The Anatomy of Mobile Handsets: On the development of effective cell phone services

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Abstract: The pervasiveness of cell phones in emerging economies has converted these devices in an ideal platform to cater services to underprivileged communities. In recent years, international organizations and mobile software developers have made an effort, together with local NGOs, to understand the needs of disadvantaged groups. However, in order to provide adequate solutions with real impact, it is also critical to understand the types of handsets used in these countries. Failure to do so, will prevent services from being used by the people they were designed for. This paper presents a taxonomy aimed at characterizing cell phone features and understanding the types of services that could be developed. Using such taxonomy, we evaluate one-million handsets from subscribers in a Latin American emerging economy. Our findings show that in order to give coverage to large groups, services should use small amounts of memory, monochrome screens and simple connectivity features like SMS.

1. Introduction

In the last 10 years, the penetration rates of cell phones in emerging economies have experienced a steady growth, even leapfrogging landline infrastructures. For example, recent studies carried out by the International Telecommunication Union (ITU), show penetration rates of 96% in Venezuela, 42% in Kenya and 30% in India, as well as ratios of mobile cellular subscriptions to fixed telephone lines of 4.3:1, 25.2:1 or 9.2:1 respectively [1]. It is fair to say that cell phones are a pervasive technology in emerging countries across Asia, Africa and Latin America, and as a result these devices constitute an important part of the citizen's livelihoods.

In parallel to the growing penetration rates, we have also observed an important increase in the number of mobile software developers, international institutions and carriers interested in developing cell phone-based applications and services to promote economic and social growth. Initiatives like Vodafone's *Betavine Social Exchange* [2] or the Inter-American Development Bank's *Mobile Citizen Program* [3] focus on bringing together local needs expressed by NGOs working on the field with developers and partners that might live in different geographical areas and who may not be aware of the local needs. Both initiatives have successfully managed to identify important requirements related to urban security, education, community information or health in disadvantaged social groups in Latin America and Africa.

These initiatives demonstrate that in order to develop services with social or economic impact, it is important to first discover the local needs where cell phones could provide a solution. However, it is also highly critical to understand the most common features of the actual cell phones used in the region where the service is going to be deployed, in order to

avoid developing services that are either too technologically sophisticated or on the contrary, too backward.

To date, very little research has been carried out to classify and understand the features available on cell phones in different geographical areas. Such analysis would promote appropriate service design for specific regions by answering questions such as *"If I were to develop an application for an emerging economy that needs to use WAP and a camera, what is the percentage of the population that would have access to it, given their cell phone characteristics?"*. We believe that mobile developers, who often times tend to focus on high-end cell phones like smartphones, could benefit from such a study. In fact, by understanding local cell phone features, we might help assess whether common generalizations such as "*their phones are similar to ours*" or "*in Latin America, even poor people own very expensive cell phones with lots of features*" are misconceptions or actually apply.

In this paper, we propose a taxonomy for mobile handset features that classifies the main characteristics of cell phones in terms of programming features, service features, connectivity features and economic features. This taxonomy aims to provide a framework to understand, plainly, the types of services that could be developed given the existing mobile handsets in a specific country or region. Additionally, we present a case study that uses the proposed taxonomy and a dataset of 1 million IMEIs. An IMEI (International Mobile Equipment Identity) is an identifier that uniquely characterizes a mobile handset brand and its model. The IMEIs in our study have been drawn from a carrier in an emerging economy in Latin America[1], and are completely anonymous (they cannot be correlated to a cell phone number). The case study evaluates the taxonomy features across the one million handsets, and analyzes the types of services that could (not) be developed to serve large social groups in the emerging economy. Thus, the main contributions of this paper are twofold:

- A taxonomy based on features that classifies the main characteristics of mobile handsets.

- An in-depth analysis of the types of mobile handsets used by 1 million subscribers in an emerging economy in Latin America, and the services that could be developed for them.

The rest of the paper is organized as follows: Section 2 summarizes related work, Section 3 describes the mobile handset feature taxonomy, and Section 4 presents an in-depth analysis of the types of handsets among one million subscribers in an emerging economy in Latin America, and the services that could be offered. Finally, in Section 5 we describe our main conclusions and future work.

