their operator. A second alternative is post-paid payments, as part of their contract (9.8%). However, 23% of the users do not prefer any of the methods proposed in the list of alternatives.



Payment Methods	N.	%	% Cumulative
Prepaid payment through the operator	175	47.43%	47.43%
Postpaid as part of their contract	36	9.76%	57.18%
Using debit card	8	2.17%	59.35%
Using credit card	20	5.42%	64.77%
Using a bank transfer from a bank account	12	3.25%	68.02%
Through secure payment service (i.e paypal)	24	6.50%	74.53%
Other (please specify)	6	1.63%	76.15%
N.A	71	23.85%	100.00%
<b>Total</b>	<b>352</b>	<b>100.00%</b>	

**Table 26: Payment Method preferences for accessing content - Peru**

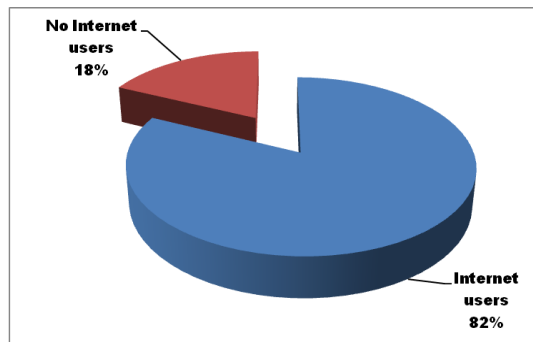
The main reasons, explaining the low usage of mobile services in rural localities, are given in Table 25. Accordingly, 41% of the respondents confirm the limited access to those services due to lack of electricity, while 31% claim high transport costs from where they live to the service access points. On the other hand, 20% of the respondents complain about instability of the service with frequent network drops.

Reasons	Percentage
Frequent network drop	20%
Transport costs and distance from access points or boundary	31%
Billing system used	1%
Lack of electricity	41%
Fear or low knowledge on how to use a particular technology	2%
Cost of services	7%
Services not available	15%
Few hotspots or coverage	10%
I'm not interested in the content or services offered	1%
Other	2%

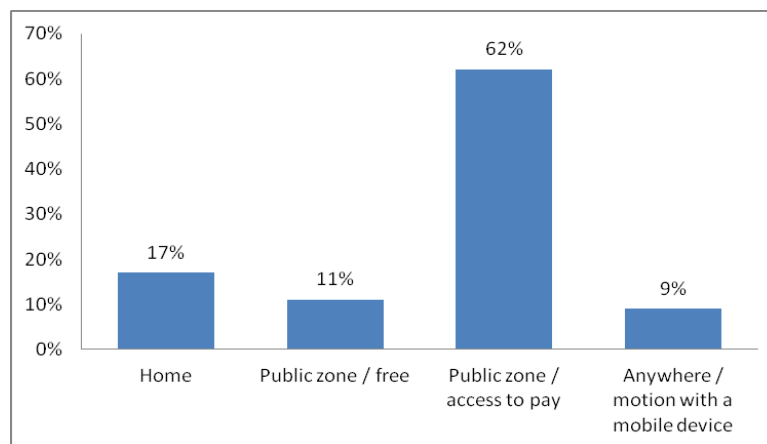
**Table 27: Main reasons for not using the mobile phone service - Peru**

#### **d) Internet usage and location**

82% of the population is currently using internet services, i.e. at least once a month, while 62% of internet users are accessing the service on a public area with charge-based access (public cabin), 17% access at home, 11% in free public access area and 9% at any place through their mobile devices as given in Figure 21.

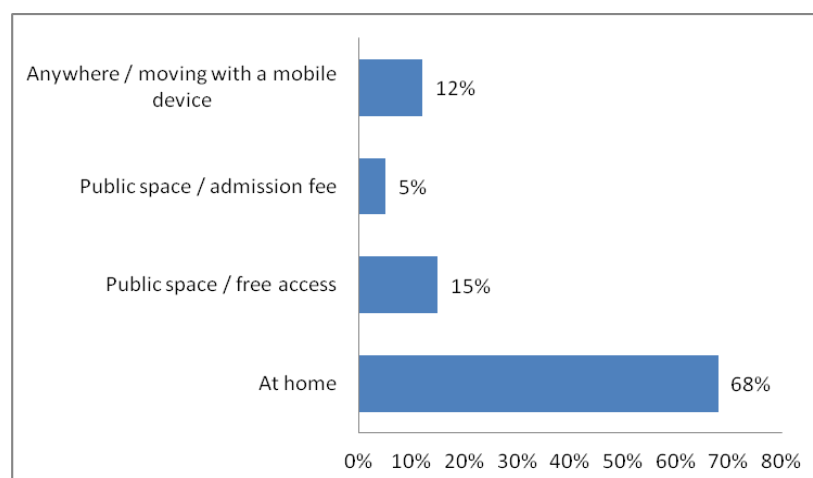


**Figure 19: Internet Usage - Peru**



**Figure 20: User preferences on the access point of the internet services - Peru**

According to access point preferences for personal communication needs, 68% of Internet users claimed that their primary preference is accessing the internet while they are at home and 12% of prefer to have access from their mobile device. More details are given in Figure 21.



**Figure 21: User location preferences on accessing internet for personal communication needs - Peru**



Considering the communication needs in employment or business activity, 52% prefer to have internet access at home, 32% at mobile way and 15% at free public access area. See Figure 22.

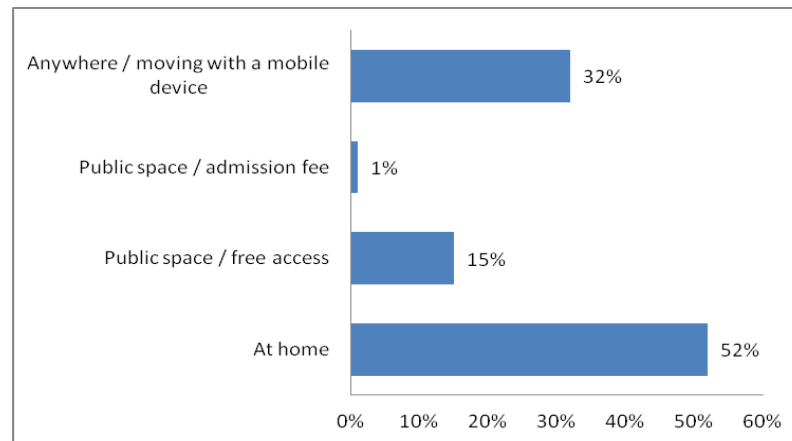


Figure 22: User location preferences on accessing internet for business activity - Peru

#### e) Mobile advertising

Regarding mobile advertising, 43% of users prefer receiving advertising messages to their mobile devices only once a week. 22% expect to receive advertising messages every day, while 14% expect to receive two to three advertisements per month. In contrast, 7% prefer not to receive any messages at all. More details about the preferences on receiving advertisement messages and the form of the message can be found in Figure 23 and 24 respectively.

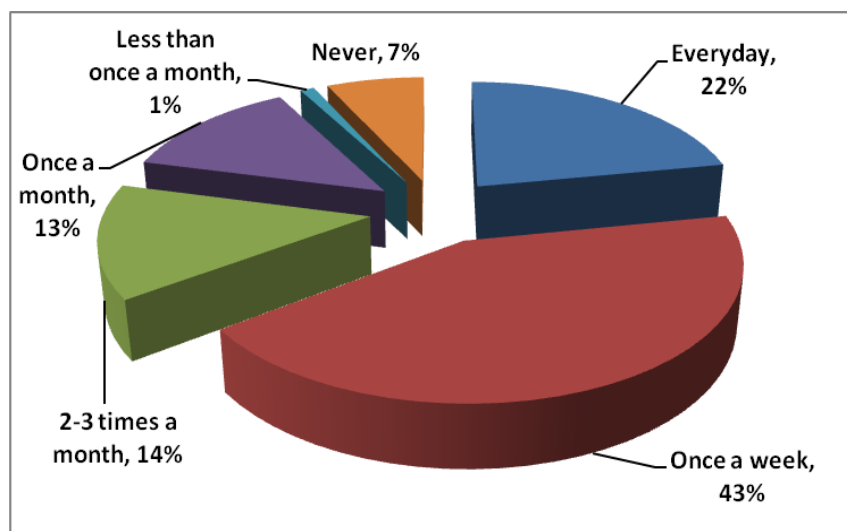
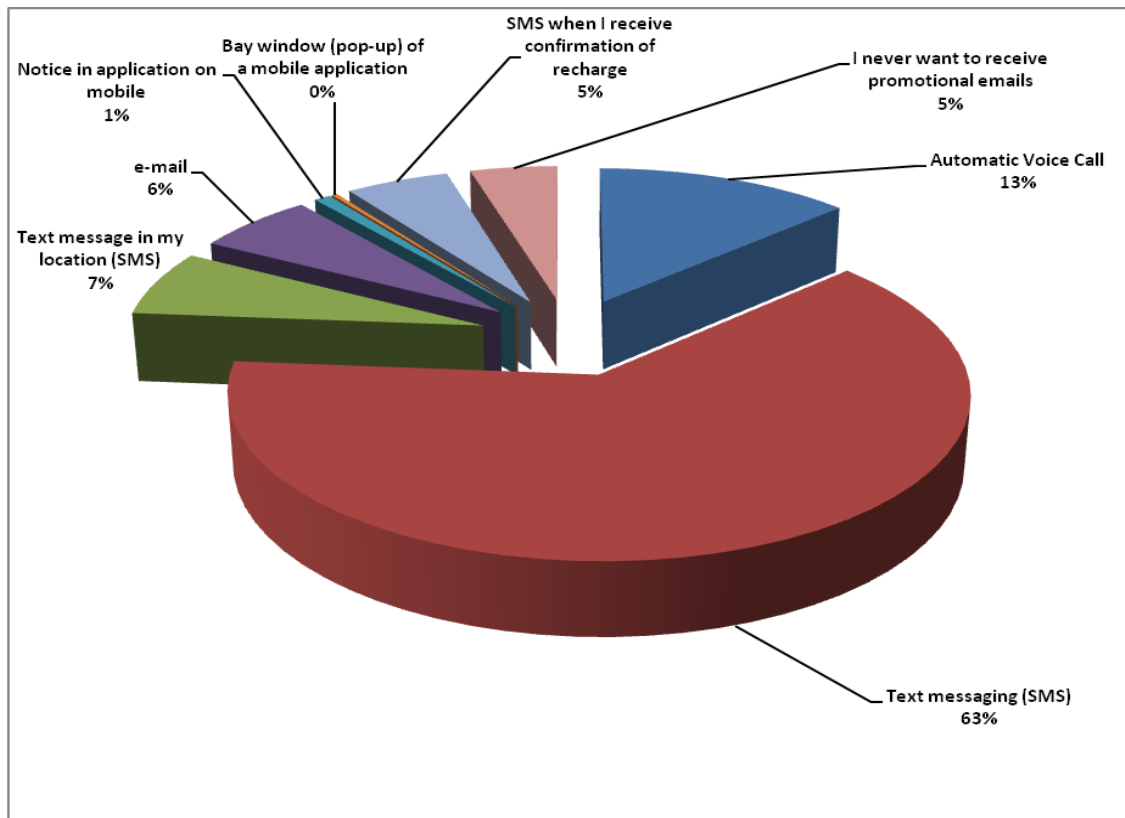
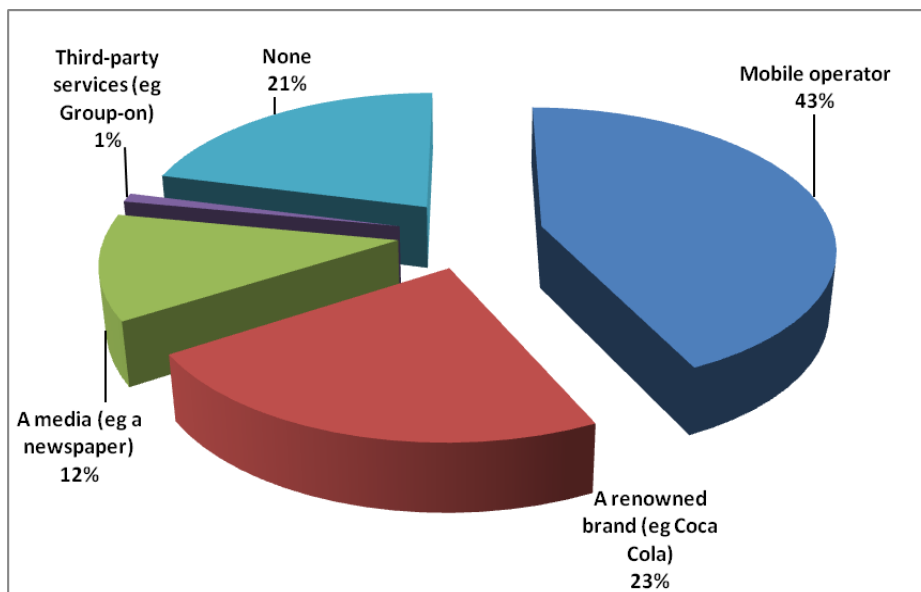


Figure 23: Frequency for receiving advertising message to mobile phones - Peru



**Figure 24: Preferences on receiving promotional messages from businesses in mobile phone - Peru**

Also, according to Figure 25, users of the mobile phone service would be willing to trust messages from their mobile operator or some renowned brand.



**Figure 25: Will to trust advertising message senders – Peru**



#### *4.1.1.1.8 Key findings*

- Regarding age, the vast majority of the market for the offer of 3G mobile services is composed of inhabitants between 12 and 50 years old, while the majority are men. More specifically, half of the population, according to the sampling, is between 20 and 40 years old and thus specific services for this target group have to be taken under consideration.
- Agriculture is the main source of income for the population, since over half of the population work in the agricultural sector. Moreover, according to their occupational seasonality, they majority does not have a fixed income.
- The monthly income of 42% of the population is less than US \$ 140, for 34% of the population is ranging from US \$ 141 to US \$ 355 and only 24% has an income over US \$ 356.
- 72% of the population has access to electricity in their home, but only in a hourly-restricted basis. On the other hand, levels of access to sewerage and drinking water are very low, with only 17% and 25% of the population having access respectively.
- Most of the households have a simple mobile phone but, considering the high prices of mobile services and low incomes, most of the people are not willing to pay more than US \$ 70 to have a new mobile phone. They also prefer to use an economical model/brand with similar features for a lower price instead of an expensive model.
- Only half of the population is aware of the advantages of using the Internet, but most of them believe that continuous internet access could benefit their lives, since they would be able to communicate better with relatives in other localities.
- Locals keep up with the current news mostly by television and radio. When they need information for business or educational purposes, they obtain it mainly from libraries, despite the poor quality of the information they get.
- Mobile users make an average of 5 calls per day for work purposes or communication with their families, with those having a better income tending to make a bit more calls per day.
- Although most of the internet users spend less than US \$ 3.5 per month for access through internet public booths, there is a significant group of people (18%) that spends more than US \$ 14 per month.
- Most of users are willing to pay more than US \$ 7 per month for continuous internet access, with men willing to pay more than women.
- A large amount of users (61%) would subscribe for 2 or more applications with a rate of US \$ 1 per month. The main content they would like to access is educational (39%), followed by news (35%) and business/productivity (22%).
- In order to access these services 18% would rather buy data packages and another 18% would prefer to use a free service based on text only.
- The main reasons for the low use of mobile services in rural localities are the lack of electricity, the high transportation costs and time, given the long distances to access points, and the constant network drop. Cost of services is not considered, by the respondents, an important factor (7%).
- The vast majority of the respondents use the Internet at least once a month on a public access area near their homes, but they would prefer to access it at their homes.
- The majority of the respondents would prefer a prepaid payment method (49.7%), but also a significant number (20%) prefer methods alternative to the ones mentioned in the research.
- The majority of the respondents believe that advertising and promotional messages are preferred to be sent to users once a week by text messages.

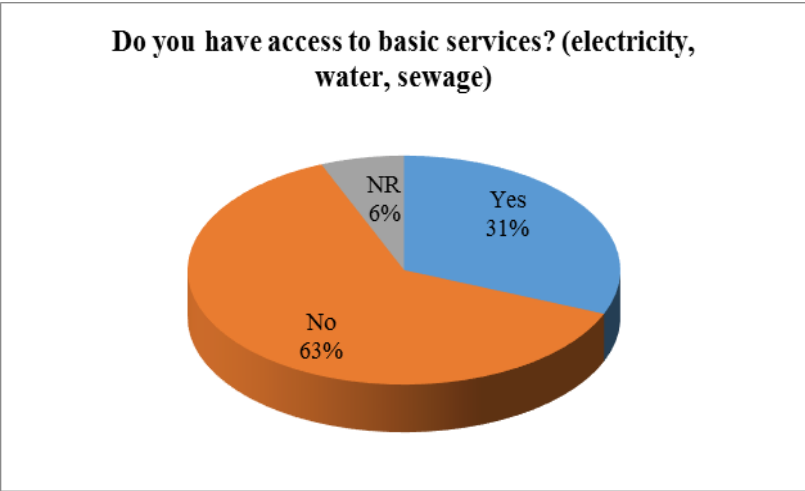


**4.1.1.2 Colombia**

For the Colombian side, 56 private users took part in the interviews, mainly from the department of Cauca, specifically municipalities of Silvia and Purace. The first cycle of interviews was carried out in the municipality of Silvia, 59 kilometres from the capital city of the state. Although all interviews were conducted in the municipality of Sylvia, the respondents were from rural, small villages of the department. The study was carried out with the assistance of APROPESCA. A second cycle of interviews was carried out in the municipality of Purace, 30 kilometres from the capital city of the State. The study was carried out in the municipal head of Coconuco.

