Mobile Apps and Romanian Mobile Devices Users’ Preferences

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Abstract—During the last years the development of mobile technologies generated the formation of a new segment of software industry dedicated to applications for mobile devices. At their turn, mobile apps created new tendencies in software development but also generated important revenues at the level of the specialized industry as well as at global level. From this perspective, the present article, on one hand, describes an image of the mobile infrastructure, mobile applications and their users, on the other hand, includes a study regarding Romanian users of mobile devices in order to identify the types of applications usually employed in mobile activities, the time dedicated to these activities, the number of downloaded applications and their cost levels. We consider that the results of this study may be useful to mobile app users and developers, and mobile device providers.

Keywords: mobile devices, mobile platforms, mobile apps.

I. INTRODUCTION AND LITERATURE REVIEW

In the last years, the development of mobile technologies changed the image of communication infrastructure both at individual and corporative levels.

We all assisted at the rapid translation from traditional Internet connection to mobile connection, from web-based applications to app-based, from the client-server deployment models to SaaS and Mobile cloud models, from traditional websites to mobile ones.

It was easy to notice how the software industry developed a new segment of mobile technologies, thus generating a large number of applications and solutions for mobile platforms, also forming new user segments for them.

From these reason, it is useful to draw an image of the mobile environment, its infrastructure, users and specific applications, as well as their development and evolution.

A. Statistic picture of mobile infrastructure, mobile applications, users and usage

Mobile devices

In 2013, worldwide sales of smartphones to end users totaled 968 million units, registering an increase of 42.3% from 2012 and worldwide sales of smartphones (expressed in thousand units), depending on the operating system, were dominated by Android, followed by iOS, Microsoft and BlackBerry. Sales of Android smartphones have been estimated to one billion units in 2014 [1].

According to Gartner, Inc., in 2013 the most important smartphone producers were Samsung, Apple, Huawei and Lenovo. The same source indicates that 195.4 million tablets were sold, while the global tablet operating system market share was 61.9% for Android, followed by iOS with 36% and Microsoft with 21% [2].

Operating systems and browsers for mobile devices

Worldwide, from April 2013 to April 2014 the most used mobile operating systems were: Android, iOS, Series 40, Symbian OS and Samsung [3], while the most used mobile browsers were: Android 25.5%, iPhone 21.4%; Chrome 15.6%; Opera 12.3 % and UC Browser 11.1% [4].

In Romania, in the period April 2013- April 2014, the preferred operating systems where: Android, iOS, Series 40, Symbian OS and Windows Phone [5], and the most used browsers: Android, Safari, iPhone, Chrome, Opera and Nokia [6].

Mobile applications

Worldwide mobile applications generated approximately USD 12 billion in 2012, and it is forecasted to increase to over USD 60 billion in 2017, while downloads and paid applications were in continuous diminution at global level, representing only 10% of total downloaded applications [7].

In 2012, the most downloaded categories of mobile applications were: games (33%), widgets (8%), entertainment (7%), social (5%), communication, utilities (3%) [8].

In May 2013, the number of mobile applications available in Apple App Store, the online shop for iOS applications, was estimated to 850.000; in Google Play Apps for Android telephones 800.000 mobile applications were available; Windows Phone store had over 145.000 applications and BlackBerry over 120.000 [9].

In 2013, the indicated annual volume of downloads of mobile applications was 56 billion, of which Android from Google held 58% of total, iOS 33%, Microsoft Windows Phone below 4%, while BlackBerry only 3%. During the same year, 14 billion mobile applications were downloaded on tablets, as follows: 75% applications running on iOS, 17% for Android, 4% from Amazon and only 2% for Windows [10].

Mobile application downloads from the well-known stores reached 102 billion in 2013, while total revenues were of USD 26 billion. Free applications represented 91% of the total downloads of mobile applications: 60% of applications
available on Apple’s App Store and 80% of those on Google Play [11].

**Number of mobile subscriptions**

In 2014 the number of mobile subscribers is estimated at almost 7 billion worldwide, representing 95.5% of the world population. 14 countries from the world have over 100 million mobile telephone subscribers (China has the largest number of subscribers with 1.2 billions, while Mexico the lowest number from the top 14 countries with 102,700,000 subscribers) [12].

In Romania there were 22,910,000 mobile telephone subscriptions in 2013, resulting in 104.77 subscribers per 100 inhabitants [13].