2. Related Work

Although previous attempts have been made at reaching mobile handset feature taxonomies, these tend to be either very general or hard to reproduce due to platform constraints. Schiefer proposed a general taxonomy to study the different classes of mobile terminals (notebooks, handhelds, smartphones and feature phones) and described each group [4]. Gansemer proposed a more complex taxonomy based on the ER Model, a relational database model and a product-specific database implementation [5]. The lack of a simple taxonomy to structure and organize the actual features available on the handsets clearly prevents us from understanding the types of services that could be offered given a particular set of characteristics. Our aim is to provide a feature taxonomy for mobile handsets that is both complete and easy to replicate by others so as to be able to share analyses and results in a simple manner.

[1] Based on the 2009 International Monetary Fund (IMF) World Economic Outlook Country Classification, www.imf.org/external/pubs/ft/weo/2009/02/weodata/groups.htm

In terms of analysis of the mobile handset ecosystem, most of the results in this area root from mobile advertising companies that analyze handset technology worldwide and profile users' behavior in an attempt to offer personalized services and ad campaigns to different markets. In fact, we have witnessed in recent years a tremendous increase in mobile internet traffic mostly from developed economies. This growth has sparked the creation of mobile ads companies like *Actionality, ScreenTonic, Enpocket, Quattro Wireless* or *AdMob*. Some of these have been recently acquired by large Internet or Telecommunication companies to carry out mobile analytics aimed at gaining a better understanding of the worlds'mobile ecosystem and trends. Other companies like *Wapalizer, Bango, Amethon* or *Mobilytics* focus more on analytical aspects rather than advertising, but carry out similar evaluations.

The mobile analyses developed by these companies are typically web-based i.e., the information about user behaviors and handset models is gathered when the user accesses information on the web (via mobile web or mobile wap browsers). Although results about the handset models around the world are publicly available in some cases [6,7], these statistics suffer from a major drawback: the bias due to the lack of information from users that do not have cell phones prepared to access the web or users that fear the costs associated with that access, who in the case of emerging economies constitute a significant percentage.

In this scenario, telecommunication companies can play an important role to help understand the types of handsets and their main features for all users in the mobile handset ecosystem. In fact, these companies have access to the updated IMEIs of their subscribers, which guarantees that a handset characterization and classification can be done for all types of subscribers and not just for those with access to mobile internet. Hence, our goal is to provide a replicable feature taxonomy for mobile handsets that allows to model users from all socio-economic levels in an emerging economy and to understand the type of services that could be deployed for this specific population.

3. A Feature Taxonomy for Mobile Handsets

We propose a taxonomy aimed at characterizing and classifying mobile handsets according to four differentiated groups of features: programming features, service features, connectivity features and economic features. Compiling these features for a specific geographic region will allow us to determine the type of services that can be developed to guarantee their usability by large social groups.

3.1 – Programming Features

We use two indicators to characterize the programming capabilities of a mobile handset. Studying these capabilities allows us to determine the programmability of cell phone platforms and how usable and accessible these are to developers.

3.1.1 – Memory. This feature characterizes whether the mobile handset has internal or external memory, as well as its size. The internal memory not dedicated to the phone's Operating System (OS), can be used to allocate applications and games that might be downloaded by the user or might be pre-installed on the cell phones. Some handsets also have external memory cards, which might provide additional memory space for personal use like pictures, ringtones, or in the case of smartphones even for executable applications.

3.1.2 – Operating System and Software Platforms. In terms of the Operating System, we have divided the mobile handsets into proprietary and open source software. Examples of open source operating systems are Google's *Android* or Nokia's *Symbian^3* or *^4* platforms. This type of operating systems is generally associated to smartphones, and allows for the

development of high-end applications and services ranging from location-based services to translation or driving routes applications.

On the other hand, we also evaluate whether the operating system provides at least one of the following: (i) an SDK for open source development like the *iPhone SDK*, *Nokia S40* series or Samsung's *Bada*; or (ii) a software platform like JavaME (Sun) or BREW (Qualcomm), to develop applications that can be downloaded to the mobile handset.

3.2– Service Features

These features explore the hardware and multimedia characteristics present on mobile handsets that might have an impact on the type and the quality of the service or application.

3.2.1 – Type and Resolution of Screen. This indicator characterizes the resolution of the mobile handset screen, as well as whether it is monochrome or color-based.

3.2.2 – Battery Life. This is another important feature of a mobile handset, especially for emerging economies where the access to the grid power is scarce. Specifically, we measure the talk-time battery life.

