# The Next Paradigm Shift in the Mobile Ecosystem:
## Mobile Social Computing and the Increasing Relevance of Users

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***Abstract:*** Social computing has become the paradigm for the increasingly relevant role of users in the Internet world. In this paper, it is argued that mobile social computing will eventually cause an even bigger impact in the mobile ecosystem. We are already at the beginning of the "transference" of a significant part of Internet social computing usage to the mobile domain, where users are no longer passive consumers of content and applications, but co-creators and even innovators of them. However, mobile social computing will go one step further in the contribution to the development of the mobile ecosystem, since it will put the many situations of users' daily activities at the centre stage. To prove this case, this paper gathers available data and evidence on the patterns of mobile social computing usage and discusses user innovation and user empowerment in the framework of the current mobile ecosystem.

***Key words:*** Mobile social computing, user innovation, mobile ecosystem.

## ■ Introduction: from social computing to mobile social computing and beyond

Originating around 2003, social computing has become an important trend and driver of the information and communications industry and of the Information Society, at least from 2005 (PASCU, 2008a). It comprises today a range of applications that basically enable the co-generation of content by users and the re-use of data provided by them (MABILLOT, 2007; O'REILLY, 2007; PASCU *et al*., 2008). People have been using social

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computing to broadcast their lives, to keep up in real time with friends and particular interests, to create, change and enhance content, as well as to comment on, discuss and assess it. Beyond social networking, social computing applications have been adopted widely to co-create and provide both private and public services where users have discovered "the strength of weak cooperation" (AGUITON & CARDON, 2007); in the education sector, to build and share knowledge; in the healthcare domain, to support community of professionals and patients; in the governance area, to provide user-generated services or to monitor and report crime; and in the daily activities of companies, to improve knowledge management and innovation opportunities.

Sometimes referred to as mobile web 2.0 and born around 2005 (JAOKAR & FISH, 2006), mobile social computing replicates these usages of social computing and transforms them, adding the specific features of the mobile domain. It is defined as the range of applications developed to enable interaction, collaboration and sharing between users but with the essential characteristics that leverage the mobile context (PASCU, 2008a). Mobile social computing, in contrast to its static counterpart, uses context to profit from the information about the user's environment and to match content and applications to user's current situation and needs (DE VOS, HAAKER, TEERLING & KLEIJNEN, 2008). Therefore, it can be said that using and creating social computing content in the mobile environment is a first stage and that mobile social computing will evolve beyond being a complementary means of access to social computing applications while on the move. As an example of this future potential, users leave traces that can be used-anonymously and/or with privacy matters solved-as a way of sharing preferences and interests just by reading social computing content. Thus, even what could look like "passive usage" can be further exploited in the mobile domain. Fish [1] argues that the mobile device opens up the possibility of sharing 90% of the daily pattern, in comparison with a mere 10% in a fixed access web model or with just 1% in today's television limited interactivity model. Therefore, mobile combined with context-location as a prime, but not unique, example-represents the next social computing frontier.

Mobile social computing appears when the mobile ecosystem reaches a turning point in its evolution. The recent availability of mobile broadband connections, their increasing affordability, and the usability of new mobile

[1] Tony FISH on 'Bothered by 2.0" at:
http://opengardensblog.futuretext.com/archives/2007/05/bothered_20_by_tony_fish.html

devices are the necessary conditions now met to arrive at a critical mass of users of advanced mobile services (FEIJÓO *et al*., 2009). Within this new framework, mobile social computing applications are mushrooming (FEIJÓO, MAGHIROS & RAMOS, 2008) and many companies are racing to replicate the success of social computing in the mobile domain. They are companies already prominent in the Internet world, where typical examples are Facebook or Google, but there is much start-up innovation taking place, as well as more traditional mobile industries-operators and suppliers alike-as well as software (e.g., Microsoft) and hardware (e.g., Apple) industries. Some of these new mobile forms of creating and using content have already been taken up massively by users. Twitter is arguably the biggest example as the "ultimate presence indicator" [2]. Even a new word, micro-blogging, has been coined for those looking to grow their online presence and to extend brief thoughts and messages to friends and contacts. Consequently, a new panorama opens whereby mobile users take on new roles of service delivery. On the supply side, mobile social computing allows interested actors to use social innovation as a new resource for providing more useful and cost-effective private and public services and applications. New mobile techno-economic models take the user as consumer, as creator of content and as a source of inspiration; they consider the mobile device as the means to harness collective intelligence (JAOKAR & FISH, 2006).