**B. Mobile applications – overview**

In case of mobile applications (MA), specialized literature as well as software industry specialists provided a series of comprehensive definitions. Thus MA was defined as a “set of coded instructions used by a mobile device to solve a problem” [14] (Zamfiroiu 2014).

Another point of view regarding mobile applications is that they are considered software programs running on client-server architecture able to interrogate a web server and provide information to final users in a variety of forms depending on the technical characteristics of the mobile devices used [15] (Kim J., Park, Kim C., Lee, 2014).

There is a differentiation between Mobile Web and Apps in the specialized literature, they being classified as follows: “standard web apps (applications dedicated to desktop computer browsers), responsive web (applications with a responsive web design apply a different style), mobile web (websites dedicated to mobile devices), hybrid apps (mobile web applications packed into a native app), native apps (apps specifically created to particular features mobile devices)” [16] (Serrano, Hernates, Gallardo, 2013).

In case of mobile applications there was defined “four-tier architecture of data aggregation in mobile ecosystems: basic data to obtain system access, general usage data via OS, specific usage data via 3rd-party app publisher and aggregated data via 4th-party aggregator (e.g. household spending tracked by GPS, tour, time, and shops)” [17]; also, it is shown that mobile applications generate “a particular type of Big Data: highly personalized, rich data about consumers” [17] (Buck, Horbel, Kessler, Germelan, 2014).

The development of “mobile ecosystem” was carried out “from network operator-centered to platform-centered”, so that platforms as iOS, Android, Symbian, Rim, Bada, and Microsoft have developed their own mobile application stores operating as “online application distribution systems” open markets and which had a key role in simplification and multiplication of mobile app development. [15] (Kim J., Park, Kim C., Lee, 2014).

Mobile applications have a set of limitations generated by the mobile context, the connectivity, and configuration and characteristics of mobile devices (small screen size, different display resolution, limited processing capability and power, data entry methods). [18] (Harison, Flood, Duce, 2013)

In case of mobile applications ecosystem, a series of elements were defined, starting with the high diversity of mobile devices and platforms used, continuing with multiple forms of user login, data storage and restrictions on the data used. For MA, a series of specific rules were also identified which must be observed connected to the type and time of interaction with the user, the dimension and structure of the applications, reduction of the intake of available resources on mobile devices, security and portability on different mobile platforms. [19] (Zamfiroiu, 2012).

The development process of mobile applications is defined as the “process by which applications are developed for small low-power handheld devices which are either pre-installed on phones during manufacture, or downloaded by customers from app stores and other mobile software distribution platforms” [20] (Flora and Chante, 2013).

The lifecycle of mobile applications has also been defined as including four phases: “discovery, design, development and testing, deployment”. A second lifecycle model for mobile application development has also been developed and it contains six phases, namely: “identification, design development, prototyping, testing, deployment, maintenance (security, performance improvements, additional functionality, new user interfaces, etc.)” [21] (Vithani, Kumar, 2014).

Mobile applications have different characteristics from traditional apps such as “interface with other applications, handling device movement, mobile application types, cross-platform compatibility, varying hardware complexities, security risks, privacy, user interfaces, testing complexity, power consumption, 24/7 “always on”, personal mobile computer, development process, size of the application and size of the mobile phone screen”. [20] (Flora and Chante, 2013).

The quality of MA is influenced by a mix of internal factors (source code and used technologies, speed of controls and volume of data available) and external factors (depending on the developer of the application, the expectations of final users, type of distribution of MA, and technical and configuration characteristics of the mobile devices on which MA runs). [14] (Zamfiroiu, 2014).

In mobile application development, as well as in traditional software development “software reuse” practice is used, which supposes that the developer takes over the benefits as well as the disadvantages of reused applications. In case of mobile apps, reuse starts from class and library reuse, providing qualitatively enhanced versions of the application, developed in shorter time but also generating permanent dependence on the reused objects and a longer integration time of these in the final product. [22] (Mojica, Adams, Nagappa, Dienst, Berger, Hassan, 2014).
Was identified a stable relationship between the evolution of smartphone mobile OS market share and creation of mobile application developers’ community, indicating the influence of these communities on the evolution of specialized markets. [23] (Yu, 2013)