3.2.3 – Music Player. This indicator specifies the presence of a music player on the mobile handset, which can be used to develop music-based services.

3.2.4 – Camera. This indicator specifies whether the mobile handset has a camera available or not, which can be used to implement applications that use image capture.

3.2.5 – GPS. This feature determines whether the mobile handset has a Global Positioning System, which can be used to developed geo-localized services.

3.3 – Connectivity Features

The connectivity features provide an understanding of the types of connectivity with the outside world offered by mobile handsets. As with the other features, a good understanding of these indicators will clear the path towards the development of connect-to-others' services that are adequate to the majority of the users in an emergent economy.

3.3.1 – Type of Network. This feature indicates the type of network capability: 2G, 3G, etc. This indicator is of high importance when developing mobile wireless-based services given that 3G capabilities and higher allow for always-on data access and for high data transmission rates, which are necessary for demanding applications like live streaming videos.

3.3.2 – EMS. This indicator determines whether the mobile handset can execute the Enhanced Messaging Service, which is an extension of the SMS service with functionalities like text formatting and limited picture and animation support.

3.3.3 – MMS. This variable characterizes whether the mobile handset has the Multimedia Messaging Service enabled. This service allows the submission of videos, audio and pictures to other cell phones.

3.3.4 – Bluetooth. This variable specifies the presence of Bluetooth on the mobile handset, to allow direct connectivity to other cell phones or computers over short distances.

3.3.5 – Mobile Web and Wi-Fi. This indicator studies whether the mobile handset offers access to the web and the process used for such end so as to understand the quality of the navigation service. We evaluate the presence of WAP or WEB (HTML) browsers, and the

availability of Wi-Fi. In general, WAP browsers are simpler versions of HTML Web browsers. Its basic version (WAP 1.0) is text-based and has no security features. Its more recent version (WAP 2.0) is graphic-based, and offers a navigation experience almost similar to WEB browsers. While WAP browsers typically require the existence of a WAP gateway for optimized service, WEB browsers use standard HTTP over TCP/IP to connect to the web servers.

3.4 – Economic Features

We use a unique indicator to model the economic features of mobile handsets: *the price*. This feature characterizes the average price (in euros) of a mobile handset model. Mobile handsets that are acquired through a contract with a carrier are typically offered at subsidized prices or might even be provided for free. Thus, in order to represent the real amount that the subscriber spent on the cell phone purchase, we only consider subscribers that have a pre-paid option with the carrier as good proxies to model this feature. Although one might find that this selection limits the coverage of the analysis due to the elimination of the users with a contract, it is important to highlight that in emerging economies in Latin America, typically a 95% of the total subscriber population uses the pre-paid option.

Finally, in order to account for the difference in prices due to the *age* of the handset *e.g.,* the cost of a mobile handset that entered the market in 2005 compared to one that entered the market last year; prices have to be updated to the current year by taking into account the yearly CPI (consumer price index) in the emerging economy under study and the *year of entrance to the market* of the mobile handset. The price indicator attempts to capture the maximum amount of money that citizens are willing to spend on their cell phones. It is in fact an upper bound price, given that handsets acquired in second hand markets will probably be priced at smaller quantities.

4. Taxonomy-Based Handset Analysis for an Emerging Economy

In this section, we apply the taxonomy presented above to carry out an analysis of the main mobile handset features drawn from 1 million pre-paid subscribers at an emerging economy in Latin America. Given that the IMEI uniquely specifies the cell phone manufacturer, the model type and the country of approval of the handset, we identify the IMEIs of the one million subscribers and analyze the types of mobile handsets observed.

These subscribers, whose identities are anonymized, have been randomly selected from the total population of the country. As a result, we posit that the sample constitutes a varied representation and a good approximation of the types of cell phones across urban and rural environments. Our final aim is to investigate the basic handset features available to the population and to evaluate the type of services that could be developed as well as the percentage of the population that could benefit from such services (*coverage of the service*).

Figure 1 shows a histogram with the percentage of the one million subscribers that own a different mobile handset model. The *x axis* shows the brand and model of the cell phone and the *y axis* represents the *coverage* or total percentage of the population in the study that owns such a handset model. For clarity purposes, the Figure only shows the most and the least popular handset models in terms of coverage (out of a total of 400 handsets in the sample).