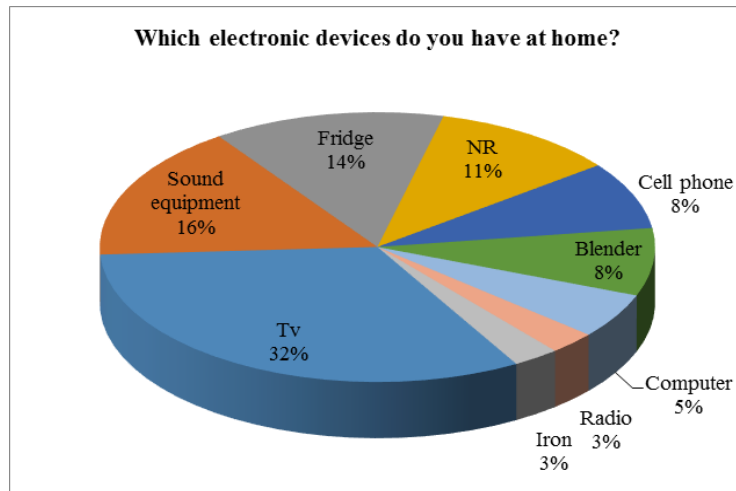
**4.1.1.2.1 Private user identity of Colombian sample**

Respondents are mostly farmers, the majority of whom falls in the 40 to 68 age range and an average of 6 people per family, with ages from one to 56 years old. Due to their occupational seasonality, their income also varies with an annual average of U.S. \$ 1,781. Access to public services, as presented in Figure 26, is limited.



**Figure 26: Access to basic services for Private Users - Colombia**

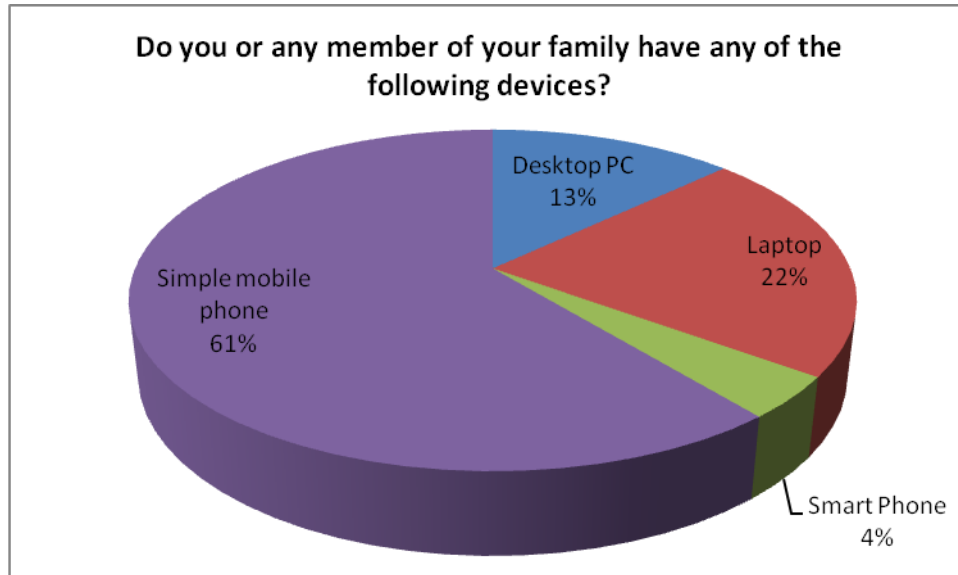
The most common appliances in this community are television sets with 32%, followed by sound equipment and refrigerators. More detailed information is given in Figure 27.



**Figure 27: Availability of electrical/domestic appliances - Colombia**

#### 4.1.1.2.2 Device ownership

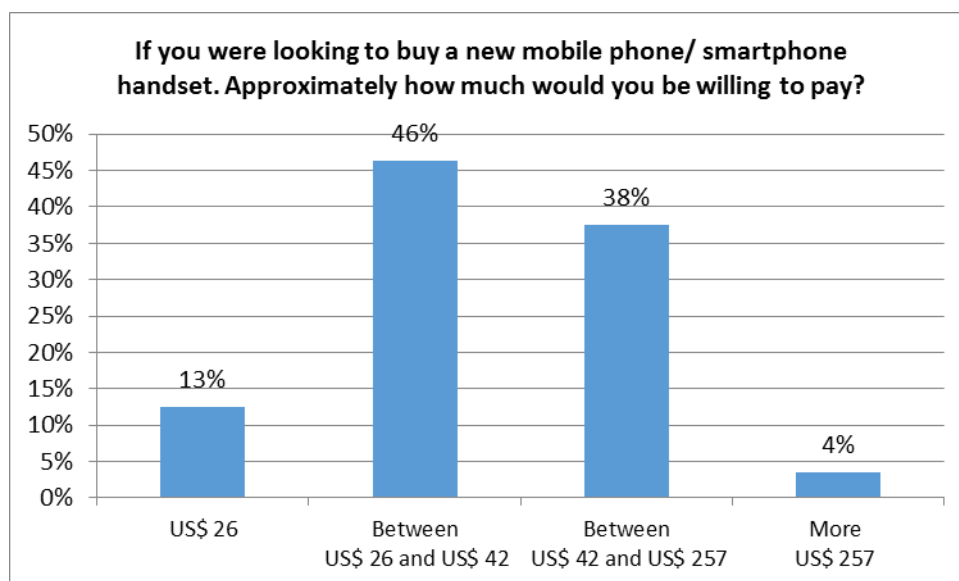
In relation to device ownerships, 61% of the respondents claimed to have a simple mobile phone, while 35% have computers (desktop or laptop). More detailed information can be found in Figure 28. 87% of the devices mentioned are being used as mobile solutions.



**Figure 28: Device ownership - Colombia**

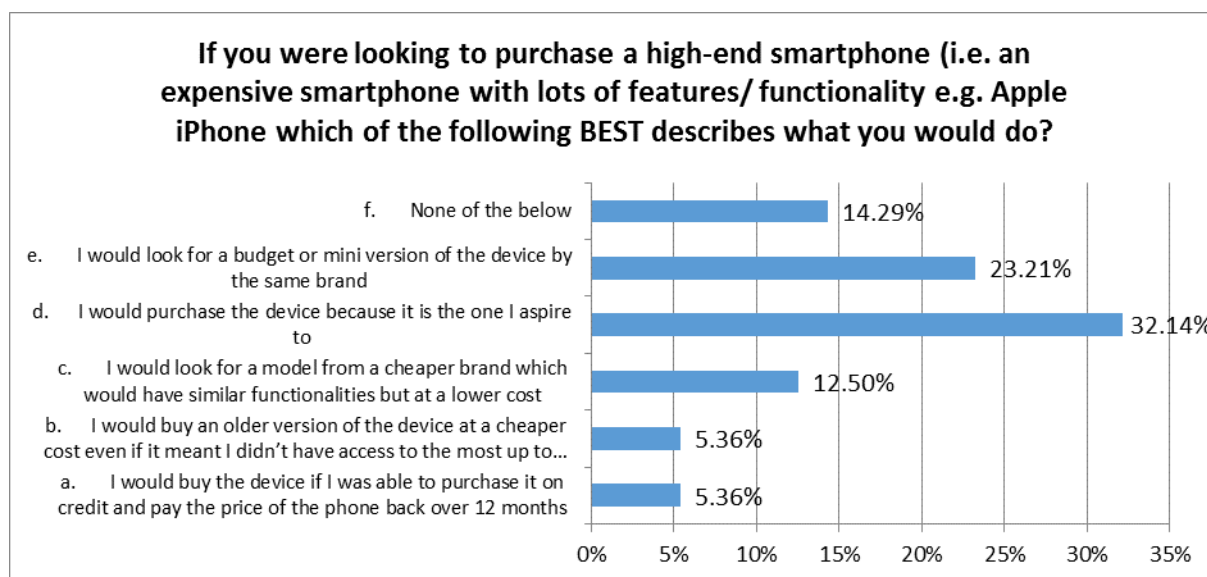
When asked how much money they are willing to pay for a new mobile phone, 56% of the respondents suggested they would pay between US \$ 26 and US \$ 42.





**Figure 29: Willingness to pay for new mobile phone - Colombia**

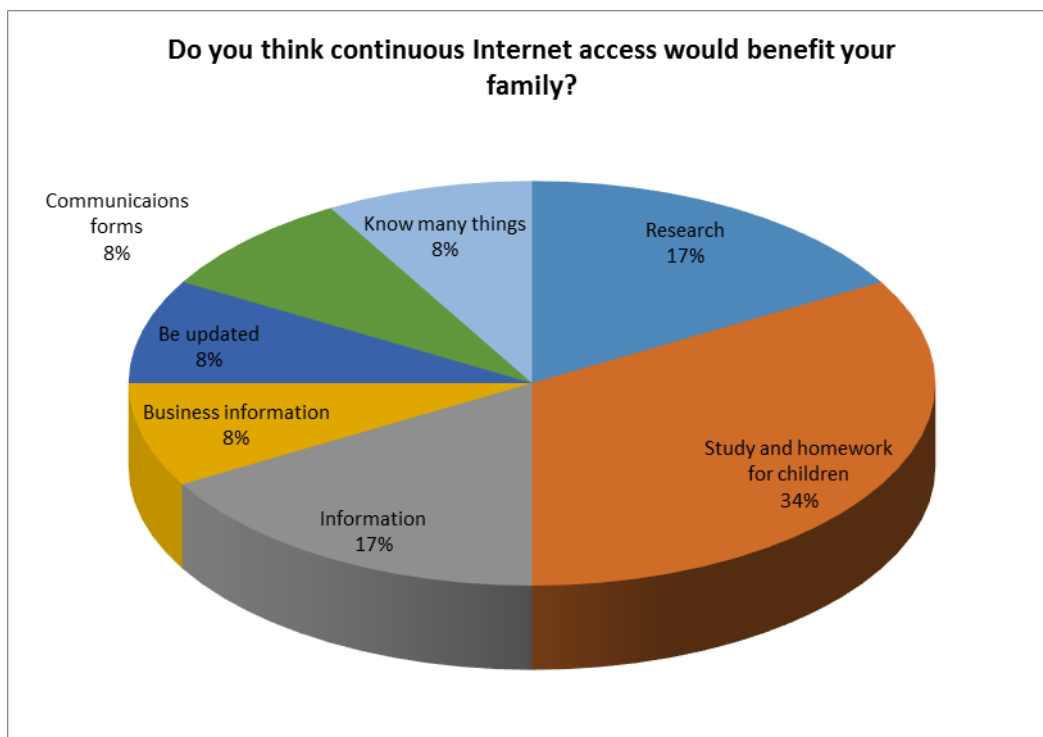
The majority of the respondents claimed that if at some point they would like to purchase a next generation device, the majority would seek for a smaller and more economical device.



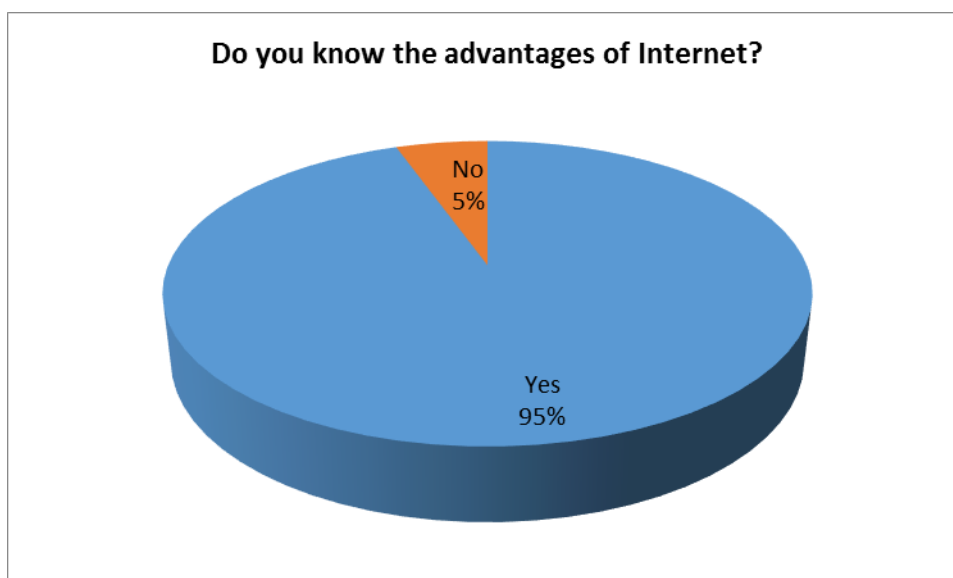
**Figure 30: User preferences on purchasing a smartphone – Colombia**

#### 4.1.1.2.3 Internet access relevance

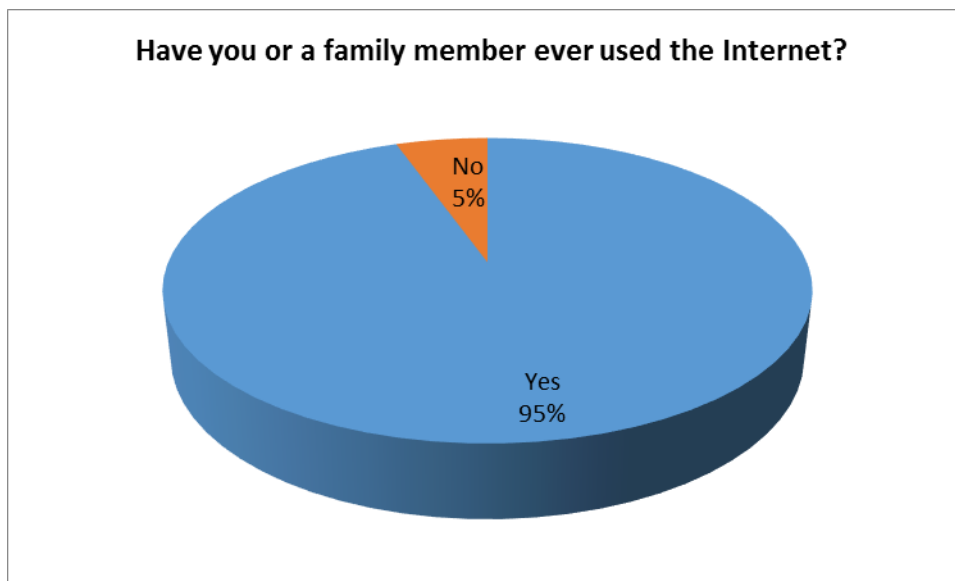
According to the respondents, 80% are aware of the advantages of using the Internet, 81% have used the Internet at least once, while 94% of the respondents recognize that continued internet access would bring benefits to their families. Details about possible benefits the respondents think that they could get with continuous internet access are given in Figure 31.



**Figure 31: Internet Access relevance – Colombia**



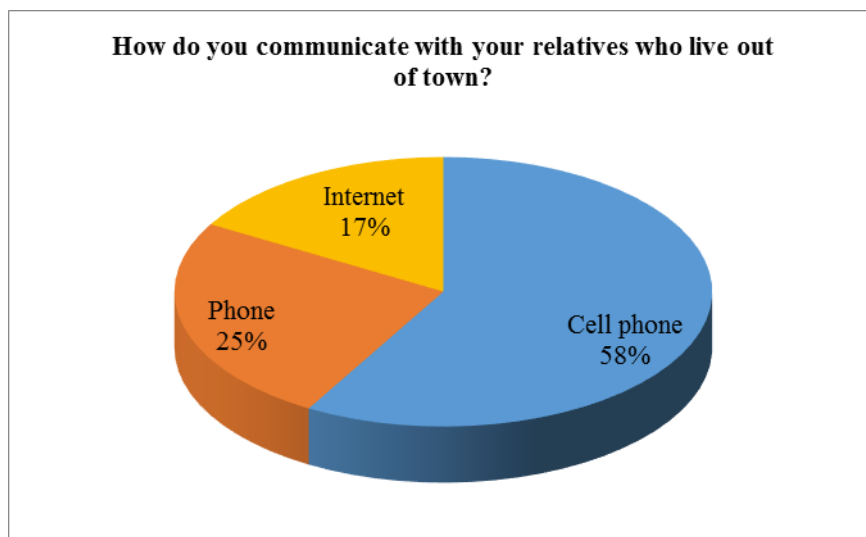
**Figure 32: Awareness of Advantages of the Internet – Colombia**



**Figure 33: Usage of Internet by family members – Colombia**

#### 4.1.1.2.4 Communication needs

Findings suggest that 69% of surveyed population have relatives in other cities or countries and the most commonly used communication device/method with them are mobile phones, while 54% have relatives living in other cities that have internet access.