Mobile applications developers adopted several forms of business on the mobile application market, based on distributing the manufactured applications for increasing the profitability of their activities. The less preferred form is the distribution of applications free for downloading, while the profits of the develop result from the publicity placed on the user interface of the application. Another commonly used form is the online distribution of applications for a predetermined price through owner platforms such as Apple or Google that either charge certain percentage as royalty fee on sold applications or a one-time fee for opening a publisher account. The distribution of applications can be realized either directly through complete sales versions, or in free versions with limited functionalities. Taking into account the continuously growing number of mobile applications and the quick development of mobile technologies, the most suitable solutions for obtaining a profit from mobile application development is a mix of specific forms of distribution depending on the trends of the specialized market, type of applications and characteristics of final user. [24] (Rakestraw, Eunni, Kasuganti, 2013)

Final users find mobile applications available publicly online in mobile application stores that continuously grow in number. Mobile application distribution stores may be classified according to different criteria: stores specific for owner mobile platforms (such as Google Play, official Android app store, Amazon Appstore for Android, App Store -Apple’s official iOS application store, BlackBerry App World - RIM’s official BlackBerry app store, Microsoft’s Windows Phone Store), Operators App Stores (Verizon App Store, Vodafone AppSelect, AT&T App Centre, China Mobile, etc.), Manufacturer App Stores (Samsung Apps, LG Smart World, Lenovo App Store, Motorola Shop4Apps, etc.), Cross-platform App Stores (OpenAppMkt - Android and iPhone-compatible market, GetJar, Handster - across Android, Symbian, Java and BlackBerry platforms, Opera Mobile App Store, etc.) [25]

Another set of classification criteria of mobile application stores can be linked to the mobile platform, the regional level covered, the services offered for developers.

In this mobile apps stores the majority of applications are free to download in trial versions, while for complete versions or upgrading there is a payable fee. Another practice is the freemium monetization, used especially for mobile games through which accessing the game is free, but additional features must be paid for enhancing the gaming experience.

From Apple’s App Store a total of 50 billion apps were downloaded between July 2008 and June 2014.

The most popular categories of applications were games (19.06%), education (10.6%), business (8.4%), lifestyle (8.1%), and entertainment (7.75%). From Google Play App Store, a total of 25 billion apps were downloaded from August 2010 to July 2013 [26].

According to a study carried out by Vision Mobile, the number of mobile application developers is estimated at 2.3 million persons worldwide, of which Asia holds 32.9%, Europa 29%, while North America only 29.4% [27].

Countries of the European Union provided 19% of the global economy of mobile applications in 2014, showing a decrease of 25% in comparison to 2012, when it represented 25%. In 2014, the estimated production will reach USD 16.5 billion resulting from 2.9 million developers. At global level a tendency of increase in using Android platform is identifiable in application development, while iOS dominated the markets of handheld devices, Windows Phone is continuing to gain field in the preferences of the developers. 37% of mobile developers use HTML5 as a platform, while 83% of app developers develop applications for tablets. The most used mobile platforms Android, iOS and HTML5, followed by the second generation of BlackBerry 10, Windows 8 and Windows Phone, followed by Firefox OS, Tizen, Jolla, Ubuntu. More than 67% of developers create applications for end-users of which games bring the highest profit [28].

There were over 400 Romanian applications for iOS and the same number for Android platform in mobile app stores in 2012 and their number is increasing continuously. Taking into account the number of applications downloaded by Romanians on their mobile phones, they have installed a very small number of applications, only 4 -5 in comparison to Germany, Great Britain, France, Italy and Spain having the highest number of applications on their mobile platforms. Over 90% of Romanian users downloaded only free applications, and their preferred categories were applications for social networks, utility and information applications, games and entertainment [29].

This general picture regarding used mobile technologies, the number of users and that of mobile applications (categories, development and distribution, number and usage) may be considered as a presentation of the offer available on the software market segment dedicated to mobile environment. As a consequence, we considered useful to carry out a study on the other pillar of the mobile application market, namely the demand for these applications.

The study regarding preferences of Romanians in activities deployed in mobile environment and in using mobile applications was carried out taking into account this consideration.