We can observe that, in general, the market is very fragmented with lots of different handset models owned by small percentages of the total population. The most popular handset is the *Motorola C139*, with the largest coverage among all handset models: approximately a 3.67% of the total population under study. This cell phone has a price of 16

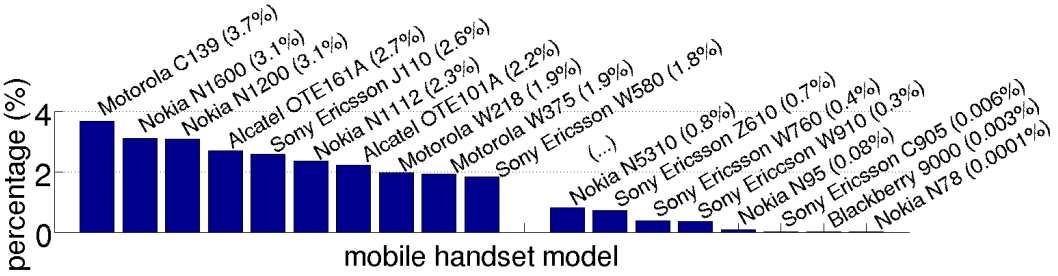

Figure1.Percentage of the population covered by different mobile handset types.

euros and very basic features: a TFT 65K color-screen, 96*64 pixels and no user-available internal or external memory. In addition, it relies on proprietary software and does not offer Java support, radio, camera, MMS or EMS. Thus, we can infer that the type of services that could be developed for this handset model must be voice- or SMS-based, since these are the only features available for communication. The other two most popular cell phones are the *Nokia 1600* and the *Nokia 1200* with coverages of 3.1% of the total population. Compared to the *Motorola C139*, these two models have 4MB of internal memory available. Additionally, while the *Nokia 1200* has a monochrome screen, the *Nokia 1600* has a 65K color-screen.

At the other end of the spectrum, we observe that handset models with the lowest coverage rates (below 0.006% of the total population under study) are mostly smartphones with average prices above 170 euros (see right hand side of the histogram in Figure 1). These handset models include the *Sony-Ericsson C905,* the *Blackberry 900* or the *Nokia N78*. Although not very popular across the population, these models offer all sorts of high-end features including 3G or 3.5G networks, 240*320 pixels-screens with 65K to 16M colors, internal and external memories available up to 8G, Java support, MP3 player, camera, mobile web, MMS and Bluetooth. It is obvious that these types of mobile handsets invite to the development of high-end services and applications, almost PC-like. However, it is important to highlight that these handsets are used exclusively by a very small percentage of the total population, and that any service specifically developed for such models will have low impact on the bulk of the population.

The following sub-sections describe in detail the *programming, service, connectivity and economic features* that we have observed across all the mobile handset models under study. For each feature, we evaluate two parameters: (i) the total *coverage of the feature i.e.,* the percentage of the population whose mobile handsets have that feature available (out of a total of one million subscribers), and (ii) the percentage of different mobile handset models where the feature is available (out of a total of 400 different handset models). We envision this type of analysis as a useful tool for mobile application developers that want to understand the availability of specific features across the population before designing useful and effective services for large social groups. Throughout our analysis, the features will be either *numerical features*, like the amount of internal memory available or the screen resolution, or *categorical features* like camera or MMS that simply state whether the feature is available or not on a handset model. For each numerical feature, the analysis will show a CDF (Cumulative Distribution Function) or a histogram describing the percentage of population and the percentage of handset models that share a specific value for that feature. For each categorical feature, the analysis will simply compute the percentage of the population and the percentage of handset models that have that feature available.

4.1 – Programming Features

Table 1 shows the percentage of the population (*%Population*) and the percentage of handset models (*%H.Models*) that have particular memory and software capabilities available for use.

We observe that around 51% of the total population has mobile handset models with internal memory available (58% of the handset models under study). In order to visualize the exact amounts of memory in stock, Figure 2 shows the CDF for the percentage of population and the percentage of mobile handset models with internal memory and the specific amounts available (in MB). As can be seen, approximately 8% of the population with internal memory available owns handsets with 1MB or less (around 6% of the handset models with internal memory); nearly 68% of the population with handsets with internal memory available have between 1MB and 5MB; 17% of the population (20% of the handset models) have available between 5 and 15MB, and the remaining 7% of the population with handsets with internal memory owns cell phones with more than 15MB. This 7% of the population is represented by almost 40% of the handset models (160 different models), which suggests a wide variety of mobile handsets with large memory for a small percentage of the population.