**Figure 34: Means to communicate with relatives - Colombia**

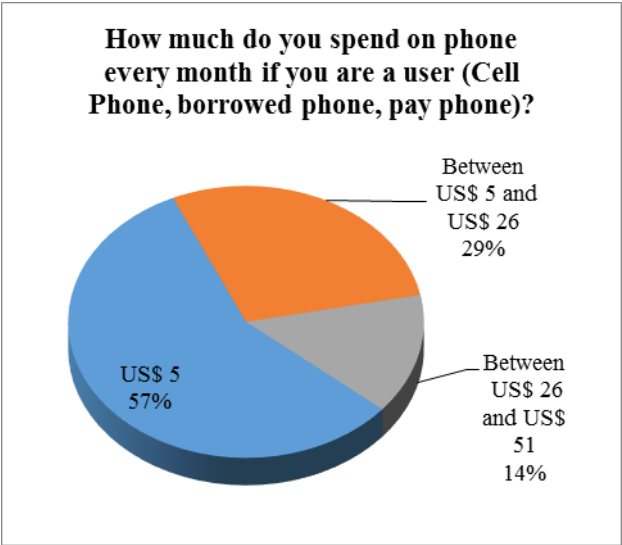
Adding to the above, all the respondents claimed to use television sets or radio receivers in order to get informed regarding national and international news, while critical information needs for work purposes is obtained mainly by the public library. Adding to the above, internet usage for the same purposes is very limited due to limited access.



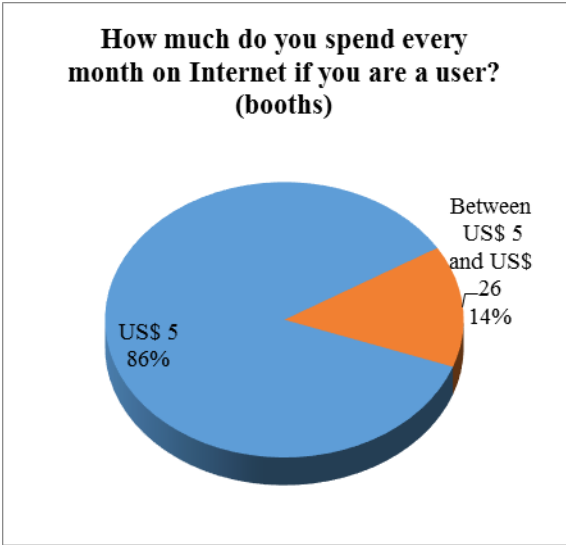
**4.1.1.2.5 Usage – type/duration**

According to the survey results, frequently visited websites are identified as e-mail providers, Google, Facebook, YouTube and Wikipedia. 50% of the respondents claimed to use mobile phones on a daily basis, while 31% use them occasionally and 13% mentioned to use them on a weekly basis. The monthly cost varies between US \$ 5 and US \$ 51. More detailed information can be found in Figure 33.

On the other hand, internet usage trends appear very low according to the survey. 86% of the respondents claim to spend about US \$ 5 per month to access to the internet (Figure 34).

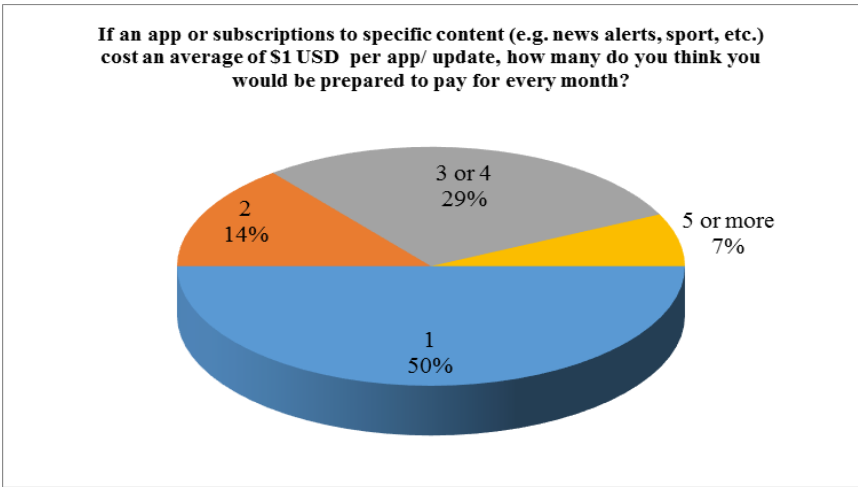


**Figure 35: Distribution of monthly expenses for mobile phone - Colombia**



**Figure 36: Distribution of monthly expenses for internet - Colombia**

In addition, all the respondents consider purchasing at least one application if the cost per application is about US \$ 1. In fact, 75% of the respondents claimed to use (or be willing to use) applications with business/productivity content. More details about user preferences can be found in Table 26.



**Figure 37: Willingness to purchase a new application – monthly payment - Colombia**



Which of the following types of content do you/ would you access to through a mobile phone/smartphone (e.g. via an app, news alerts, website access etc.)?	
a. Business / productivity	75,00%
b. Education	50,00%
c. Entertainment	18,75%
d. Family and kids	12,50%
e. Food and drink	25,00%
f. Games	12,50%
g. Health and fitness	25,00%
h. Lifestyle	12,50%
i. Music	31,25%
j. News	62,50%
k. Photo and Video	18,75%
l. Social networking	31,25%
m. Sports	18,75%
n. Travel	12,50%
o. Political services	25,00%
p. Other (please specify)	0,00%
q. None	0,00%

**Table 28: User preferences on application content for mobile phone - Colombia**

When using services via a mobile phone/ smartphone, which would apply to you?	
a. Buy data bundles when I need to access the service	6,25%
b. Use pre-paid cards for data services	31,25%
c. Use data allowance included in my prepaid contract	12,50%
d. Use a low cost version of the service with limited functionalities	12,50%
e. Use a free, text only version of the service	0,00%
f. Other (please specify)	0,00%
g. None of the above	31,25%

**Table 29: User preferences on service purchases - Colombia**

According to Table 29, 31.25% of the respondents prefer to use pre-paid cards for mobile service purchase.



If respondents had access to these services, preferred payment methods would be:

<b>Please imagine that you had to pay to access content through a mobile phone/ smartphone (e.g. paid-for apps, subscriptions to news alerts etc.). Which of the following methods of payment would you find most convenient to use?</b>	
a. Prepaid payment through the operator	50,00%
b. Post-paid as part of contract	18,75%
c. By using debit card	6,25%
d. By using credit card	0,00%
e. By bank transfer through my bank account	12,50%
f. Secure payment services (e.g. paypal)	0,00%
g. Other (please specify)	0,00%
h. None of the above	12,50%

**Table 30: Payment Method preferences for accessing content - Colombia**

According to the respondents, as presented in the Table 31, the most important reasons for not using mobile phone services are the lack of knowledge about the use of technology and the limited number of access points. Furthermore, frequent network breakdown and cost of services are also mentioned by a significant number of respondents:

<b>What are the main reasons for not using a service</b>	
a. Often Network breakdown	31,25%
b. Distance and transport costs to the points of access	12,50%
c. Billing system	6,25%
d. Lack of electricity	12,50%
e. Fear/ lack of knowledge about the use of technology	37,50%
f. Cost of telecommunication services	31,25%
g. Non- availability of service provision	0,00%
h. Few access points	37,50%
i. Not interested in content / services currently offered	0,00%
j. Other (Not signal)	6,25%

**Table 31: Main reasons for not using the mobile phone service - Colombia**



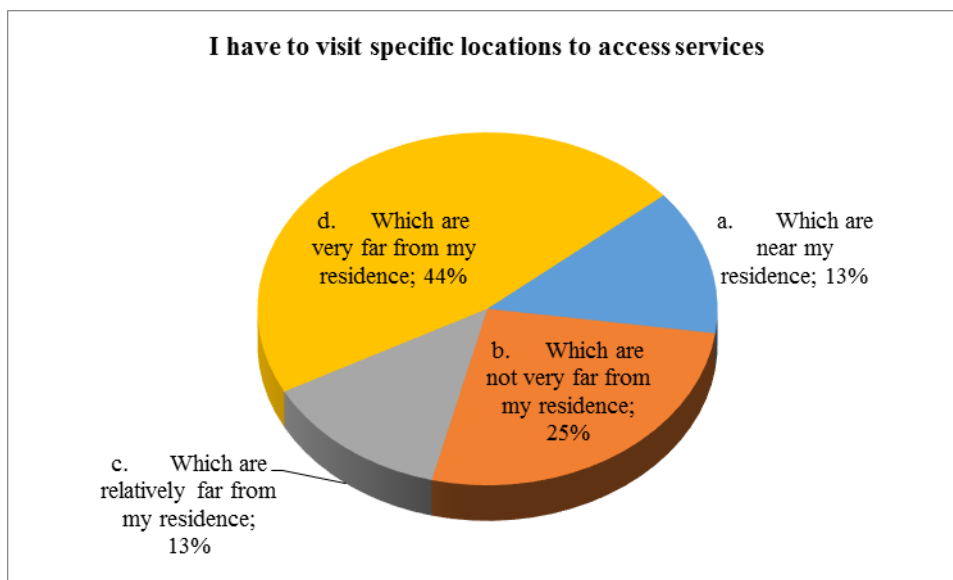
**4.1.1.2.6 Usage – location**

The majority of the respondents believe that Internet access services, regarding their business and personal communication needs, should be offered in a public area with free access.

	Home	Public area / free access	Public area / paid access	While on the go / moving through mobile device
Where do you access internet services from?	18,75 %	25,00 %	56,25 %	0,00%
Where do believe it will be more convenient to access internet services from regarding your personal communication needs?	25,00 %	62,50 %	6,25%	0,00%
Where do believe it will be more convenient to access internet services from regarding your business communication needs?	6,25 %	75,00 %	6,25 %	6,25 %

**Table 32: Internet Access / Location - Colombia**

44% of the respondents claimed that the access points are very far from their residence.

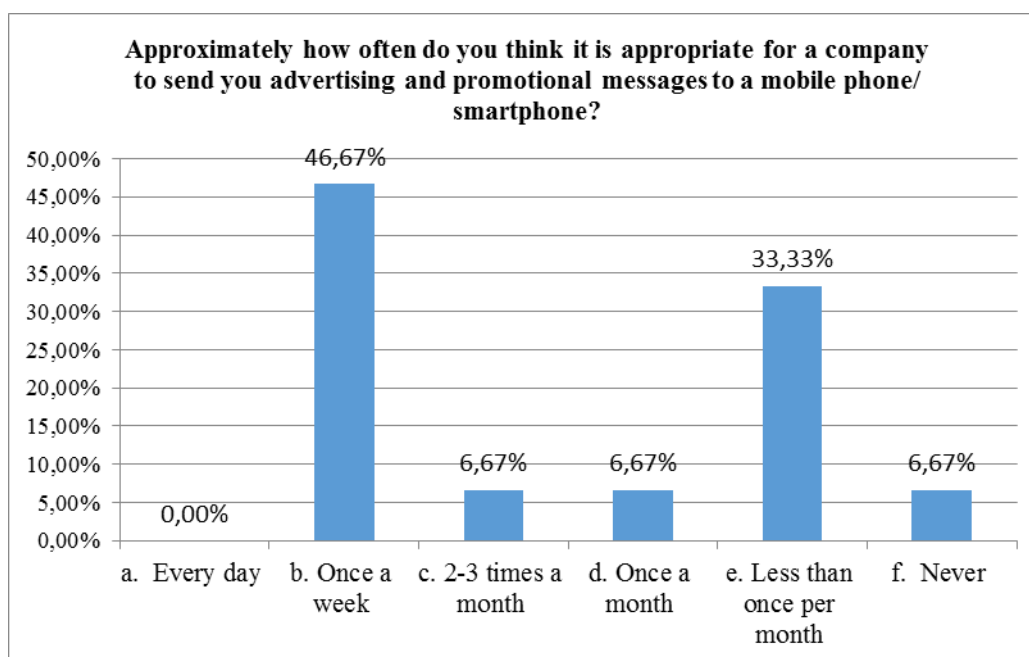


**Figure 38: Distance from residence - Colombia**



**4.1.1.2.7 Mobile advertising**

The majority of the respondents prefer receiving advertising messages to their mobile devices advertisement/promotional messages once a week, at most.



**Figure 39: Frequency for receiving advertising message to mobile phones - Colombia**

60% of users would feel more comfortable receiving promotional messages by text messages.

Which of the following ways would you like to receive promotional messages from companies on a mobile phone/ smartphone?	
a. Automated voice call	13,33%
b. SMS text	60,00%
c. SMS text relevant to my location	26,67%
d. Email	13,33%
e. Banner in mobile app	0,00%
f. Pop-up from mobile app	0,00%
g. SMS when I get confirmation of top-up on a Pay as you go service	13,33%
h. Never want to receive promotional messages	6,67%

**Table 33: Preferences on receiving promotional messages from businesses in mobile phone - Colombia**





20% of the respondents claimed that they would be willing to trust messages from their mobile operator, while 73.33 are not willing to trust any provider of promotional messages, at all.

<b>Which ONE of the following would you trust MOST likely if they sent you promotional messages to a mobile phone/smartphone offering you new services/content?</b>	
a. Mobile operator	20,00%
b. Well known consumer brand (e.g Coca Cola)	6,67%
c. Media (e.g. newspaper)	0,00%
d. Third party service provider (e.g. Group-on)	0,00%
e. None	73,33%

**Table 34: Will to trust advertising message senders - Colombia**

**4.1.1.2.8 Key findings**

- Respondents are mostly farmers, the majority of which fall in the 40 to 68 age range and an average of 6 people per family, with ages from one to 56 years old.
- Their income varies (monthly, weekly) with an annual average of US \$ 1,781.
- Access to basic services such as electricity, water and sewage is limited (63% have no access to them).
- Most of the households have a simple mobile phone and they would be willing to pay between US \$ 26 and US \$ 42 to buy a new one. In addition, they would prefer to buy an economy brand model.
- The majority of the respondents recognize the advantages of using the Internet and they believe that the continuous internet access could benefit their families, since, for example, they could better communicate with their relatives in other localities, with whom currently they communicate mostly by cell phones.
- The preferred means to keep up with the news are television and radio. When they need information for business and educative purposes, they mainly obtain it from libraries. A very small percentage of the respondents claimed to use internet for the same case.
- The frequency of mobile phone use is high and mostly daily based. The monthly cost of phone calls ranges between US \$ 5 and US \$ 51.
- The frequency of Internet use is low and the monthly cost of this service ranges between US \$ 5 and US \$ 26.
- The respondents would consider purchasing at least one application if the cost per application is about US \$ 1. The preferred content would be business, news and education, while they would prefer to pay for it through prepaid cards.
- The main reasons for the low use of the Internet are lack of knowledge about the use of technology, the limited number of access points, which are mostly far away from their residence, the instability of the network due to breakdowns and high costs.
- Most of the respondents believe that the access points for internet services should be in a public area and free of charge for both business and personal purposes.
- The majority of the respondents claimed their preference on receiving advertising and promotional messages once a week, at most, by text messages, however they do not find any sender of promotional messages trustworthy.



## 4.1.2 Business Users

As mentioned in previous sections, data collected from business users comes from a variety of locations covering both Peruvian and Colombian areas. In total, 8 business users participated in the survey, out of which 5 are coming from Peru and 3 are coming from Colombia. Participants are mainly operating in the restaurant and transportation business, while some of them are operating in the field of handcrafting and tourism. Below you may find detailed information regarding the procedure of collecting data from these users.

### 4.1.2.1 Peru

#### 4.1.2.1.1 Users profile

Regarding Business Users in Peru, 5 small businesses were interviewed, all of them located in Santa Clotilde, a municipality sitting on the Napo River in Northeastern Peru. At this point, it is worth mentioning that all interviews were carried out through telephone.

Nº	Name of the Company	Business Activity
1	La llegada del forastero	Restaurant
2	Rápido Río Napo	River transportation company
3	Manuel Grandez	Carpentry workshop
4	Fenit Congunche	Store that sales prepaid cellphone credit
5	Princesa 1	Motel

**Table 35: Business Users in Santa Clotilde, Peru**

All five business users interviewed represent a sufficient selection sample, both of the business activity which takes place in the area and the overall population of small businesses acting in an area which is inhabited by 13 river communities.

#### 4.1.2.1.2 Key findings

- All users indicated that they do not have access to internet, as the only place for accessing internet was a public booth which doesn't exist anymore.
- 80% of business users believe that promoting their business through internet would increase their income.
- Business users believe that use of TUCAN3G services will allow them to better communicate with their customers. Especially the business users operating in tourism can improve their business with online services such as booking, billing and customer relations.
- All business users are willing to buy new devices which enable access to internet services, as well as, pay a fee for internet services. Most of them (60%) would prefer a prepaid payment than a postpaid contract service.
- The majority of the business users would utilize TUCAN3G services to communicate with their customers via emails, calls and social networks. They also believe that productivity tools will be useful for them.
- Business users believe that the provided service has to be reliable and stable despite the weather or other conditions.