We consider that the results of the study can be useful to mobile app users, developers and distributors from indie and corporative categories, but also to providers of mobile platforms and devices.
II. MOBILE APPS – STUDY REGARDING ROMANIAN MOBILE DEVICE USERS’ PREFERENCES

The aim of the study was to identify the typed of used applications, users’ behaviors in their mobile activities (time dedicated to these activities, number of downloaded mobile applications and their corresponding costs) starting from the available mobile infrastructure.

For carrying out the study, we used primary information sources resulting from responses to a questionnaire, as well as secondary resources resulting from statistical data, respectively offline and online studies.

The questionnaire was produced in web-based format and consisted of nine closed questions grouped in modular structure as follows:

- The first module regarded the socio-demographic profile of respondents: age, gender, education, field of professional activity;
- The second module aimed to identify respondent’s mobile infrastructure: type of available mobile devices, permanent access to mobile Internet connection, mobile platform/operating system used;
- The last module was dedicated to identifying the daily quantum of time spent in mobile environment, categories of mobile applications used (the mobile application categories named in the questionnaire were those from Google Apps Marketplace, being very comprehensive regarding the fields and types of activities), number of mobile applications downloaded monthly and costs of these downloads.

The study was carried out between December 2013 and May 2014. The sample for the research was selected using the method of simple random sampling. Population of the study consisted of 654 subjects, while the final sample included 522 persons. Invitation to complete the questionnaire was launched to the members of the sample included 654 subjects, while the final sample the method of simple random sampling. Population of the study consisted of 654 subjects, while the final sample included 522 persons. Invitation to complete the questionnaire was launched to the members of the sample using mobile and traditional social networks. 503 valid questionnaires were obtained which made up the analyzed database.

III. RESULTS AND DISCUSSIONS

Analysis of the data resulting from the first module of questions allowed the identification of a socio-demographic profile of respondents, according to which the mobile user is a man (51.7%) with age between 35-44 years (27.87%) (the other age categories in decreasing order were: 25-34 (25.01%), 18-24 (22.26%), 45-54 (18.78%), 55-64 (4.76%), and over 65 years (1.32%)); has university level studies (52.11%) (the following educational categories indicated by respondents were college (21.02%), high school (16.54%), post-university (7.88%)); he is a student (21.97%) or works in the field of sales or commercial activities (14.78%) (the other categories indicated by respondents in decreasing order of results were: production/manufacturing (11.76%), business services (10.54%), education (8.56%), research/academic (7.12%), ICT (5.87%), other fields such as health services, tourism and services, marketing and media, environmental services were indicated by less than 5% of the respondents).

The respondents’ mobile communication infrastructure results from the analysis of data from the questionnaire’s second module of and shows a very high percentage of smartphone owners (89.76%), 78.45% have a laptop, 32.11% a tablet, while iPad and e-book readers are owned by less than 10% of the respondents. It has to be noted the fact that 71.12% of respondents have a second mobile device, 42.11% have three mobile devices, while 9.89% own over three mobile devices.

The most used mobile platform is Android (40.12%), followed by iOS (29.34%), BlackBerry and Windows Phone with close to 11%, the rest of the operating systems being indicated by less than 4% of respondents.

A large segment of respondents indicated that they have permanent access to a mobile Internet connection from their mobile devices (71.14%).

The questionnaire’s final module of questions has led to the identification of users’ preferences for activities in mobile environment, starting with the daily time dedicated to activities in mobile environment, the categories of mobile applications accessed, implying also the type of preferred activities and continuing with the habits for downloading applications and budgeting their procurement.

The results obtained identify a segment of 43.89% of respondents for whom the daily time dedicated to online activities on mobile devices is more than 3 hours, followed by the category of respondents spending between 2 and 3 hours in such activities with 40.34%, while the rest of respondents spend less than one hour for this purpose.

From point of view of the mobile applications used in relation to the preferred activities, the main activity is communication (72.11%), followed at a considerable length with a percentages of responses between 20% and 40% by the categories games (38.56%), widgets (31.34%), tools (22.89%) and finance (21.03%). At the end of the preference ranking, with less than 10% of responses, the following categories were indicated: weather, educations, transportsations, news & magazines, medical and shopping (Table 1).