Going back to Table 1, we see that only around an 18% of the total population in our study has the possibility to add external memory. The typical external memory cards are M2 (Memory Stick Micro) and microSD, and offer sizes of 1MB, 2MB or 8MB. In terms of the Operating System, Table 1 shows that all the handset models under study have a proprietary OS. Among these, a 13% of the handsets offer open source development via an SDK, most of which are *Nokia S40 and S60* (which correspond to Symbian OS v9.2 and v9.3 that are not open source). In terms of software platforms, approximately a 41% of the total population has JavaME-enabled handsets. We have found no mobile handsets providing BREW.

From this analysis, we can determine that the development of applications for mobile handsets with open source OSs or with SDKs is of little use for this emerging economy in Latin America, since these services will cover a very small percentage of the population. Thus, developers should highly focus on understanding what type of SMS-based or JavaME-based applications could be developed. Additionally, it is critical for mobile software developers to understand that half of the population does not have internal memory available and that approximately 75% of the other half will not be able to download applications larger than a few megabytes (1-5MB).

Table 1:
Programming Features across handsets in an emerging economy. We evaluate the presence of internal and external memory, the type of OS, and the software platforms available.

Feature	%H. Models	%Population
Internal Memory	58%	51%
External Memory	36%	18%
Propietary OS	100%	100%
SDK	13%	5%
JavaME	53%	41%
Brew	0%	0%

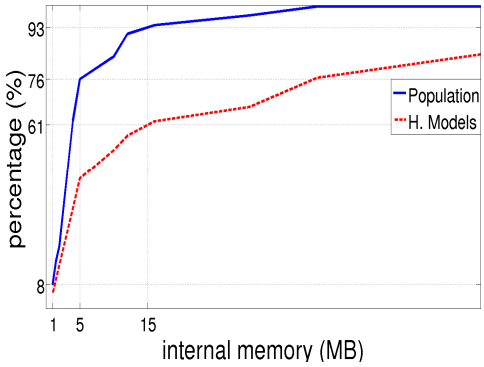

Figure 2. CDF for the amount of internal memory (MB) available in terms of (i) % of the population with internal memory and (ii) % of handset models with internal memory.

4.2 – Service Features

Table 2 shows a comparison of the service features in terms of percentage of population (*%Population*) and percentage of handset models (*%H.Models*) that share common characteristics. We observe that approximately 34% of the population owns mobile handsets

with a color screen. To better understand the colors available, Figure 3 shows the histogram for the number of colors observed across handset models with a color screen and across the population that owns them. We see that approximately 76% of the population with color-screen handsets has 65K colors (63% of the color handset models), 21% of the population with color-screen handsets has 256K, and the remaining 3% owns handsets with 16M colors.

In terms of screen resolution, Figure 4 shows that around 46% of the population under study owns handsets with screen resolutions of up to 96*68 pixels; around 42% of the population (26% of the handset models) has handsets with screen resolutions between 96*68 and 128*160 pixels; 11% of the population owns handsets with screen resolutions between 128*160 and 240*320 pixels and represent around 120 different handset models (a 30%). Finally, only 1% of the total population owns handsets with screen resolutions of 480*320.

Table 2:
Service Features across mobile handsets in an emerging economy: color and screen resolution, battery, music player, camera and the presence of a GPS.

Feature	%H. Models	%Population
Color Screen	69%	34%
Screen Resolution	see Figure 4	
Battery Life	see Figure 5	
Music Player	50%	41%
Camera	47%	30%
GPS	16%	2%

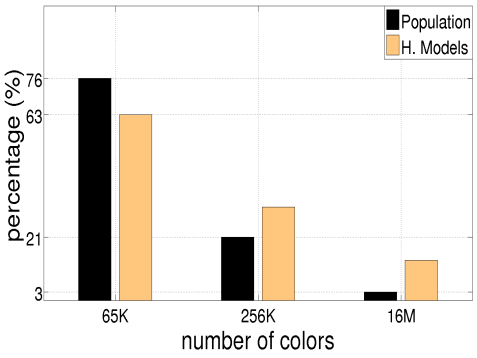

Figure 3. Histogram for the number of colors available in terms of (i) % of the population with color screens and (ii) % mobile handset models with color screens.