- Users are willing to pay up to US \$ 35 per month for internet and voice business services, which will be used by them and their employees or assistants. In order to utilize the services they are willing to invest in relevant infrastructure, which will allow them to expand their business to new operations.

#### 4.1.2.2 Colombia

##### 4.1.2.2.1 Users profile

Regarding Business Users in Colombia, 3 small businesses were interviewed, all of them located in Coconuco.

N°	Name of the Company	Business Activity
1	Chiliglo Fish farming Station	Fish farming
2	Coconuco – Comfandi Inn	Motel
3	Transporte Transtimbio	People’s Transportation

**Table 36: Business Users in Coconuco, Colombia**

At this point, it is worth mentioning that the main business activity in the area is agriculture - the main crops are corn, cabbage and beans -, which narrowed down the sample for conducting the interviews.

##### 4.1.2.2.2 Key findings

- Transtimbio: Currently, the company does not use any internet service for communicating either with their customers or with the central office in Popayán. They mentioned they are willing to use internet services, as this would allow them to improve their services/business. In addition, they believe that the internet service should be accessed through a fixed fee and data plan.
- Coconuco – Comfandi Inn: The company uses internet only to handle institutional mail, however they do not handle online bookings or offer WiFi services to their guests. For them, the improvement of the internet service would be of great importance, since they welcome a lot of tourists who want to use the service to stay connected.
- Chiliglo Fishfarming Station: The fishfarming station offers also its facilities for touristic purposes. They are considering investing on an internet service subscription and appropriate infrastructure, in order to offer WiFi services to their visitors.

In general, all respondents are familiar with the benefits that internet access can offer, but they do not have the financial capacity to acquire an appropriate device for connecting to the network.

#### 4.1.3 Institutional Users

Data collected from institutional comes from both Peruvian and Colombian actors. In total, 18 institutional users participated in the survey, out of which 16 are coming from Peru and 2 are coming from Colombia. All institutional users come from areas such as schools, police stations, health centres and community centres.



#### *4.1.3.1 Peru*

During the conducted interviews with the local staff from both the health and educational centres, the respondents stated that the people will benefit indirectly from the better means of communication and access to voice and data to be provided by TUCAN3G.

Among the surveyed localities given in Table 12, only Santa Clotilde has internet service available in the school and the health centre. The service is free of charge for the students, but it is working also as a public booth, administrated by the teacher with an hour-based charge (US \$ 0.70). The funds raised are used to cover the maintenance costs, such spare computers' parts and electricity provided by a generator. Moreover, local people state that there is an urgent need for unrestricted electricity availability in order to maintain daily active internet services, as a sufficient number of people use or are willing to use internet services. The majority of the population, particularly younger ones, already have mobile devices. In addition, a number of professionals from various public and private institutions have smartphones.

##### *4.1.3.1.1 Key findings*

- Although, operators are discouraged from investing in better technology infrastructure (3G), the use of 3G equipment is growing in Peru, as it is favoured by the market entry of low-end Smartphone used by young people.
- The development of 3G technology will allow people to communicate better with family members, have access to labour and market information and individuals may transact quickly.
- The staff of health and education centres interviewed believes that local population would be indirectly benefited from TUCAN3G services, by the improvement of the quality of services offered.
- Without a doubt, the services provided by TUCAN3G, will improve the management of educational institutions. However, TUCAN3G services contribution by the pedagogical side would be minimal, since it is not considered as a priority for improving the quality of teaching.

#### *4.1.3.2 Colombia*

Regarding the Colombian part of institutional users, two main users were contacted: the National Police and the Health Centre.

- **National Police of Colombia – Coconuco Police Station:** During the interview with the institution, it was identified that internet is currently used mainly for institutional e-mails. They consider that the party responsible for the investment in improving the telecommunications must be the operators not the users or the institutions. On the other hand, their expectation is having applications with business, news, educational content, while they believe that improving the quality of service should be the main priority.
- **Coconuco Health Centre:** In this institution, internet is used to manage the clinical history of the local patients, as well as the clinical history of the patients transferred from other institutions to this centre. Health Centre's representative also admitted that there is big



difference on the service quality between Coconuco and Popoyan with respect to the velocity of the service.

#### *4.1.3.2.1 Key findings*

- **The national police** stated that the internet is used mainly for institutional e-mails. They mentioned that the improvement of the quality of the service is necessary and that the operators should be responsible for it.
- **The health centre** also suggested the improvement of the quality of the service. In the institution interviewed the internet was used for the management of the clinical histories of local patients and those of patients transferred from other institutions to that centre.

## **4.2 SUPPLY SIDE**

Data coming from the supply side is related to public sector stakeholders, mobile network operators and equipment manufacturers coming mainly from Peru or from outside South America. These actors and stakeholder will present us the overall picture of challenges, boundaries and opportunities related to the examined area and how these will affect the services developed throughout TUCAN3G project.

### **4.2.1 Public Sector Stakeholders**

Officials responsible for the telecommunications sector in rural areas (related to the use and development of policies in the field of telecommunications) and officials responsible for sectors with a presence in isolated rural areas were interviewed in Peru in order to collect all relevant data.

#### *4.2.1.1 User Profiles*

Two main groups of public sector stakeholders were identified:

- a) Public sector stakeholders responsible for the telecommunications sector in rural areas (related to the use and development of policies in the field of telecommunications) and
- b) Public sector stakeholders responsible for sectors with a presence in remote rural areas:

The interviews were conducted between July 18th and 28th October, 2013, with the following officials:

- **Representative of the Telecommunications Investment Fund (FITEL).**
- **Representative of the Supervisory Agency for Private Investment in Telecommunications (OSIPTEL).**
- **Representative of the Ministry of Education.**
- **Representative of the Agency for the Promotion of Private Investment (PROINVERSIÓN).**

#### *4.2.1.2 Analysis of results*

- a) Officials responsible for the telecommunications sector in rural areas (related to the use and development of policies in the field of telecommunications):

- i. **Representative of the Telecommunications Investment Fund (FITEL).**

The interview took place on October 18th, 2013, with Mr. Luis Andrés Montes Bazalar, Technical Secretary of FITEL. He mentioned that FITEL has not developed any project similar to TUCAN3G yet, however some telecommunications projects are already implemented in



remote rural areas using satellite technology through VSAT remote stations. They argue that increased social benefits occur through the population's greater access to internet services such as telemedicine, web banking and others. Also in terms of business activity, they argue that better internet access will provide an important boost to the local and national economy.

The main limitations of the access to telecommunications services of the rural population are three:

- **The distance:** Subject rural localities are at great distance (at least 400 km) from urban areas which makes the logistical support very hard.
- **The geography:** Subject localities are very difficult to access, mainly due to the presence of the Andes mountain range.
- **Poverty:** The poverty level in the subject region is very high and this is one of the main factors that private operators are not involved to projects development. The poverty level is reflected in the low payment capacity with potential rural users. The average monthly expenditure capacity hovers around US \$ 7.

The use of 3G device equipment is growing in Peru, something which is favoured by the market entry of low-end Smartphone. It is noted that smartphone users are usually between 12 and 35 years old, while older people show little or none interest at using cutting edge technologies and/or smartphones. However, this problem is expected to be diluted in the next three years with aggressive campaigns organization and information technology education.

ii. **Representative of the Supervisory Agency for Private Investment in Telecommunications (OSIPTEL).**

The interview took place on October 25th, 2013, with Mr. Gonzalo Martin Ruiz Diaz, President of OSIPTEL.

The main telecom companies in Peru are: Telefonica Moviles S.A. (Movistar), America Movil Peru S.A.C. (Claro), Nextel del Peru S.A. and Viettel Peru S.A.C. However, only some of these companies have a specific interest on development projects of rural areas such as Movistar, Claro and Gilat to Home Peru S.A. (Gilat).

Telecommunications projects are funded mainly by the Telecommunications Investment Fund (FITEL). In addition, local governments are also developing projects, while, also, an additional funding mechanism exists, the "Fund for Rural Economic Inclusion (FONIE)". In terms of regulation of telecommunications services, OSIPTEL is responsible on supervising about all kind of regulations, however in the case of projects FITEL has the overall overview during the development period. Upon the end of the development period, services are regulated by OSIPTEL.

Another important point is the low quality of the telecommunication services in rural areas, due to the use of satellite technology. They argue that TUCAN3G services will allow users to benefit from the technology with faster and timely connectivity to the information and communication for both individual and institutional levels. On the other hand, the cost of high end smartphones is quite high, especially considering the poverty of the region. Thus, private companies should develop strategies of offering low prices and means to promote the usage,





giving emphasis to individuals located in rural areas. Another important point is the lack of 3G infrastructure in the region. The problem got worse when the local authorities prevented the implementation of antennas and when the population disapproved the installation of infrastructure.

As part of its mission, OSIPTEL gives regular visits to rural localities in order to verify the quality of the telecommunication services offered by various operators, including public telephone services. This monitoring is periodic and takes place in the 24 regions of Peru. Because most of the rural population are not familiar with their user rights and the regulatory bodies, OSIPTEL is trying to increase the awareness of the population in these matters.

**iii. Representative of the Ministry of Education.**

The interview took place on October 28th, 2013, with Mr. Sandro Luis Marcone Flores, CEO of Educational Technology department of the Ministry of Education.

From the beginning of the interview, the significant gap about internet usage in the educational policies was evident. Although there is no opposition against the internet connection from any school - on the contrary the realization of the service is much awaited by teachers and students - internet access is provided currently provided in 6,000 schools. The ministry manages two contracts with PROINVERSION-VIETTEL and with MOVISTAR to be able to reach 20,000 new connections by 2020. However, despite the expectation of connectivity by 2020, a large gap still exists as schools are more than 70,000 schools nationwide.

They highlighted that almost 95% of the schools have computers, where the rate is very close to 100% in rural areas. More specifically, in primary schools there is one computer for every six students, while in secondary schools there is one computer for every seven students. However, the limitations in the accessibility are not due to the lack of computers/equipments but due to the restrictions of electricity. The Energy and Mines Ministries are already working on a plan to grant photovoltaic cells, a solution which is expected to serve about 15,000 localities.

As for the technology used for distributing internet access in schools in rural areas, it is offered mainly through satellite technology (VSAT), operating at top speeds of 512 kbps shared downlink. Comparing with the urban areas, where internet connectivity is offered through land lines and wireless lines operating at the speeds of 2MB to 4MB, connection in rural areas is poor.

**iv. Representative of the Agency for the Promotion of Private Investment (PROINVERSIÓN).**

The interview took place on October 28th, 2013, with Mr. Jesus Guillen Marroquin, Project Manager at Telecom Topics in PROINVERSIÓN.

The most important point mentioned during the interview is that operators are discouraged from investing in better technology infrastructure (eg. 3G) due to the size of rural market and small amount of revenues. However, due to the global trend of replacing 2G by 3G, operators are challenged to do so. On the other hand, he mentioned that PROINVERSION's participation in the development of telecommunications projects, is mainly in the stages of auction and



allocation of radio spectrum bands (which just allows telecommunications operators providing services 2G, 3G and 4G). He also highlighted that there is no major difference between rural and urban users in terms of user demands, since both types of users are willing to pay for improved services. However, in the case of rural areas, users often complain about the quality and reach of internet services and not about the cost. Taking into account the above, 3G might be the ideal technology for overcoming existing obstacles and barriers.

The development of 3G technology will allow rural population to communicate better with their family members and to have an access to labor and market information. Also, public institutions such as schools and health centers can improve their services due to an improvement in communication and access to information. Last but not least, a great challenge exists on the tourism sector as a large number of tourists visit the area but cannot access the internet through their mobile devices since 3G is not available in the region.

**b) Officials responsible for sectors with a presence in remote rural areas:**

Through the survey, two main issues came up to the surface:

- i. The first is the lack of continuous power as in the case in Santa Clotilde locality, where a diesel generator works for only one hour in the morning (5:00 to 6:00 hours) and five hours at night (18:00 to 23:00 hours). At this point, it is worth mentioning that Santa Clotilde is the capital of the district, which means that other localities in the region have either no electricity at all or more limited access than Santa Clotilde.
- ii. The second is the poor quality level of the existing telecommunication services. Some localities have mobile phone coverage, but the signal is inadequate. The only operator in these localities is Movistar.

**4.2.1.3 Key findings**

- FITEL mentioned that they believe that TUCAN3G can be the way to reduce social gaps and pointed out several social benefits such as greater access to data services and applications to use certain services of interest, telemedicine, telebanking and all sorts of social networks as well as it would be a good improvement for tourism related services.
- In terms of regulation of telecommunications services, OSIPTEL is responsible for all types of regulations. However, in the case of projects funded by FITEL, they are controlled by FITEL during the development phase, until the end of the project contract. After this period, OSIPTEL gets the control about the regulations.
- According to the Ministry of Education, the Internet is a much awaited service by the population of students and teachers. 20,000 schools are about to have the Internet service by 2020 as part of a project, but there is still a big gap to be filled, since there are currently 70,000 schools nationwide.
- In the case of public institutions such as schools, health centres and police stations, the access barrier and low connectivity is the bigger problem.
- Telecommunication services in rural areas are still of low quality, due to the use of satellite technology. The distance from the urban areas, the lack of electricity, the challenging





geographical conditions and the high poverty level are also some limitations that were mentioned.

- Another important problem of digital illiteracy of adult people. However it is expected to overcome to this problem in the next three years with aggressive campaigns to promote the usage of technology.

## 4.2.2 Mobile Network Operators

Regarding Mobile Network Operators, *Telefónica del Perú (TdP)* and *América Móvil Perú (CLARO)* agreed to take part in our survey. Main findings are presented below in detail, with the key concepts highlighted.

### 4.2.2.1 Operators' strategy on rural areas

- *Opportunities and challenges of expansion to rural areas.*
- *Criteria for expansion to rural areas.*
- *Modifications on operations and business model for expansion to rural areas.*
- *Investment rates in rural and urban areas.*
- *Main competitors in rural areas.*

- Interviewed operators agree that expansion to rural areas hide **an important opportunity to create new markets** due to several reasons. There is a high demand which has been ignored up to now (considering that total population in Peru is 30 million people, there are still about 10 million people without phone service). On the other hand, reduction of poverty level is as well an important reason to expand to rural areas. Besides, the state is interested in supporting the operators by sharing the investment costs.
- Regarding the challenges, **geographical characteristics of rural areas and high dispersion of population** are pointed out as the main ones. Thus, any possible implementation has to offer huge technical complexity, which creates an unsustainable business model, to be able to provide required service level. Intervention of the State is needed to provide the service, and this is usually difficult. Also, **regulations** and inapplicable in the conditions of the region. Furthermore, there are limitations to provide a full service with sales channels and customer support.
- The limited number of previous experiences in rural areas makes difficult to estimate the potential market demand. In this sense, projects financed by FITEC are helping to better understand the rural area dynamics and, in most of cases, to confirm that demand predictions are often exceeded. On the other hand, valuation of a potential business is conditioned by particular characteristics, depending on the **isolation level and economical activities** of the region. However, operators agree that there are rural locations with an emergent commercial dynamic resulting from agricultural activities that suppose a positive example of potential market.
- The main criteria for operators to start operations in rural areas are:
  - The first and most important of all is the existence of a stable 24 hours **power supply**. In this sense, photovoltaic cell implementation is pointed out as an alternative for isolated



areas. However, these systems are expensive (batteries must be replaced every 4 or 5 years) and solar panels are often stolen for resale. The investment required to provide solar energy to a region is sustainable only if the population is large enough and the safety of the system is guaranteed by the community or any other actor.

- The second main criterion is the **access roads** in regions with extreme geographical conditions. This is important to maintain the network.
- Another important aspect is the **minimum volume of demand**: According to operators, the acceptable value is at least 400 people for voice service.
- Other factors that are taken into account are: the poverty level in the region must be under 60% for services that are not subsidised and must be sustainable; the locality must be in a transit route; economic development of the region; existence of other operators providing the same service in the region (volume of demand is not large enough to create competition); and the state support for network sustainability.
- Operators point out that the main modification in operation and business model needed for expansion to rural areas is the creation of an efficient infrastructure in order to reduce complexity and costs. However, the modifications that were considered as most important by operators are not related to their own operational model or technical issues, but to external factors that are typical of rural market: geographical characteristics, lack of power supply and safety, or strictness of regulations. These are the key aspects that **discourage the expansion to these markets**.
- Operators' investment rate in rural areas is typically about 10% - 20% of total investment (total investment of CLARO in 2012: US \$ 300 million; Tdp: US \$ 530 million).
- The main competitors in rural areas are CLARO, TdP and GILAT. GILAT provides land phone based on satellite networks. Its model consists in installing a land phone in a private house, company or public institution, so the owner of the land phone is responsible for charging the users of the service.
- Regarding the rates applied in rural areas, the price per minute for calls is usually fixed by telephone operators. As a reference value, the price for calls with source or destination in rural land phone is about US \$ 0.7 per minute.



