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## An Investigation of Phone Upgrades in Remote Community Cellular Networks

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## RESEARCH BRIEF – COMMUNITY CELLULAR

The majority of people who upgrade from 2G feature phones to data-enabled 4G smartphones do so in regions with greater urban development, because typically these areas have the necessary infrastructure to support 4G devices. In some rural and remote areas (areas with no 4G coverage and sometimes no cellular coverage at all) people elect to upgrade their device from a 2G feature phone to a 4G smartphone while skipping 3G altogether. This study investigates two such regions in the Philippines and Indonesia that first received access to cellular networks in 2013 and 2016, respectively to understand the extent of 2G to 4G upgrades.<sup>1</sup> The study also asked why people are choosing to upgrade to 4G even when no 4G coverage is available.

Using a mixed-methods approach, this longitudinal study looked at cellular phone usage data that indicated what type of phone models were in use. Fifteen semi-structured interviews of people who had recently upgraded their phones in the Philippines complemented the quantitative analysis. Based on the analysis of the findings, this research concludes that cellular companies should concentrate on implementing only 2G and 4G networks in remote, rural areas of the countries under consideration. Based on the increase of 4G phones, companies may choose to focus on 4G only because of its potential for profitability, especially if done in conjunction with the deployment of mechanisms to accelerate the uptake of 4G smartphones in rural areas. This study is significant because it outlines the realities of people from rural, remote regions and the constraints to 4G smartphone adoption that could limit the introduction of services such as mobile money applications and other services for financial inclusion.

The research design integrated both a quantitative and a qualitative approach to investigating phone upgrades in rural and remote regions of the Philippines and Indonesia. Data was collected from two community cellular networks (CCNs) installed in remote areas of the world. CCNs are unique in that local agents own and operate them independently from existing telecoms and they are usually located in rural areas that do not have cellular coverage from existing telecoms. The research sites were Barangay San Andres in the Philippines (data collected from April 2016 to April 2017) and Bokondini, Papua in Indonesia (data collected from August 2014 to April 2017). This study analyzed Type Allocation Codes (TACs) logs that indicate the type of mobile device in use, and this information was cross-referenced with the International Mobile Subscriber Identity (IMSI) to

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<sup>1</sup> This research brief is based on the following paper: Kushal Shah, Philip Martinez, Josh Blumenstock, Jo Dionisio, and Kurtis Heimerl. 2017. An Investigation of Phone Upgrades in Remote Community Cellular Networks. In *Proceedings of the Ninth International Conference on Information and Communication Technologies and Development (ICTD '17)*.

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determine phone upgrades. The researchers also used this data to determine if multiple SIM cards were associated with any given phone. These phones that utilized more than one SIM card were referred to as “shared phones,” however, it is likely that phone sharing happens on a broader scale than what was indicated by the observations. The TAC data showed information including marketing name, phone manufacturer, radios, model name, operating system, device type, and date of manufacture.

Complementary interviews were performed only in San Andres due to research constraints at the site in Bokondini. Participants were asked about their phone usage and upgrade behavior through topical interviews. The participants were grouped demographically by age, gender, occupation, and self-described familiarity with technology.

This research found that 4G smartphones were prevalent even when the local network did not support 4G data. During the research period, 4G smartphone adoption accelerated on both the networks in the Philippines and Indonesia, and the upgrades that accounted for this acceleration often went from 2G feature phones directly to 4G smartphones, bypassing 3G. On 2G networks, 2G feature phone users were more active than those who had upgraded to 4G. Demographically, those who upgraded to 4G smartphones were younger. The interviewees expressed a desire to upgrade in order to consume media, and they frequently repurposed their 2G feature phones for use by other family members. Repurposing and sharing of 2G feature phones was common practice for many in these regions.

Based on the rapid increase in the number of 4G smartphones on the networks, replacing older networks with 4G capacity and building new networks to support 4G smartphones could facilitate additional upgrade activity. Besides younger phone users’ desire to access better media, the deployment of infrastructure to support 4G smartphones could open up possibilities to smartphone-specific applications, such as mobile money applications. This type of service could especially benefit those who live in rural, remote regions and who have not yet had avenues to financial inclusion. Other limitations to 4G adoption would have to be overcome as well. Most notably, smartphones require a greater amount of energy to power, so modifications to and expansion of the existing power grids would be necessary to encourage 4G smartphone adoption. Finally, the devices themselves would need to be sturdier in their design. Some participants had multiple phone models because 2G feature phones withstood the elements better in addition to their longer battery life. The sturdier phones with longer battery life were especially valued by those who had to travel long

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distances and worked outside. Participants also expressed concerns about theft, and this could be an area of future study.

This study shows that upgrading to 4G smartphones in remote, rural areas goes well beyond personal choice and preference. Limitations to existing infrastructure (electric power and cellular networks) and practical concerns such as durability are important to the people who live and work in rural, remote regions. This study indicates that context-specific behavior and constraints must be understood in order to accelerate 4G smartphone adoption and disseminate the perceived benefits associated with such devices. With a better understanding of the use and adoption of mobile phones in rural, remote regions of Indonesia and the Philippines, better assessment of additional services such as mobile money applications can be made.