Figure 5 shows the analysis on the talk-time battery life. Around 42% of the total population (42% of the mobile handset models) has an average talk-time battery life of up to 5 hours; around a 26% of the population has between 5 and 7 hours; around 24% of the population has between 7 and 9 hours and the remaining 8% has more than 9 hours (representing an 6% of the handset models, around 24 different mobile handset models).

Finally, Table 2 shows that 50% of the handset models have a music player, 47% include a camera, and a 16% have GPS. In terms of population covered by these services, approximately 41% of the total population has access to a music player, around a 30% has a camera available (2/3 of which also have video), and around a 2% has access to a GPS.

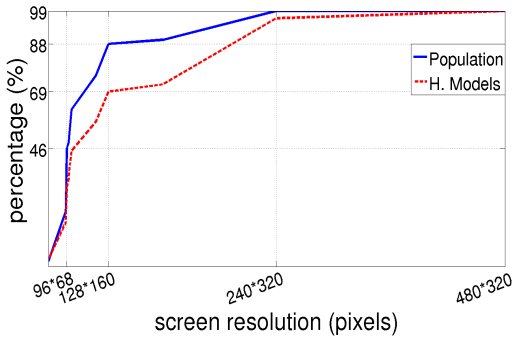

Figure 4. CDF for different screen resolutions across % handset models and % of population.

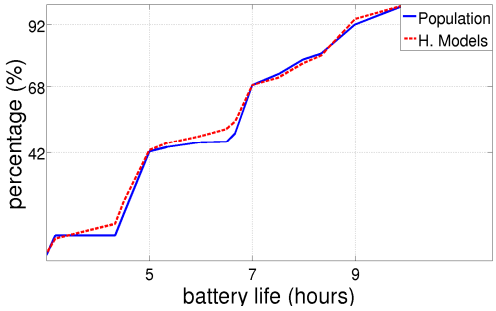

Figure 5. CDF for talk-time battery: % of handset models and % of population covered.

To summarize, we give a few hints on service and application development customized to the emerging economy under study. We note that applications and services based on color screens will fail to serve approximately a 66% of the population whose cell phones are monochrome and with resolutions of up to 96*76 pixels. Music players and cameras seem to be available to around 30-40% of the population, with a talk-time battery life of 5 to 7 hours for almost 70% of the population. Finally, GPS-based services are only available to around 2% of the population unless the service is run by the carrier itself, in which case any handset model can be automatically localized with the subscriber's consent.

4.3 – Connectivity Features

Digging into the main connectivity features shared by the mobile handsets under study, can give us an insight into the type of connections to the outside world that new services or applications on these cell phones could use. Table 3 and Figures 6 and 7 summarize this analysis.

In Figure 6, we see that almost 97% of the total population owns 2G handsets (and all have GSM systems). In terms of mobile handset models, 80% of them have a 2G network; 5% have 3G, and the remaining 15% have a 3.5G network. Although all mobile handset models under study have SMS service available, Table 3 shows that only a 25% of the population has access to the EMS service. A similar availability is found for MMS, where a 30% of the population under study has access to that service. Connectivity between cell phones or with other devices via Bluetooth is present for approximately 25% of the population. Finally, the mobile web feature is analyzed in Figure 7. Approximately 52% of the population under study does not have access to WAP/WEB capable handsets, 21% of the population (14% of the handset models) has access to WAP 1.x and 27% of the population has access to handsets with WAP 2.0. Additionally, a 15% of the population has access to both WAP and HTTP/HTML Web browsers. Finally, only a 0.18% of the population (11% of the mobile handset models) has Wi-Fi available on the handset.

To recapitulate, this analysis shows that 97% of the population only has access to 2G networks, 52% of the population does not have access to WAP/WEB capable handsets, and 99% do not have access to Wi-Fi connections through their cell phones. These results highlight that web browsing through mobile phones in this emerging economy is not available to almost half of the general population. Alternatively, voice-based browsing or SMS-browsing should be taken under consideration. On the other hand, EMS, MMS and Bluetooth are only available to 25%-30% of the population under study.

Table3:
Connectivity Features across handsets in an emerging economy: type of network, EMS, MMS, Bluetooth and Mobile Web.