#### 4.2.2.2 Concerns of the operator for expansion to rural areas.

- *Technical barriers*
- *Economic barriers*
- *Government role in reduction of digital divide.*
- *Legal framework.*
- *Level of investment*

- The main technical barriers are again the **geographical characteristics of isolated areas**, the **low concentration of population** and the **lack of power supply and access roads** to reach many localities. In the same way, operators point out the **lack of safety** for infrastructure maintenance and the existence of technical solutions that are suitable for rural context but that don't meet the **quality standards** required.
- Regarding the economic barriers, the main one is the high dispersion of the demand. Besides, the poverty level in some places reaches the 50%, which represents a clear economical barrier. However, operators agree that **the main barriers are technical and regulatory**, since there is a formal economical support through FITEC.
- There is a common agreement stating that the government should **promote a proactive policy for the development of telecommunications in rural areas** and **increase the financial support**. Operators claim incentives to operate in these areas, like tax exemptions, reduction of costs for the use of spectrum, flexibility with fines, etc., in order to compensate for the high cost and risk of the deployment. They also claim for a reduction of the quality and service availability standards, which are not reasonable in rural conditions.
- **Legal framework is considered as one of the main barriers for expansion to rural areas.** A more flexible regulation is needed that will identify and accept the reality in isolated rural areas and will understand the point of view of the operator. Operators claim for a **different regulation for these areas** that doesn't lead to such hard penalties in case, for example, of interruption on the service due to a breakdown (even though it is not possible to reach some locations within 24 hours, the regulation requires that breakdowns must be fixed in a period of time that is independent of the geographical location). So the high investment required due to technical complexity, together with the risk of penalties, discourage the operators from entering these markets. An asymmetric regulation that takes into account the distinctive features of rural areas will encourage operators and will increase the coverage in these areas, even though it is not possible to provide the same quality as in urban areas.
- Regarding the role of the Telecommunications Investment Found (FITEC), operators agree that **FITEC must have a prevailing role in expanding coverage to rural areas**, although, currently, this support is very conditioned to the strict legal framework. It is necessary to reinforce and to strengthen its work trying to reach smaller and less dense populated towns than those raised so far. Also, since FITEC is an organism that depends on the Government, operators ask FITEC to promote the development of more flexible regulatory models adapted to rural contexts.
- From the point of view of the operators, a high capital investment is required to enter the rural market due to the high geographical complexity of the country. The required economical effort will vary, depending on each particular case and the obtained economical support, but



costs of infrastructure deployment could become 5 times higher than those generated in urban areas (besides, in urban areas there are more possibilities to recover, so risks in rural areas are really higher).

#### 4.2.2.3 Attitude towards TUCAN3G project

- *Advantages resulting of TUCAN3G project.*
- *TUCAN3G backhauling: exclusive access or sharing with other operators.*
- *Advantages of using 3G femtocells compared with other technologies.*
- *Potential suppliers.*
- *Price of the service: valuation of differentiated rates by area and clients.*

- In general terms, TUCAN3G project is **interesting** for operators because it looks for a more suitable technology adapted to rural context. TUCAN3G also tries to reduce costs, so it becomes an attractive opportunity for operators. However, there is some **scepticism** about its real deployment due to the existing **regulatory barriers**. Besides, operators are not sure if the proposed solution can achieve good service availability with the existing **quality** standards.
- There are different points of view about the fact of sharing the network backhauling. In one side, operators will accept it as long as the initial investment is also shared or made by a third party. They also point out that sharing the backhauling will increase the network complexity. When the market volume is high, sharing the backhauling seems to be clearly justified; but in the case of rural areas, the market volume is so low that it would be more efficient to compete for areas (each operator in a different area) instead of sharing the area.
- In general, there are not well-known advantages of using 3G femtocells and heterogeneous backhauling. Operators are quite **cautious** about that because it seems to be a limited solution due to the high dispersion of the population. Besides, they point out that infrastructure is the most expensive part of the network, thus, it is expected not to be such a significant economical advantage, from their point of view.
- Operators are familiar with the type of equipments used in TUCAN3G (Femtocells) and they've already known several suppliers like Huawei, Ericsson, Alcatel.
- Regarding the **price of service**, different rates are currently applied in specially isolated areas. Operators agree to set different rates, but sometimes it would be better to use promotions to stimulate the demand instead of subsidies because different rates could create wrong perception to the client. In relation to different kinds of users – particular users versus companies/institutions – the use of different rates is not considered because the main criterion to establish the service price is the traffic. Anyway, improvement of rates is always considered in these areas, but it will depend on the relation between the efforts assumed by the operator, the cost assumed by the client and the support provided by the government.



#### 4.2.2.4 Key findings

- Operators believe that expansion to rural areas is supposed to be an important opportunity to create new markets. The main reasons are that it is an ignored demand and the reduction of poverty level.
- The main barriers pointed out are the geographical characteristics of rural areas, the high dispersion of population, the poverty level, the lack of power supply, access roads, safety as well as the strictness of regulations.
- The main criteria for operators to start operation in rural areas are the existence of a stable 24 hours power supply, the access roads in regions with extreme geographical conditions, compliance with the minimum volume of demand (at least 400 people for voice services), an acceptable poverty level and sufficient economical development of the region.
- Operators believe that the government should promote a proactive policy for the development of telecommunications in rural areas, increase the financial supports and create incentives to operate in these areas.
- They claim for a different regulation for these areas that takes into account the distinctive features of rural areas and that doesn't lead to such hard penalties.
- The high capital investment required to enter the rural market due to technical complexity, together with the risk of penalties, discourage the operators from entering these markets.
- TUCAN3G project seems interesting for the operators because it looks for a more suitable technology adapted to rural context and tries to reduce costs, but they are chary about its real deployment due to the existing regulatory barriers.
- About sharing the network backhauling, the operators will accept it as long as the initial investment is also shared or made by a third party, but they mention that this will increase the network complexity.
- Operators propose it would be more efficient to compete for areas (each operator in a different area) instead of sharing the area.
- Regarding the price of service, different rates are currently applied, especially in isolated areas. They feel that it would be better to use promotions to stimulate the demand instead of subsidies.

#### 4.2.3 Equipment Manufacturers

Equipment manufacturers are critical for the overall success of the project. For the scope of TUCAN3G, a number of worldwide manufactures have been selected to participate in our survey. These manufactures cover the whole range of equipment needed for the distribution of services to be developed within TUCAN3G activities. The manufacturers selected for interview were SiRRAN Communications Ltd, Altobridge, Sistelnetworks, iDirect and ip.access.

##### 4.2.3.1 Supplier Forces

- *Population of Suppliers*
- *Importance of volume to the manufacturers*
- *Specific features in the radio or chipset hardware or firmware needed to address the rural marketplace*
- *Ways of differentiating your products from the competition*
- *Key thresholds in output transmit power or power supply level that are important and impact the product specification (e.g. standard types of power supply) which can cause a step change in product requirements?*



- The interviewed manufacturers agree that there are several suppliers of 3G femtocells, however they agree that not all solutions have been developed specifically for rural areas and also if we consider satellite backhaul, just a few manufacturers can meet these characteristics. In the existing market about 9 providers have BTS optimized for satellite (IP Access, Alcatel-Lucent, Cisco, Argela, Contela, Altobridge, Vanu, VNL and Lemko), and also there are several systems integrators (Triagnosys, Sirran, Public Wireless, etc.)
- Manufacturers agree to indicate that the volume means efficiency in price. Small cells are meant to be relatively cheap; consequently significant volume is needed to offset fixed costs including development, trials, certifications, integrations, etc. The volume depends on the number of locations required to be covered in a given region and the deployed infrastructure (TIER I, TIER II and TIER III) model. The minimum required amount may vary between 50 and 500 units depending on the provider. For very small number of sites, it may not be economically possible to build dedicated hubs etc, but it is often feasible to find an existing facility and operate a shared network or a virtual network.
- The interviewed manufacturers indicate that small cells have to work in tougher conditions than Local Area base stations. In isolated rural areas, maintenance plays an important role in the design of the network, thus hardware and firmware must comply with features that allow them to operate in critical environmental conditions and preferably have self-organizing network (SON) capacities. Accordingly, additional issues should be considered to make the backhaul bandwidth more efficient, such as:
  - Low bandwidth calls (efficiency of backhaul)
  - Local off-loading data
  - QoS KPIs that assure voice and data quality where backhaul bandwidth is low
  - Local call switching.
  - Satellite backhaul.
  - Balanced RF power and coverage for small localities
  - Low power consumption
  - Outdoor hardware
- Manufacturers agree that in order to differentiate their products they should develop features that make them more competitive against other similar alternatives.
  - Features that enable low consumption of bandwidth for voice signalling and data call.
  - Low power consumption
  - Low maintenance costs
  - Automatic configuration and remote management functions
  - Reliable outdoor hardware
  - Address a specific market and differentiate their products with better technical parameters.
- In rural areas, the solution depends on the characteristics of the localities to be covered. However, generally, the low power consumption should be considered in order to set the transmission power in minimum necessary limits to meet the needs of budget and coverage. Beyond 1W of output power level, additional techniques in power amplification are required. One of the manufacturers recommended a 24 volt power supply which better suits the needs of photovoltaic energy. For the satellite network compatibility, the availability of highly efficient modems and BUCs are the keys in an off-grid environment.





#### 4.2.3.2 Barriers to entry

- *Absolute cost advantages of a small cell solution for rural coverage over the alternatives*
- *Governmental or regulatory policy pressure that assists or inhibits entry for manufacturers to the rural cellular markets in any countries*
- *Economies of scale that will reduce barriers to entry and potentially increase profitability – e.g.*
  - *Can the same product be sold across a number of operator markets*
  - *Is there any possibility for a framework supply agreement to be signed with operator unions that requires a common product specification and commonality in operator or regulatory approval, thus reducing the cost of sale as well as increasing volume*
  - *Are there sufficiently common requirements between operators that allow for one or more products in the mix to be widely applicable*
- *Existing incumbents in the market that make economies of scale hard to achieve?*
- *High capital requirements to enter the rural market? – e.g. investment in new product design, type approval costs, homologation costs for countries with small volume*
- *Sufficient backhaul capacity in the target regions available to make supplying 3G viable*
- *Power sources for a cell (e.g. solar) sufficiently available at the right power and charge levels to be able to power a small cell*

- Manufacturers agree that the use of small cells is optimal in rural scenarios against the traditional macrocells developments because small cells minimize installation, energy and maintenance costs. Unlike current macro cells, small cells (e.g. using the 3GPP Iuh specification) are intended to work with a lower cost imperfect IP backhaul, and can be situated closer to where local coverage is needed, reducing total overall cost of ownership. However, supporting satellite backhaul is more expensive than fiber or microwave which are not available in some circumstances like in extremely isolated locations.
- Manufacturers agree that they are not aware of policies that inhibit entry to the rural cellular market. Some operators are aware of policies that encourage operators to improve rural coverage and data rates.
- - Manufacturers agree that their products are framed on standards that can be used by different operators. For small cells, the limitation is the frequency band in each country while for satellite backhaul it can be also across different applications
  - Manufacturers agree that a contract framework is possible, feasible and desirable to streamline processes and minimize costs.
  - Manufacturers agree that requirements are common among operators of various countries, especially in 2G and 3G standards, however each operation may request customization of some parameters to integrate the equipment into their networks.
- Manufacturers indicate that one of the barriers to achieve scale economies is the financial part; however the companies manage features on their equipment that make it feasible. Also there is fear from operators to new small vendors without a track record or financial stability.



- Costs of research and development of hardware and software prototypes and tests carried out in countries are relatively high. In addition they need to invest in features that make the product differentiable against other options. On the other hand, the integration costs to the operator's network have to be considered.
- Transport capacity to support 3G network is enough, especially with the current 3G technology that allows satellite transport which is expensive but feasible with bandwidth optimization in voice and data. There are also new types of deployment like High Throughput Satellites (HTS) will add huge amounts of capacity, but in regions that have not previously been connected, voice is the dominant service and backhaul capacity is only for 2 or 3 Mbps per cell, where EDGE is the better solution.
- There are several ways to power up small cells, thanks to optimizations in power consumption. However, it is necessary to make a particular study for each location to design the capacity of photovoltaic or wind energy system.
- An additional comment provided by a supplier: An important point that should not be forgotten to make a study of 3G coverage is the penetration of 3G devices in the village.

#### 4.2.3.3 Customer Forces

- *Particular price points or price ranges that the customer expects*

- Providers have prices for their equipment depending on the quantity and the characteristics of coverage, number of simultaneous users and the requirements of the operators but typically a total solution price for the remote site plus a share of the BSC/RNC < US \$ 5 K – US \$ 10 K depending on the requirement for coverage.

#### 4.2.3.4 Substitutes

- *Availability availability of substitutes? – e.g. Wi-Fi, 2G+EDGE, Macro cellular solutions*
- *Cost of switching –Rural solutions already deployed that would be expensive to remove or replace, thus making it harder for manufacturers to sell your product or solution. E.g. proprietary wireless or satellite systems, WiMAX, existing rural small cells, or existing macro cellular infrastructure that covers profitable areas*
- *Particular cost, regulatory or other reasons that would favour (or act to prevent) substitutes than 3G such as*
  - *Extending Macro cellular coverage*
  - *Providing carrier / higher powered Wi-Fi*
  - *2G + EDGE*

- Providers commented that GSM small cells can be considered as a good substitute. On the other hand, GSM macrocells are not feasible due to the high cost of equipment installation. Although, WiFi can be another option in the developed countries as an adjunct to licensed spectrum, it less applicable in developing world as mobile phones with WiFi access or smartphones are cheaper access points than laptops. Macro cells can be deployed where the population density justifies or where geographic (as opposed to population) coverage is explicitly required e.g. along roads. 2G networks works well if a voice-centric solution is required instead of a data-centric an there is limited backhaul bandwidth.





- There are some solutions on VoIP, which can be a little complicated to replace but in the most cases, the solutions can be integrated or co-exist since developments are standardized. Especially, 2G solutions deployed in remote locations could be easily replaced by 3G technologies, particularly if the backhaul solution can be re-used.
- - Extending the coverage of the macrocells is not always the most accurate solution, because, in the majority of the cases, high towers should be built, and their bandwidth consumption is high; in fact they are not based on IP links. Likewise, these extensions create gaps in coverage.
  - Providing higher power links increases the power consumption and they are, also, very sensitive to interference. WiFi needs no licence fee, but it cannot handle the voice traffic.
  - Although basic handset costs are likely to be less than 3G handsets, 2G+EDGE is principally designed as voice-centric solution.

#### 4.2.3.5 Competition

- *Exit barriers to enter the rural marketplace (if any) e.g.*
  - *Specialist manufacturing or test equipment that could not easily be sold or relocated*
  - *Closure costs and asset write-offs involved in closing down a market segment*
  - *Negative impact on inter-related business (e.g. macro network or fixed network equipment sales) that exiting the rural segment would incur once you entered the segment*
  - *Significant loss of prestige from the customer point of view if you have other business with them?*
- *Current industry growth and in what phase is the rural cellular market? Introduction, Growth, Maturity, Decline*
- *Overcapacity in the market that could put downward pressure on prices?*

- - The rural coverage designed equipment of many manufacturers has similar design characteristics of protection due to the outdoor isolation. However, some localities may require very specialized features, requiring special tests and developments.
  - Small cell and macrocell technologies do not compete with each other. Due to nature of their architecture, they are complementary products.
- Unless manufacturer delivers poor quality products, products, there will be no effect on provider's prestige from the customer perspective.
- The manufacturers believe that the mobile market in rural areas is in its early stages, introduction or early growth.
- The market is still growing and there are several trends of developments of new characteristics that differentiate manufacturers and their products. However there is an important risk if macrocell vendors apply some discounted pricing to win a large contract.



#### 4.2.3.6 Segment Accessibility and Identification

- *Difficulties / costs occurred in establishing interoperability with any existing macro network infrastructure – e.g. is there any difficulty or a high cost of establishing interoperability with other existing infrastructure at RAN or core network level*
- *Understanding of the composition of the segment for you to build a business case on?*
- *Classification of segment across a small set of parameters*

- There are not many difficulties in establishing interoperability with existing infrastructure. Small cells providers can easily integrate their equipment to the core of other vendors. There may be a small cost in development and engineering for compatibility but it can be easily afforded by the vendors.
- Providers can make the business case with information of economic growth and balance between voice, data, population density and disposable income affecting the desire for service
- The segment is classified according to the parameters that are necessarily aligned to the needs of each operator.