The answers regarding respondents’ habits in downloading the preferred mobile applications on a monthly basis show as the most important segment those who do not download at all mobile applications (31.24%), followed with relatively close percentages by those who download between 2 to 5 applications per month (26.12%) and those who limit themselves to download a single application monthly (22.76%). Users having well established monthly downloading habits represent smaller segments, only 15.76% for 6-10 monthly downloads and only 4.12% used downloading more than 10 applications monthly (Fig. 1).
TABLE 1 - CATEGORIES OF MOBILE APPLICATIONS USED

<table>
<thead>
<tr>
<th>Mobile apps categories used</th>
<th>(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communication</td>
<td>72.11%</td>
</tr>
<tr>
<td>Games</td>
<td>38.56%</td>
</tr>
<tr>
<td>Widgets</td>
<td>31.34%</td>
</tr>
<tr>
<td>Tools</td>
<td>22.89%</td>
</tr>
<tr>
<td>Finance</td>
<td>21.03%</td>
</tr>
<tr>
<td>Social</td>
<td>18.76%</td>
</tr>
<tr>
<td>Sports</td>
<td>17.89%</td>
</tr>
<tr>
<td>Travel</td>
<td>17.45%</td>
</tr>
<tr>
<td>Entertainment</td>
<td>17.44%</td>
</tr>
<tr>
<td>Music&amp;audio</td>
<td>16.13%</td>
</tr>
<tr>
<td>Media&amp;video</td>
<td>14.32%</td>
</tr>
<tr>
<td>Comics</td>
<td>12.76%</td>
</tr>
<tr>
<td>Books</td>
<td>12.05%</td>
</tr>
<tr>
<td>Business</td>
<td>11.90%</td>
</tr>
<tr>
<td>Lifestyle</td>
<td>11.09%</td>
</tr>
<tr>
<td>Weather</td>
<td>9.78%</td>
</tr>
<tr>
<td>Educations</td>
<td>9.65%</td>
</tr>
<tr>
<td>Transportation</td>
<td>7.34%</td>
</tr>
<tr>
<td>News&amp;magazines</td>
<td>7.22%</td>
</tr>
<tr>
<td>Medical</td>
<td>5.43%</td>
</tr>
<tr>
<td>Shopping</td>
<td>3.11%</td>
</tr>
</tbody>
</table>

The results obtained from the responses to the last question provided information related to allocating a monthly amount of money for acquiring mobile applications. The major segment of users prefers free apps (31.24%), and they do not pay at all for downloading applications.

At the opposite pole we have users paying more than 10 euro per month to buy mobile apps (4.12%), while the rest is divided between the categories with monthly payment of 2-5 euros and up to 1 euro (Fig 2).

Finally, it is possible to draw up the profile of the Romanian user depending on his preferences and habits related to activities carried out in mobile environment, user who is owner of a smartphone, but also owns another mobile device (laptop or tablet), uses as mobile platform Android, has permanent mobile Internet connection, and uses mobile applications from the following categories:

Communication, Games, Widgets, Tools, Finance, Social, Sports, Travel, Entertainment, downloading between 2 to 5 applications monthly and uses free apps.

IV. CONCLUSIONS

In a world where the development of mobile technologies imposed mobility both at individual and corporate level as an intrinsic element of daily life, and the development of mobile applications become an extremely dynamic segment of the software industry, it is very important that individuals as well as the business environment are able to maintain permanently updated the level of usage of products offered by these industries.

From this perspective, we consider that the results of this study can provide important information to users connected to mobile environment, to mobile application developers and distributors, as well as for mobile platform and mobile device providers.

Mobile application users can find here information related to mobile applications and identify tendencies in the usage of mobile platforms and development of mobile applications.

Developers of mobile applications, both indie and corporative, as well as distributors, based on the profile of the average Romanian mobile app user can identify the preferences of a geo-located segment of users regarding used applications, habits regarding activities deployed in mobile environment and those regarding the usage of free of paid applications. Based on this information, developers can define their development and distribution strategies for mobile applications, concentrating the efforts on preferred mobile app categories, but also taking into consideration the development of applications from other categories in order to generate demand for them.

Producers or providers of mobile platforms and devices, starting from the preferences of a regional segment demanding their products are able to identify strategies for covering the demand niches that have the lowest representation.

The limitations of this study are related to the level or representativeness of the population coming from a geographically limited region, but the results obtained may constitute a basis for comparing the results to other similar studies or as a starting point for studies extended from geographical point of view and by also taking into account other variables for analysis.

REFERENCES
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[23] [24] [25] [26] [27] [28] [29]