Feature	%H. Models	%Population
Type of Network	See Figure 6	
EMS	22%	25%
MMS	47%	30%
Bluetooth	42%	25%
Mobile WEB	See Figure 7	

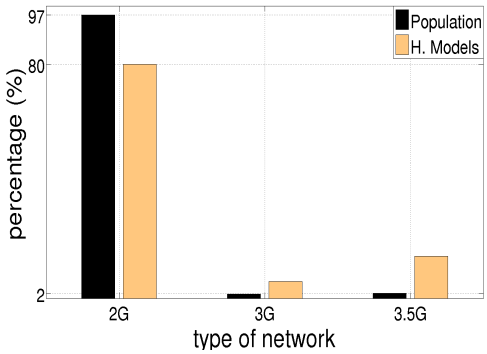

Figure 6. Histogram for the types of networks available in terms of (i) % of the population and (ii) % of mobile handset models.

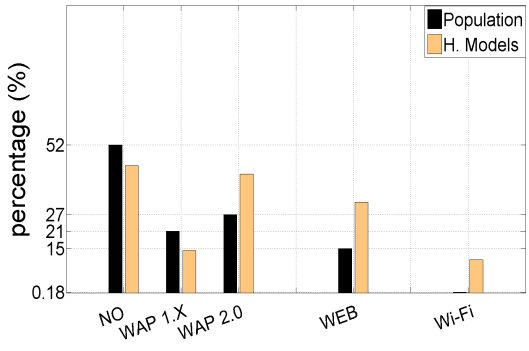

Figure 7. Histogram for Mobile Web access across % of mobile handset models and % of population.

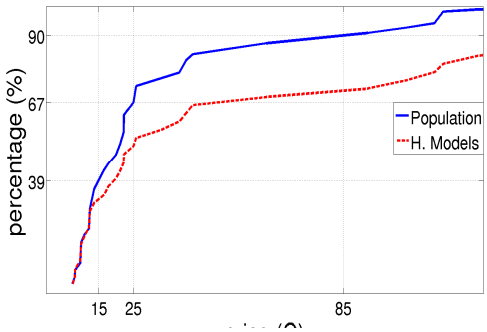

Figure 8. CDF for price feature in terms of % of population and % of handset models.

4.4 – Economic Features

Figure 8 shows the CDF for the percentage of handset models (*H.Models*) under study that cost up to a certain price, and the percentage of the population (*Population*) that spent up to a certain amount of money on their handsets. We observe that 39% of the total population has paid less than 15 euros to acquire their handsets (which represent 32% of the handset models). Around 28% of the population spent between 15 and 25 euros; a 23% spent between 25 and 85 euros, and the remaining 10% spent more than 85 euros on their handsets. In terms of *age* of the handsets, a 25% of the population owns a phone from before '05, a 67% owns a phone dated between '05-'07 and the remaining 8% owns cell phones from '07 to date.

5. Conclusions and Future Work

We have presented a mobile handset feature taxonomy that allows a relatively easy characterization of the features available on the handsets of a specific geographical region. The analysis of these features can then be used to suggest the types of services and applications that could be developed. Additionally, we have presented a case study that uses the taxonomy to understand the main characteristics of the cell phones from 1 million subscribers at an emerging economy in Latin America. Our results show that services that aim to cater solutions to a large percentage of the population should consider the small amounts of memory available (1-5MB), the widespread presence of monochrome screens, simple connectivity features like SMS, and the relative availability of JavaME and WAP.

We expect that telecommunication companies and mobile developers with a focus on emerging economies will find the proposed taxonomy useful and continue to explore its application to other countries. By sharing this information across developers it might be possible to achieve a clearer understanding of the types of applications and services that could be developed for different countries. Future work will focus on studying whether there exist correlations between the types of mobile handsets in a specific geographic area, and its demographic or socio-economic indices in an attempt to ensure a better service design for different social groups.

References

[1] ITU ICT-Eye Free Statistics, http://www.itu.int/ITU-D/ict/statistics/
[2] Betavine Social Exchange, http://www.betavine.net/socialx-web/cms/home/
[3] Mobile Citizen Program IADB, http://www.mobilecitizen.bidinnovacion.org/en/
[4] G.Schiefer et al. "Taxonomy for Mobile Terminals", International Conference on E-Business,'08.
[5] S. Gansemer et al. "Database Classification of Mobile Devices", IEEE IDAACS Workshop, '07.

[6] AdMob, Mobile Advertising Network, http://www.admob.com/
[7] GetJar, Coverage Statistics, http://stats.getjar.com/statistics/