#### 4.2.3.7 Profitability and Costs

- *What are the volumes you would like as a minimum and/or anticipate for each product? (if the data is available)*
- *Are any products or parts of products, in the rural product mix already being manufactured for, or easily adaptable from, those used in other segments? (e.g. urban outdoor small cell, large enterprise/stadium indoor small cell, backhaul units)*
- *What is your view on the acceptable market price for rural products?*
- *Is there any particular demand or added-value for some customers that will allow higher pricing? – e.g. urgent need or pressure for products, availability of some proprietary backhaul solution or the need to vertically integrate the solution*
- *Are there any indicative prices from competitors that limit pricing? (related to competition)*
- *Is there an approximate estimation for the cost of materials and per-unit assembly costs to produce one or more distinct products that are acceptable to the market?*
- *What is the distribution channel? – is it bigger than direct distribution to operator? (which may reduce the profitability per unit as each company in the channel needs revenue)*
- *Are there significant transportation costs per unit from point of manufacture?*
- *Are there abnormally high import taxes or other local taxes that affect the cost and price in a particular country? (e.g. total shipping, import and relocation costs in Brazil add over 50% to the product price)*
- *What is the approximate cost of an existing product modification? (or developing new ones)*
- *Are there additional testing costs for a rural product over an indoor one?*
- *How many operators are there with rural cellular goals? And what is the potential volume/market size for each operator?*
- *Can the profitability include Cross-Selling and interlinked products? – E.g. are you able to take a view on the overall profitability of selling a bundle of related products and services rather than focusing on just the rural product.*



- The minimum order can vary between 100 and 500 units, and around 5,000 units are required in order to develop new features. For some operators order could be no less than 1,000 units.
- Products easily adaptable to other segments exist. In many cases existing solutions are adapted and optimized for rural solutions.
- The manufacturers agree that this value depends on the needs required by the operators and the volume of equipment requested. As mentioned earlier – total solution cost per site between US \$ 5 K – US \$ 10 K per site depending on the power / range needed. For OPEX, the cost of satellite bandwidth dominates over all other.
- The manufacturers agree that there are no features that raise the price of the equipment since small cell solutions already meet the users' requirements; for specific cases there could be a premium for rapid deployment.
- The market is currently growing and prices vary according to the characteristics of the equipment.
- Price depends on the features required (capacity, output power, etc) by the operator of equipment and testing parameters to be considered. For backhaul, it has to be comparable to pricing for microwave P-P or P-MP links that would be used in similar (but non remote) locations
- The equipment may be distributed directly to the operator or through other distributors, depending on each individual case. However, direct distribution is preferable.
- Prices may vary depending on destination, typically could be between 50 and 500 euro per unit. Transportation costs in the country of delivery and installation are often the most important elements in reaching remote rural sites.
- Import taxes vary on each country. In general operators and manufacturers should study each case carefully, for example in Brazil, the import taxes are high.
- Costs may vary from 50,000 euro for modifications of an existing product up to 700,000 euro to develop a new product.
- The manufacturers agree that if rural products require special testing and certifications, it is expected to have additional costs. These costs can be vary depending on levels of protection required and necessary certifications for accreditations, but, usually, these costs are not very important in comparison with the development cost
- The manufacturers agree that there are many operators which are going to operate in rural areas but they have no specific information of their participation in the market – this depends on each country and its regulations.
- It is possible to get profit with cross-selling, but it depends on the manufacturer and the technologies developed.



#### 4.2.3.8 Actionable / Effective

- *Does the manufacturer have enough resources to address the segment? If no, what is the deficit?*
- *In the case of limited resources, what level of profit or profitability would need to be seen to select the rural segment over the currently served segment?*
- *Does the segment contain customers with homogeneous characteristics and needs?*
- *Can the size of segment be measured? – E.g. do you have a marketing mechanism to enable you to assess your success in addressing the rural market segment?*
- *Can the purchasing power of the buyers for rural solutions be well estimated? – I.e. do you feel that the buyers (operators) have sufficient budget available to be able to purchase what is necessary?*
- *Are the requirements for rural products well understood?*

- The manufacturers agree that they have sufficient resources to cover the segment
- The BTS's manufacturers do not have a specific answer for this question. Backhaul's annual sale is around 5,000 sites per year.
- Operators in rural areas require similar features on their equipment with some variations depending on the locations; however, customers have a wide variety of profiles depending on whether they are residential or business or whether they are voice or data centric.
- It's hard but can be analysed, using information of providers in each region and special programs for voice and data simulations.
- It's hard to estimate, operator's business case could have special considerations. Above the budget, the most important element is the return on investment; therefore operators seek for low maintenance costs and operation solutions to improve their income by reducing their expenses.
- The manufacturers agree that they are familiar with the requirements of products in rural areas. On the other hand, probably the options are less well understood in the developed world than in the developing – but the latter tends to be very conservative for a variety of reasons.

#### 4.2.3.9 Attitude towards TUCAN3G

- *Do you believe a platform like Tucan 3G would help you expand to rural areas? Why?*
- *Would you be interested in research and production of specific equipment designed to address the requirements of this kind of deployments?*
- *What is the amount of of time/money/equipment you are willing to invest to gain access to a platform like Tucan 3G?*

- A platform like TUCAN 3G would help operators to speed up the process to expand into rural areas, and also it may enable us to understand technical issues for radio and backhaul handling in remote rural scenarios.
- Unfortunately, suppliers are not directly involved with the objectives of the project; however their involvement would make more viable the expansion in rural areas and also allow them to increase their sales.



- Providers would be willing to support with the research they have already done in this field, and the LTE research would also be important.
- Providers are willing to test their equipment and systems for providing their experience and participation in the project if they are invited.

#### 4.2.3.10 Key findings

- Just a few manufacturers can meet the characteristics for rural areas, considering also the satellite backhaul needs.
- They indicate that the volume means efficiency in price. The volume depends on the number of locations required to be covered in a given region and the deployed infrastructure. For very small number of sites it is feasible to find an existing facility and operate a shared or a virtual network.
- In isolated rural areas maintenance plays an important role in the design of the network, and this is why the hardware and firmware must comply with features that allow them to operate in critical environmental conditions preferably have the capacities of a self-organizing network.
- Manufacturers agree that to differentiate their products they should develop features that make them more competitive against other similar alternatives such as features that enable low bandwidth consumption, low power consumption, low maintenance costs, automatic configuration and remote management functions, reliable outdoor hardware and address a specific market and differentiate their products with better technical parameters.
- The manufacturers agree that the use of small cells is optimal in rural scenarios against the traditional macro cells developments because small cells minimize installation, energy and maintenance costs.
- There are high costs of research and development of hardware and software prototypes and tests, which require additional costs.
- There is sufficient backhaul capacity in the target regions available to make 3G supply viable. Also, there are several ways to power up small cells thanks to optimizations in power consumption; however it is necessary to make a particular study for each location.
- In most cases, already deployed rural solutions can be integrated or co-exist since developments are standardized; especially 2G solutions deployed in remote locations could be easily replaced by 3G technologies, particularly if the backhaul solution can be re-used.
- The mobile market in rural areas is in its early stages and there are several development trends of new characteristics that differentiate manufacturers, their products and the prices.
- The minimum order (volume) can vary between 100 and 500 units, and to develop new features around 5,000 units are required.
- Prices may vary depending on destination, typically could be between 50 and 500 euros per unit. The in-country transport and installation costs are often the biggest element in reaching remote rural sites.
- The approximate cost may vary from 50,000 euro for modifications of an existing product up to 700,000 euro to develop a new product.
- The manufacturers agree that they have sufficient resources to cover the segment and that they are familiar with the product requirements in rural areas.

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- The manufacturers agree that they can help with the research they have already done in this field, and are willing to test their equipment and systems for providing their experience and participation in the project, if they are invited.
- The price for rural products varies, depending on the operators requirements and the volumes of equipment requested. Generally, total solution cost is between US \$ 5 K – US \$ 10 K per site depending on the power/range needed.



## 5 SYNTHESIS OF RESULTS

The Market Survey enabled the working team to better understand the target market profile, assess the main components towards the design and development of the business model for provision of services which will be developed in further steps under the TUCAN3G umbrella. In order to gather and analyse information, indications and evidences regarding the market profile of the examined regions, a **set of qualitative and quantitative tools** has been used, such as questionnaires and semi-structured interviews, taking into account the peculiarities of the target groups.

The two main target groups of this market survey were **demand and supply side target groups**. Demand side target group consists of the target users of the services which are the private users, business users and institutional users. Supply side target group includes all stakeholders which need to be engaged in order to provide services to the target users, such as mobile network operators, equipment manufacturers and the public sector. The survey has captured all different angles and views of these stakeholders and allowed to draw the bigger picture of the regions and the market.

All these data drawn out of this survey will contribute towards the **design of the business model** in a way that fulfils and meets the demands of all stakeholders and target groups, takes advantages of the opportunities and tackles the major drawbacks. In the final chapter, we demonstrate the interactions of the market data and the overall design of the Business Model.

### 5.1 Market Profile

#### 5.1.1 Demand side

Demand side data refer to private users, business users and institutional users of the services to be developed and implementing throughout the TUCAN3G project.

**Private Users** participated represent a vast pool of locations with a variety of cultural and employment backgrounds. The analysis of the research results, illustrated in the Table below, offered the opportunity to determine the profile of the average Private User and has helped to better understand the economic and cultural context in which they operate.

	Colombia	Peru
<b>Average Age</b>	≈ 40	Between 21 and 40 years old
<b>Average Income per year</b>	≈ \$ 1.781,00	≈ \$ 2.742,72
<b>Primary Sector of Occupation</b>	Agriculture	Agriculture
<b>Access to Basic Services (i.e. Water, Sewage, Electricity)</b>	31% (In Total)	Electricity: 72% (btw 6 pm to 11 pm) Sewage: 17% , Water : 25%
<b>Desktop PC</b>	13%	7,2%
<b>Simple Mobile Phone</b>	61%	68,9%
<b>Laptop &amp; Tablets</b>	22%	17,1%
<b>Smartphone</b>	4%	10,7%

**Table 37: Data from Private Users: Summary Table**





Taking into account the above data, we observe that the average user in both areas is up to 40 years old, works in the agricultural sector and has limited access to basic services such as water, sewage and electricity. The most significant difference between the two participant countries/areas refers to the average income per year with the Peruvians having 54% more income than their counterparts. Another interesting point is that although both target groups have a significant difference in their income, they are willing to pay almost the same amount of money ( $\approx$  \$36) for purchasing a new mobile phone or smartphone. Nevertheless, dissimilarities exist regarding the initiatives that potential Colombian and Peruvian users will undertake for purchasing a new Smartphone/mobile phone which will meet their demands. From one side, the Colombian users are willing to purchase a less up-to-date model of a well-known brand (37%) instead of purchasing the most updated one, while their Peruvian counterparts are willing either to buy the device they wish on credit and pay the value of the phone in 12 months (34.81%) or look for a model of an economy brand that has similar features but at a lower cost (34.25%). When it comes to Internet usage, the majority of the respondents has already been familiar to the use of Internet and the anticipated benefits that it may bring in their lives and their families, nevertheless they are not willing to pay a lot of money to purchase a phone which can exploit the Internet features. The previous statement combined with the overall profile, leads us to the conclusion that Internet needs are mostly limited to their laptops and desktop computers. Moreover, findings demonstrate that the average user spends around US \$ 5 for phone and US \$ 5 for internet usage and are willing to pay up to US \$ 7 for continuous access to internet. Further findings from our survey suggest that a large number of residents are willing to use the internet for accessing their everyday habits such as communicating with family over a large distance, get updates regarding news, access to business and educational material, etc. Regarding the internet service, the preferred mean to purchase the service is the use of prepaid cards. The respondents consider purchasing an application according to the price of it, most of them spending US \$ 1 per month for one. On the other hand, the main reasons that prevent them from using the Internet are the frequent network breakdowns, the lack of knowledge about the use of the technology, the cost of telecommunication services, lack of electricity, the lack of access points and the high transport costs to public access points. While most of the respondents use public areas to get paid access to the Internet for their business and personal needs, they feel that this access should be free. Another significant observation is that in the majority of cases, these access points are very far from their residence, making it more difficult for them to access Internet.

With regard to the **small business users'** market segment, all users indicated that they do not have access to internet (in Peru) as the only place for accessing internet was a public booth which did not exist anymore at the time of the survey. Most of them (80%) believe that if they could use the internet to promote their business, this would generate more income and therefore, the implementation of the TUCAN3G project is expected to allow business users to better communicate with their customers and offer services, mainly to tourism sector, by improving booking, billing and customer relations. All business users are willing to buy devices and pay a fee for internet services while most of them (60%) would prefer a prepaid than a postpaid contract service. Most business users intend to utilize the service for communicating with customers through emails, calls and social networks.

Finally, **institutional users** representing schools, police stations, health centres and community centres mentioned that the population of the towns would benefit indirectly as they have better means of communication and access to voice and data services, such as services to be rendered by





TUCAN3G Project, while 3G technology would allow but marginal improvement in educational management, since it is not considered as a priority for improving the quality of teaching.

### 5.1.2 Supply side

With regard to the **public sector** perspectives, officials that were interviewed are currently using the Internet daily at a low rate on specific tasks like emails. Public Actors recognise the importance of the Internet and believe that TUCAN3G can indeed be the way to reduce social gaps by providing access to data services and applications including education, telemedicine, telebanking and all sorts of social networks. More specifically, they mentioned that a wider usage of the Internet would be very useful for them and improve their work and provision of services to their clients.

Nevertheless, a number of barriers have been illustrated including the distance from urban centres, the poverty level and the quality level of telecommunication services. More specifically, a major limitation of the rural population's access to telecommunications services is the distance from urban centres (many localities are at distances of more than 400 km because of the Andes Mountain). Additionally, the level of poverty in these villages is very high which is a reason explaining the fact that private operators have not expanded their business in these areas, so far. Finally, the lack of continuous power supply and the poor quality of the existing telecommunications services have also been mentioned as key barriers for provision of services.

Nevertheless, officials argued that the services demand in rural areas is very high, while communities anticipate telecommunications services of good quality. They also argued that despite the poor economics of communities, there is a strong willingness to pay for services, especially because of the high percentage of youth population with mobile devices.

**Operators** that participated in the survey argued that they anticipate benefits by the TUCAN3G project since the expansion to rural areas is an opportunity to create new markets, because the project exploits a technology more suitable and adapted to rural regions, while it reduces costs. They are willing to share an investment with the State and to start operations in rural areas, as long as some of the problems identified, like the strict regulation and the lack of basic infrastructures such as power supply, are solved. Currently, the connection in rural areas is made through satellite which results low quality, low connectivity and low speeds. Although, some rural 2G telecommunication projects exist by some operators, they are reluctant to invest in a better infrastructure for a 3G technology due to the fact that the rural areas represent a rather small market with extremely low profit for them. Representatives, stated that the government should promote a proactive policy for the development of telecommunications in rural areas and increase the financial support to the operators and provide incentives to invest in a 3G technology infrastructure for rural areas, such as tax exemptions, reduction of costs for the use of spectrum and flexibility with fines, in order to compensate for the high cost and risk of the deployment. Also, they reported that the existing strict regulation is a main reason that prevents operators from investing in rural areas, while a more flexible regulation that takes into account the distinctive features of rural areas and that does not result harsh penalties for the operators should encourage them to invest in rural areas and increase the coverage in these areas even though it is not possible to provide the same quality as in urban areas. Hence, public organizations should play a critical role in convincing the government to introduce more flexible regulatory models adapted to rural contexts.



Finally, interviewed **manufacturers** have also provided important feedback. They have indicated that the main cost centre is subject to the volume of units purchased and that the volume means efficiency in price. The volume depends on the number of locations required to be covered in a given region and that the deployed infrastructure with minimum orders (volume) can vary between 100 and 500 units while there is a minimum of 5000 units required to develop new features. The mobile market in rural areas is in its early stages, therefore, there are several trends of developments of new characteristics that differentiate manufacturers, their products and the prices.

The manufacturers have reported that in order to differentiate their products with better technical parameters, they should develop features that enable low bandwidth consumption, low power consumption, low maintenance costs, automatic configuration and remote management functions. On the other hand there are high costs associated to enter the rural market, including those of research and development of both hardware and software prototypes, as well as tests.

The major outcome of the survey was the recognition of the need and opportunity to promote the cooperation between manufacturers and operators, in terms of the necessary parameters aligned to the needs of each operator and the required conditions. Finally, they also are willing to participate in the TUCAN3G project, because the platform can enable them to better understand technical issues on radio and backhaul handling in remote rural scenarios.

In general, all different supply actors interviewed in the research, have stated that the TUCAN3G project is an important initiative, while they all evaluate the benefits that it can bring to the deployment of mobile services in their country, given the fact that the expansion of the mobile market in rural regions is a new opportunity for them in its early stages.

However, there are several barriers that make the expansion of the 3G technology in rural areas a challenging task. In order to address these barriers, supply actors need to adjust their perspective value, cooperation and strategies.

We argue that they can indeed be the facilitators of the project playing a pivotal role in its implementation as well as in the overall quality of services to be offered. Taking into consideration the benefits that each of them can have, we argue that it is imperative working with them and in accordance to their needs so that they can help make the project feasible.

## **5.2 Market input and development of the TUCAN3G business model**

Data gathered during market research will be used in the next phase of the project, i.e. the development of the **TUCAN3G business model**. This survey has been an initial step towards the development of the business model as in further steps we will develop extensively all business model aspects, concerning both demand and supply side. To this end not all parts of the business model can be completed at this stage, but we will rather limit our efforts to the ones that market survey has provided relevant input. Additional data will be required both secondary data analysis (in terms of relevant business models, information regarding the services and geographical areas under study, as well as the scope and limitation of similar to the TUCAN3G business models) and wherever needed, additional primary data.



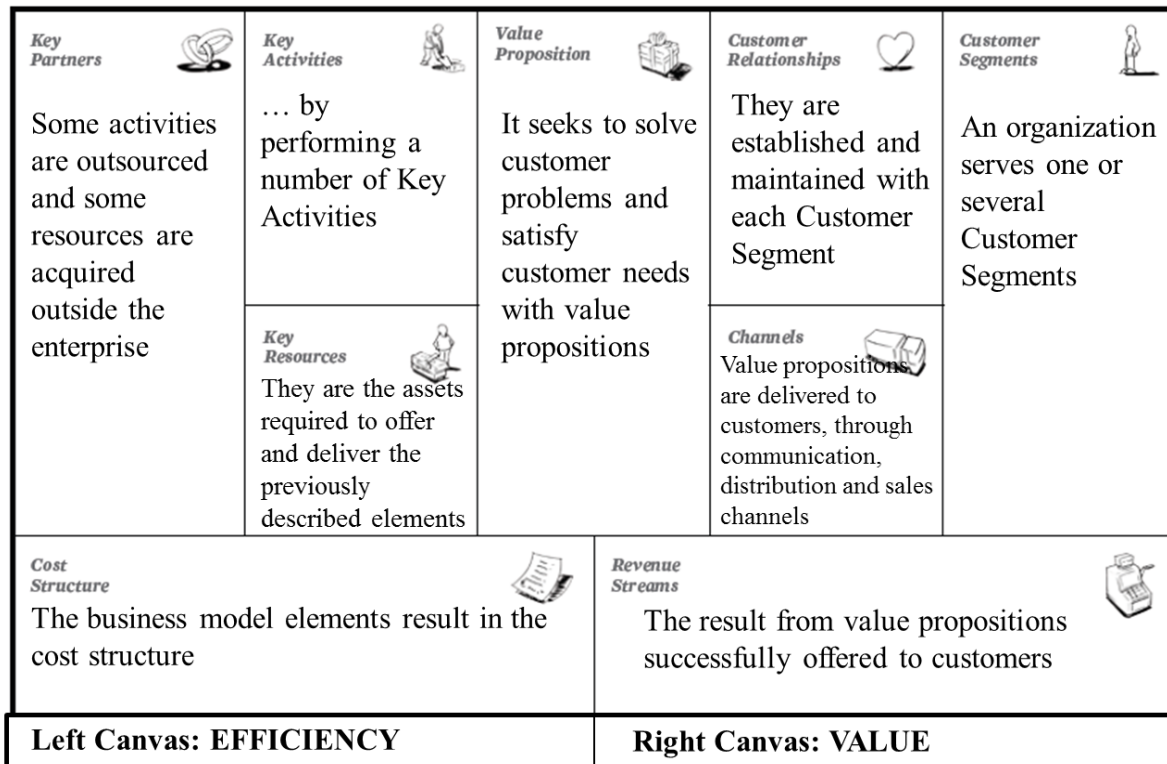
The **TUCAN3G business model** will describe the rationale of how the service will create, deliver and capture value and will be described through nine basic building blocks that show the logic of how a company can make profit:

1. Customer segments
2. Value propositions
3. Channels
4. Customer relationships
5. Revenue streams
6. Key resources
7. Key activities
8. Key partnerships
9. Cost structure

The nine blocks cover the four main areas of business:

- ✓ Customers
- ✓ Offer
- ✓ Infrastructure
- ✓ Financial viability

The business model is like a blueprint for a strategy to be implemented through organizational structures, processes and systems. These nine basic building blocks are presented in the following figure.



**Figure 40: Business Model Canvas Presentation**

The main blocks of results acquired during the current market survey were the following:



Demand Side	Supply Side
1. Private Users Survey Peru 2. Private Users Survey Colombia 3. Business Users Interviews Peru 4. Business Users Interviews Colombia 5. Other Institutional Users Interviews Peru 6. Other Institutional Users Interviews Colombia	1. Public Sector Stakeholders interviews 2. Mobile Network Operators interviews 3. Equipment Manufacturers interviews

**Table 38: Main sources of market survey results**

In order to match the relevant information provided from the market research to the appropriate building block, we will examine in depth the analysis of the different requirements as expressed in the analysis of the demand and supply side. This will be an elaborated process since in order to produce a **viable business model that will combine both profitability and social development aspects**, we need to take into consideration both the potential users needs and their economic and social status, but at the same time, be able to create a viable business case for the supply side (especially operators and equipment manufacturers) that will allow them to support the provision of services. Moreover, one of the **main findings of the market survey is the significance of the public sector stakeholders** in supporting such a business model, as well as the role of **institutional users** that can also play an active role in the initial development, usage of the services and expansion of their reach to other customer segments.

Last but not least, a clear correlation between the market survey sources and outcomes and the basic business model segments exist. More specific, data and outcomes elaborated both from the demand and supply side of users will provide valuable input to the customer segments, value propositions, distribution channels, customer relationships, revenue streams and other parts of the final business model. Further analysis of the business model will be developed in next tasks as further critical input is required.



## 6 ANNEXES

### 6.1 ANNEX 1: Research Questionnaires

#### 6.1.1 Research Questions for Public Sector Interviews

##### **Presentation of the project's scope and objective**

Brief presentation of project's scope and objective.

##### **Opinion of the telecommunication Officials**

General questions oriented to telecommunication officials of sectors with presence in the isolated rural locations:

1. What public entities invest on telecommunications?
2. What public entities have formulated telecommunications projects?
3. What public entities have financed telecommunications projects?
4. What public entities have regulated the interventions on telecommunications?
5. What is the monthly amount that your institution pays for the mobile telephony service per terminal equipment in isolated rural locations?
6. What is the monthly amount that your institution pays for the Internet service per connection in isolated rural locations?
7. What is the broadband hired per connection in isolated rural locations?
8. What is the monthly amount that your institution could pay for the 3G mobile telephony service per terminal equipment in isolated rural locations?
9. How do you think people in these rural areas could benefit from a 3G mobile telephony service?
10. What you believe are the main opportunities by deploying 3G mobile telephony service in a rural area:
  - a. For residents
  - b. For visitors / tourists
  - c. For business / entrepreneurs
  - d. For local public institutions (health posts, schools, police stations etc)
11. What you believe are the main barriers for deploying 3G mobile telephony service in a rural area:
  - a. For residents
  - b. For visitors / tourists
  - c. For business / entrepreneurs
  - d. For local public institutions (health posts, schools, police stations etc)

**Specific questions for the responsible of public institutions with presence in isolated rural areas. The interviewed are the responsible of health posts, directors of schools, responsible for police stations and local authorities.**

Brief presentation of project's scope and objective.



### **Usage of mobile telephony service**

1. Is there coverage of mobile telephony in your village?
2. Does your institution have mobile telephony service? (How long?)
3. For how long does your institution has access to mobile telephony service?
4. What is the use that your institution gives to mobile telephony?
5. What is the importance of mobile telephony for your institution?
  - a. What specific services will be used if you have access to it
6. What is the monthly amount that your institution pays for mobile telephony service?

### **Usage of internet service**

1. Is there Internet in your village?
2. Does your institution have access to Internet service? (Since when?)
3. For how long does your institution has access to Internet service?
4. What is the use that your institution gives to the Internet?
5. What is the importance of Internet for your institution?
  - a. What specific services will be used if you have access to it
6. What is the monthly amount that your institution pays for the Internet service?
7. What is the contracted broadband?

### **Intention of usage of Tucan 3g Services**

1. Do you know what 3G mobile telephony is?
2. Would you be interested on having 3G mobile telephony services?
3. Would the 3G mobile telephony service improve the work of your institution to the benefit of the rural population? (It must be explained to the interviewed, textually and graphically, what is 3G mobile telephony.)
4. What is the monthly amount that your institution could afford to pay for the 3G mobile telephony service?
5. If not able to pay, do you believe that a 3G mobile telephony service will reduce other costs of your organization (e.g. travel or postage costs)?
6. If yes, which ones and what are the expected savings?



### 6.1.2 Research Questions for Small Business Users

1. Do you have access to internet services?
  - a. If yes which one do you use most?
  - b. If not which would you use if you had access to them?
2. Which challenges do you have to overcome in the rural market?
  - a. Do you believe that the usage of internet would help you overcome some of these obstacles?
  - b. Which obstacles and in what way?
3. Would you invest some money for covering your telecommunication business needs?
  - a. Would you buy a new device to access services?
  - b. Would you pay a fee for these internet services
  - c. How would you prefer to pay for these services
    - i. Buy data bundles when I need to access the service
    - ii. Use pre-paid cards for data services
    - iii. Use data allowance included in my prepaid contract
    - iv. Use a low cost version of the service with limited functionalities
    - v. Use a free, text only version of the service
    - vi. Other (please specify)
    - vii. None of the above
  - d.
4. Which of the following types of content do you/ would access to through a mobile phone/smartphone (e.g. via an app, news alerts, website access etc.) for your business needs?
  - a. Business
  - b. Productivity
  - c. Education
  - d. News
  - e. Photo and Video
  - f. Social networking
  - g. Travel
  - h. Other (please specify)
  - i. None
5. What different requirements would you have for your business needs compared to your home needs in terms of internet service usage?
  - a. Increase quality of services



- b. Lower prices
- c. Increased features
- d. Privacy
- e. Other (Please specify)

### 6.1.3 Research Questions for Business Users Focus Groups

#### Presentation of the project's scope and objective

Brief presentation of project's scope and objective.

#### Firm identity

- 1. Sector
- 2. Years of operation
- 3. Number of employees

#### Access to mobile Internet

- 1. Do you have access to internet services?
  - a. If yes which one do you use most?
  - b. If not which would you use if you had access to them?
- 2. Which challenges do you have to overcome in the rural market?
  - a. Do you believe that the usage of internet would help you overcome some of these obstacles?
  - b. Which obstacles and in what way?
- 3. Would you invest some money for covering your telecommunication business needs?
  - a. Would you buy a new device to access services?
  - b. Would you pay a fee for these internet services
  - c. How would you prefer to pay for these services
    - i. Buy data bundles when I need to access the service
    - ii. Use pre-paid cards for data services
    - iii. Use data allowance included in my prepaid contract
    - iv. Use a low cost version of the service with limited functionalities
    - v. Use a free, text only version of the service
    - vi. Other (please specify)
    - vii. None of the above
- d. Which of the following types of content do you/ would access to through a mobile phone/smartphone (e.g. via an app, news alerts, website access etc.) for your business needs?
  - i. Business
  - ii. Productivity
  - iii. Education
  - iv. News
  - v. Photo and Video





- vi. Social networking
  - vii. Travel
  - viii. Other (please specify)
  - ix. None
- e. What different requirements would you have for your business needs compared to your home needs in terms of internet service usage?
- i. Increase quality of services
  - ii. Lower prices
  - iii. Increased features
  - iv. Privacy
  - v. Other (Please specify)

#### 6.1.4 Research Questions for Private Users Questionnaire

##### Private User's identity

1. Location
2. Name
3. Age
4. How many persons live in this household? How old are they?
5. Which sector do you work on? (merchant, farmer, rancher, miner) / Occupation
6. How is your income? Fixed or Variable? Monthly, Weekly, Daily?
7. Average Annual income
8. Which electronic devices do you have at home?
9. Do you have access to basic services? (electricity, water, sewage)

##### Device Ownership

1. Do you or any member of your family have any of the following devices:
  - a. Desktop PC
  - b. Laptop
  - c. Tablet
  - d. Smartphone
  - e. Simple mobile phone
2. How many of each device?
3. If you were looking to buy a new mobile phone/ smartphone handset. Approximately how much would you be willing to pay?
4. If you were looking to purchase a high-end smartphone (i.e. an expensive smartphone with lots of features/ functionality e.g. Apple iPhone which of the following BEST describes what you would do?
  - f. I would buy the device if I was able to purchase it on credit and pay the price of the phone back over 12 months
  - g. I would buy an older version of the device at a cheaper cost even if it meant I didn't have access to the most up to date services and features
  - h. I would look for a model from a cheaper brand which would have similar functionalities but at a lower cost



- i. I would purchase the device because it is the one I aspire to
- j. I would look for a budget or mini version of the device by the same brand
- k. None of the above

### Internet access relevance

1. Do you know the advantages of Internet?
2. Have you or a family member ever used the Internet?
3. Do you think continuous Internet access would benefit your family?
4. How do you think continuous Internet access would benefit your family?
5. Do you think the Internet can help you in your work and how?

### Communication needs

1. Do you have relatives living in other cities or countries?
2. How do you communicate with your relatives who live out of town and how often?
3. Do your family members living in other cities have Internet access?
4. Are you interested in news? How do you get information?
5. Do you need information to do your homework or work? How do you get the information?
6. Do you watch TV or listen to the radio? What kind of programs? Which are your favorite shows and channels?

### Usage – Type/Duration

1. (For Internet users) What are the websites that you visit more often?
2. (For mobile phone users) How often and why do you use this service? (An alternative is that the interviewee check the call record on the cellular and explain last month calls). How much do you spend on phone every month if you are a user (Cell Phone, borrowed phone, pay phone)?
3. How much do you spend every month on Internet if you are a user? (booths)
4. How much would you pay every month to have access to continuous Internet service?
5. If an app or subscriptions to specific content (e.g. news alerts, sport, etc.) cost an average of \$1 USD per app/ update, how many do you think you would be prepared to pay for every month?
  - a. 1
  - b. 2
  - c. 3 - 4
  - d. 5 or more
6. Which of the following types of content do you would get access to, through a mobile phone/smartphone (e.g. via an app, news alerts, website access etc.)?
  - a. Business / productivity
  - b. Education
  - c. Entertainment
  - d. Family and kids



- e. Food and drink
  - f. Games
  - g. Health and fitness
  - h. Lifestyle
  - i. Music
  - j. News
  - k. Photo and Video
  - l. Social networking
  - m. Sports
  - n. Travel
  - o. Political services
  - p. Other (please specify)
  - q. None
7. When using services via a mobile phone/ smartphone, which would apply to you?
- a. Buy data bundles when I need to access the service
  - b. Use pre-paid cards for data services
  - c. Use data allowance included in my prepaid contract
  - d. Use a low cost version of the service with limited functionalities
  - e. Use a free, text only version of the service
  - f. Other (please specify)
  - g. None of the above
8. Please imagine that you had to pay to access content through a mobile phone/ smartphone (e.g. paid-for apps, subscriptions to news alerts etc.). Which of the following methods of payment would you find most convenient to use?
- a. Through y mobile phone provider prepaid (Pay as you go)
  - b. Through y mobile phone provider post-paid (Part of contract)
  - c. By using debit card
  - d. By using credit card
  - e. By bank transfer through my bank account
  - f. Secure payment services (e.g. paypal)
  - g. Other (please specify)
  - h. None of the above
9. What are the main reasons for not using a service
- a. Often Network breakdown
  - b. Distance and transport costs to the points of access
  - c. Billing system
  - d. Lack of electricity
  - e. Fear of technology
  - f. Cost of telecommunication services
  - g. Non- availability of service provision
  - h. Few access points
  - i. Not interested in content / services currently offered
  - j. Other



### Usage - Location

1. (For Internet users) Where do you access internet services from?
  - a. Home
  - b. Public area / free access
  - c. Public area / paid access
  - d. While on the go / moving through mobile device
2. I have to visit specific locations to access services
  - a. Which are near my residence
  - b. Which are not very far from my residence
  - c. Which are relatively far from my residence
  - d. Which are very far from my residence
3. Where do believe it will be more convenient to access internet services from regarding your personal communication needs?
  - a. Home
  - b. Public area / free access
  - c. Public area / paid access
  - d. While on the go / moving through mobile device
4. Where do believe it will be more convenient to access internet services from regarding your business communication needs?
  - a. Home
  - b. Public area / free access
  - c. Public area / paid access
  - d. While on the go / moving through mobile device

### Mobile advertising

1. Approximately how often do you think it is appropriate for a company to send you advertising and promotional messages to a mobile phone/ smartphone?
  - a. Every day
  - b. Once a week
  - c. 2-3 times a month
  - d. Once a month
  - e. Less than once per month
  - f. Never
2. Which of the following ways would you like to receive promotional messages from companies on a mobile phone/ smartphone?
  - a. Automated voice call
  - b. SMS text
  - c. SMS text relevant to my location
  - d. Email
  - e. Banner in mobile app
  - f. Pop-up from mobile app
  - g. SMS when I get confirmation of top-up on a Pay as you go service
  - h. Never want to receive promotional messages



3. Which ONE of the following would you be MOST likely to trust, if they sent you promotional messages to a mobile phone/smartphone offering you new services/content?
  - a. Mobile operator
  - b. Well known consumer brand (e.g Coca Cola)
  - c. Media (e.g. newspaper)
  - d. Third party service provider (e.g. Group-on)
  - e. None
4. Do you understand the necessity of mobile advertising?
  - a. Yes
  - b. No

### **6.1.5 Research Questions for Operators Interviews**

#### **Presentation of the project's scope and objective**

Brief presentation of project's scope and objective

#### **Operators' identity**

1. Title
2. Years of operation
3. Areas of coverage
4. Main technologies used
5. Operating and expansion strategy
6. Vision and mission

#### **Operators' current strategy**

1. Which challenges do you have to overcome in the rural market?
2. What opportunities do you see in the rural areas?
3. Which are the main benefits from expanding to a rural area?

#### **Operators' expansion strategy**

1. What is the decision making scheme you rely on to take decisions for expansion in new rural areas?
2. What is the level of your current annual investment plan for the next three years?
3. What is the level of investment planned to be done this year and in the next three years in rural areas?
4. Which are the main competitors in the areas you are planning to expand to?

#### **Operators' concerns**

1. What are your main technical barriers for not expanding to rural areas?
2. What are your main business barriers for not expanding to rural areas?



3. What do you consider that should be the role of the Government for reducing the ICT gap in rural areas?
4. What alteration do you have to make to your current business model/ operations to expand to rural areas?

#### **Attitude towards Tucan 3g**

1. Do you believe a platform like Tucan 3g would help you expand to rural areas?
2. If yes / no why?
3. Do you believe that you could share a platform like Tucan 3g with other operators or would you prefer exclusive access?
4. What is the amount you are willing to invest to gain access to a platform like Tucan 3g?

#### **6.1.6 Research Questions for Manufacturers Interviews**

##### **Presentation of the project's scope and objective**

Brief presentation of project's scope and objective

##### **Supplier Forces**

1. How many potential suppliers are there?
2. What is the importance of volume to the manufacturer?
3. Are there specific features in the radio or chipset hardware or firmware needed to address the rural marketplace
4. Is there some way that products may be differentiated
5. Are there certain power supply thresholds that can only be met by certain solutions

##### **Barriers to entry**

1. Are there absolute cost advantages of a small cell solution for rural coverage over the alternatives
2. Is the government or regulatory policy/pressure that assists or inhibits entry to this market
3. Are there economies of scale that will reduce barriers to entry
4. Are there existing incumbents in the market that make economies of scale hard to achieve
5. Are there high capital requirements to enter the rural market - – e.g. investment in new product design, type approval costs, homologation costs for countries with small volume
6. Is there sufficient backhaul capacity in the target regions available to make supplying 3G viable
7. Are the power sources for a cell (e.g. solar) sufficiently available at the right power and charge levels to be able to power a small cell

##### **Customer Forces**



1. What is the price sensitivity of the customer
2. What is the availability of substitutes – e.g. Wifi, 2G+EDGE, Macrocellular solutions

### Substitutes

1. Cost of switching – Are there rural solutions already deployed that would be expensive to remove or replace?
2. What is the operator opinion about replacing already deployed solutions?
3. Are there particular cost, regulatory or other reasons that would favour (or act to prevent) substitutes to 3G such as a) Extending Macrocellular coverage; b) Providing carrier / higher powered Wifi; c) 2G + EDGE

### Competition

1. What are the exit barriers to entering the rural marketplace (if any) ?
2. Specialist manufacturing or test equipment that could not easily be sold or relocated?
3. Closure costs and asset write-offs involved in closing down a market segment?
4. Negative impact on inter-related business (e.g. macro network or fixed network equipment sales)
5. Would there be significant loss of customer goodwill
6. Industry growth and in what phase is the rural cellular market? Introduction, Growth, Maturity, Decline
7. Is there any overcapacity in the market?
8. Diversity of Rivals

### Segment Accessibility and Identification

1. What are the barriers for the introduction of rural cellular in a particular area?
2. Is there an incumbent supplier of a rural solution?
3. What are the difficulties / costs occurred in establishing interoperability with any existing macro network infrastructure
4. Is there a clear understanding of the composition of the segment?
5. Can the segment be classified across a small set of parameters

### Profitability and Costs

1. What are the likely volumes for each product
2. Can the same product be sold across a number of markets
3. Can a framework supply agreement be set up with operator groupings
4. Are any products in the rural product mix already being manufactured for other segments
5. What does a business analysis show that the elements of market segment will accept as a price
6. Is there particular demand or added-value for some customers that will allow higher pricing
7. Are there indicative prices from competitors that limit pricing (related to competition)
8. What is the cost of materials and per-unit assembly costs to produce one or more distinct products that are acceptable to the market
9. What is the distribution channel – is it bigger than direct to operator



10. If there is a non-direct channel, what share of gross profit will channel members need
11. What are the transportation costs per unit from point of manufacture
12. Are there Import taxes or other local taxes that affect the cost in particular country
13. Are significant parts of products, in the rural product mix available from products addressing other segments
14. What is the cost of modification of existing product (or developing new ones)
15. Are there additional testing costs for a rural product over an indoor one.
16. How many operators are there with rural cellular goals, and what is the potential volume/market size for each operator
17. Are there sufficiently common requirements between operators that allow for one or more products in the mix to be widely applicable
18. Can a global framework supply agreement be signed with operator groupings that has a common product specification and commonality in operator or regulatory approval
19. Can the profitability include Cross-Selling and interlinked products

#### Actionable / Effective

1. Does the manufacturer have enough resources to address the segment? If no, what is the deficit
2. In the case of limited resources, what level of profit or profitability would need to be seen to select the rural segment over the currently served segment
3. Does the segment contains customers with homogeneous characteristics and needs
4. Can the size of segment be measured
5. Can the purchasing power of the buyers for rural solutions be well estimated
6. Can the likely buying behaviour of rural providers be assessed
7. Are the requirements well understood

#### Attitude towards Tucan 3g

1. Do you believe a platform like Tucan 3g would help you expand to rural areas?
2. If yes / no why?
3. Do you believe that you could share a platform like Tucan 3g with other stakeholders or would you prefer exclusive access?
4. What is the amount you are willing to invest to gain access to a platform like Tucan 3g?

## 6.2 ANNEX 2: Private Users Survey Field Work in Peru

### a) First work group

The first work group visited the localities of San Juan de Armanayacu and San Gabriel de Varadero, ubicated in the Balsapuerto district, province of Alto Amazonas, Department of Loreto.

The visits were realised with the following itinerary:





Date	Means of Transport	Itinerary
18/09/2013	Air – Terrestrial	Lima – Tarapoto – Yurimaguas
19/09/2013	Fluvial (by river)	Yurimaguas – San Juan de Armanayacu – Yurimaguas
20/09/2013	Fluvial (by river)	Yurimaguas – San Gabriel de Varadero
21/09/2013	-----	San Gabriel de Varadero
22/09/2013	Fluvial (by river)	San Gabriel de Varadero – Yurimaguas
23/09/2013	Terrestrial – Air	Yurimaguas – Tarapoto – Lima

**Table 39: Dates and Itinerary for 1<sup>st</sup> Working Group**

The progress of the activities is given below:

- Day, September 18th, 2013:
  - Transfer by air from Lima city to Tarapoto city.
  - Transfer by land to Yurimaguas city.
- Day, September 19<sup>th</sup>, 2013:
  - Transfer by river to the locality of San Juan de Armanayacu.
  - Coordination with local authorities.
  - Conducting demand surveys to 13 homes and local authorities.
  - Transfer by river to the locality of Yurimaguas.
- Day, September 20th, 2013:
  - Transfer by river to the locality of San Gabriel de Varadero.
  - Coordination with local authorities.
- Day, September 21st, 2013:
  - Conducting demand surveys to 60 homes and local authorities.
- Day, September 22nd, 2013:
  - Transfer by river to the locality of Yurimaguas.
- Day, September 23rd, 2013:
  - Transfer by land to Tarapoto city.
  - Transfer by air to Lima city.

The following map shows the localities that the first work group visited:



**Figure 41: Map of localities that the first work group visited**

Source: Google Earth  
Elaboration: Own

The following photo shows FITEL staff conducting surveys to inhabitants in the locality of San Juan de Armanayacu.



**Figure 42: FITEL's staff conducting surveys to inhabitants (1 - San Juan de Armanayacu)**

b) Second work group



Second work group visited the localities of Tutapishco, Huitotos de Negro Urco and Santa Clotilde, located in Napo district, province of Maynas, Loreto department.

The visits were realised with the following itinerary:

Date	Means of Transport	Itinerary
18/09/2013	Air – Fluvial (by river)	Lima – Iquitos – Santa Clotilde
19/09/2013	Fluvial (by river)	Santa Clotilde – Huitotos de Negro Urco – Santa Clotilde
20/09/2013	Fluvial (by river)	Santa Clotilde – Tutapishco – Santa Clotilde
21/09/2013	-----	Santa Clotilde
22/09/2013	Fluvial (by river)	Santa Clotilde – Huitotos de Negro Urco – Tutapishco – Santa Clotilde
23/09/2013	Fluvial(by river) – Air	Santa Clotilde – Iquitos – Lima

**Table 40: Dates and Itinerary for 2<sup>nd</sup> Working Group**

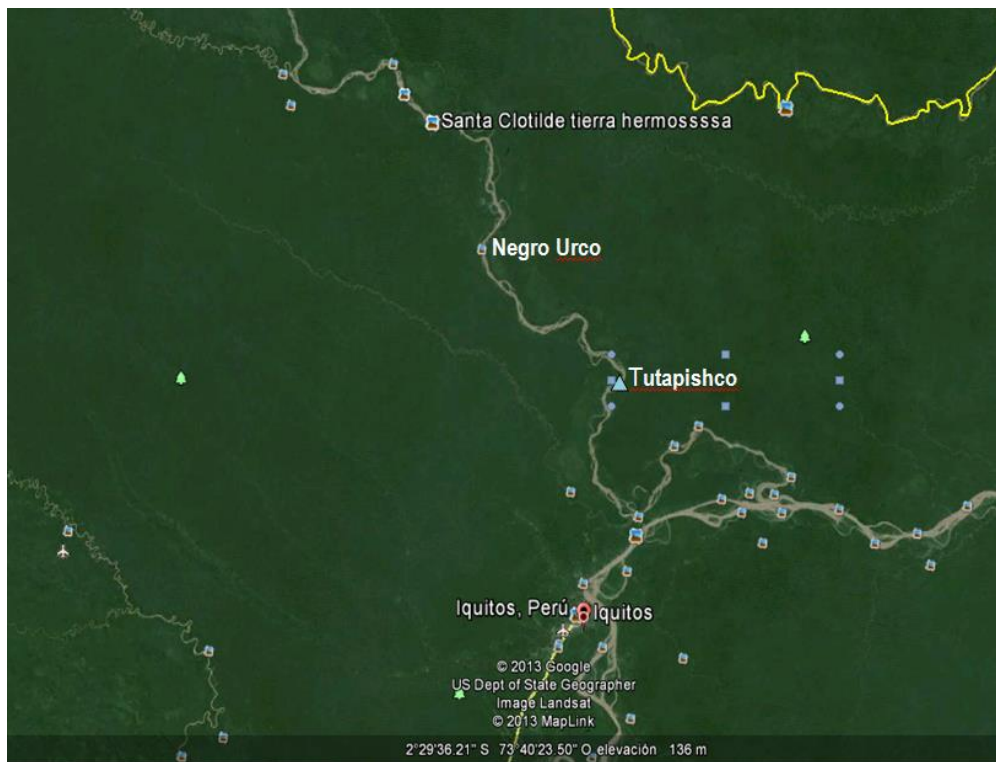
The progress of the activities is given below:

- Day, September 18th, 2013:
  - Transfer by air from Lima city to Iquitos city.
  - Transfer by river to locality of Santa Clotilde.
  - At night we contacted local authorities to coordinate and to inform them about the scope of the visit, taking knowledge of the existence of a strong need for telecommunications services, identifying a great predisposition of the authorities to the TUCAN3G project.
- Day, September 19th, 2013:
  - It began with taking demand surveys in the locality of Santa Clotilde.
  - Transfer by river to locality of Huitotos de Negro Urco.
  - It began with taking demand surveys in the locality of Huitotos de Negro Urco.
  - A meeting was held with the local authorities, standing out in the meeting, the great interest in the TUCAN3G project. Also, field observation it was identified that the majority of young people have mobile equipment.
  - Transfer by river to the locality of Santa Clotilde
- Day, September 20th, 2013:
  - Transfer by river to locality of Tutapishco.
  - It began with taking demand surveys in the locality of Tutapishco.
  - As in the previous two localities, the inhabitants of this locality have great expectations for the implementation of the TUCAN3G project. The public workers (sectors health and education) are highly likely to use 3G technology; it would be a paramount importance in the daily application of their activities.
  - Transfer by river to the locality of Santa Clotilde.
- Day, September 21st, 2013:
  - Field work and consistence in the locality of Santa Clotilde, finished with Conducting demand surveys to 206 homes and local authorities.



- Day, September 22nd, 2013:
  - Transfer by river to the locality of Huitotos de Negro Urco, conducting demand surveys to 40 homes and local authorities.
  - Transfer by river to the locality of Tutapishco, conducting demand surveys to 44 homes and local authorities.
  - Transfer by river to the locality of Santa Clotilde.
- Day, September 23rd, 2013:
  - Transfer by river to Iquitos city.
  - Transfer by air to Lima city.

The following map shows the localities that the second work group visited:



**Figure 43: Map of localities that the second work group visited**

Source: Google Earth  
Elaboration: Own

The following photo shows FITEL staff conducting surveys to inhabitants in the locality of Huitotos de Negro Urco.





**Figure 44: FITEL's staff conducting surveys to inhabitants (2 - Huitotos de Negro Urco)**

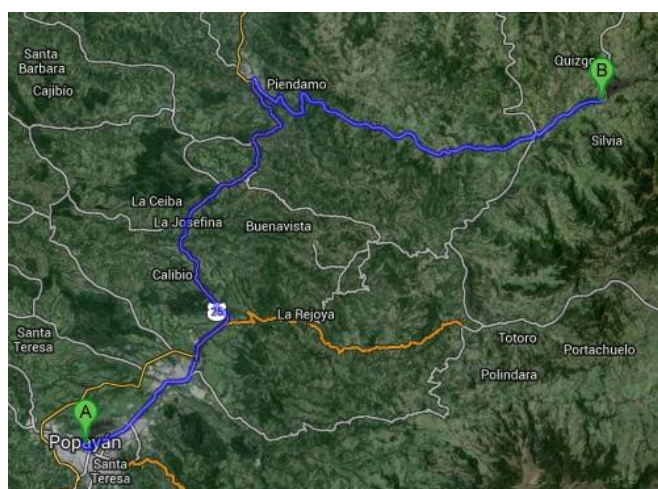


### 6.3 ANNEX 3: Private Users Survey Field Work in Colombia

Data collection was conducted in two cycles, the first cycle in the town of Silvia in September and a second cycle in December.

#### 6.3.1 Cycle 1

This first activity took place in the town of Silvia Cauca (59 kilometers from Popayan). Due to the distances to travel and the rush to gather the information, we decided to implement a strategy of convening a meeting with the partners of APROPESCA. We conducted group interviews.



**Figure 45: Silvia Cauca Google Map**

The method used in the information collection for APROPESCA was the group interview, since it allows general questions or group discussion among the respondents. For the survey in Silvia, it was decided to have a moderator who presented each question with its corresponding answer choices, and could make clarifications where necessary. Additionally, three researchers from CREPIC were also available to monitor the process of the survey. It was decided to use a moderator, thinking of the target population, since APROPESCA members are mostly peasants and natives and some are shy to answer questions that make them feel uncomfortable. Carrying out a group interview allowed the interaction among the respondents, if they felt uncomfortable to ask directly to the moderator.

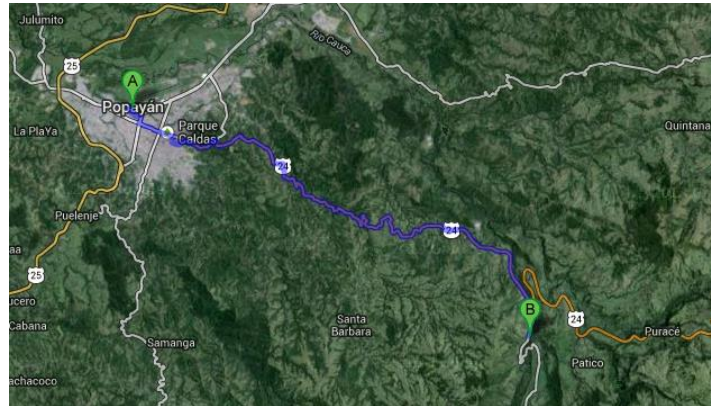


**Figure 46: Survey in Silvia Cauca**



### 6.3.2 Cycle 2

The second phase of interviews was conducted in early December with the indigenous community of Coconuco. We had three meetings with leaders of the indigenous community and worked together with an intercultural articulator in order to conduct the surveys.



**Figure 47: Silvia Coconuco Google Map**

- **Meeting 1 (December 13)**

Request for a meeting with the governor of the Indigenous Council of Coconuco. Carlos Dario Yace Tote

- **Meeting 2 (December 16)**

Meeting with Indigenous council member selected by the community in order to represent majorities



**Figure 48: Meeting with Indigenous Council Members of Coconuco**

- **Meeting 3 (December 21, 2013)**

Official presentation of the whole community council in Assembly



**Figure 49: Official presentation of the whole community council in Assembly**

For the second cycle of interviews in the municipal head of Coconuco, interviews were carried out in the traditional way, interviewing people in a personal way, with the help of Mr. Henry Guañarita, intercultural articulator, who is our contact with the community which is predominantly aborigine.