However, the mobile ecosystem does not seem completely ready for such a revolution. It is still plagued with silo models and layers of intricacy very far from the loose interoperability and open standards model of web 2.0 (FEIJÓO, MAGHIROS, ABADIE & GOMEZ-BARROSO, 2009). The shortcomings of this current incarnation of the mobile ecosystem are so evident that a number of initiatives have been launched to drastically modify the "rules of the game". Among the private ones, Google supported Android, a mobile operating system prepared for "open applications" development, is probably the most notorious of these.

It is therefore highly relevant for the evolution of the mobile ecosystem to understand the changes that the adoption of mobile social computing entails as the most representative trend in an upcoming paradigm shift. To this aim, this paper is structured in four additional sections. The first will introduce in detail the phenomenon of user empowerment in the mobile domain, followed by a summary of available data on new mobile - social computing - usage

[2] "Microblogging: Tiny social objects", J. ENGESTROM talk given at *Reboot 9.0* and at *Mobile Monday* Amsterdam 2007.

patterns. The next section will examine the role of users as innovators. A brief analysis on the challenges for the present and future response of mobile industries closes the paper as conclusions.

## ■ Users' empowerment and the role of context awareness in the mobile ecosystem

The relevance of the role of users has been a constant in the mobile industries due to the personal nature of mobile communications as opposed to the previously prevalent fixed communications that were directed at a specific geographical "location" [3]. The continuous usage of this mode of communications soon developed into a personal relationship between the user and the mobile device, as the providers of mobile applications and the device suppliers discovered early [4]. It was logical then, that within the 2.0 paradigm (at least some of) the mobile users shifted from passive consumers to active producers and the device itself become a social artefact by which people connect to people and where interactions are marked by democratic expression, individualism, citizenship and creativity (GOGGIN, 2007; ORTIZ, 2008).

The evolution of the role of users has the precedent of social computing in the Internet. User-friendly sharing and collaboration tools distributed and available on a mass scale have created huge network effects. Social computing users are active participants in services and applications, co-producing content, determining reputation, giving feedback, sharing resources, contributing to innovations and producing collective intelligence. They enjoy applications with multiple, always-on, lightweight identities to build on weak links of acquaintance, common taste, activities and co-location. They can use collective intelligence for information gathering and forecasting, for learning and problem solving, for deliberation and for decision-making.

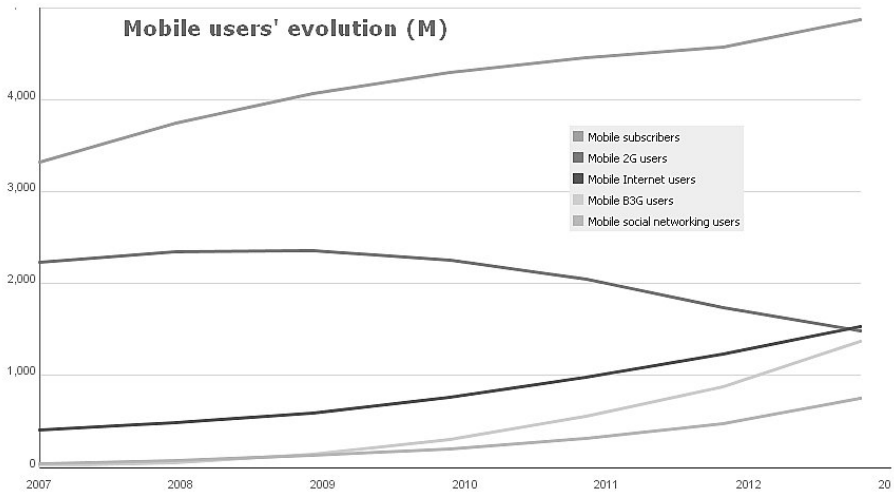
Turning back to the mobile domain, the same type of evolution is expected with even bigger network effects due to the higher penetration of

[3] As a simple example, consider the geographical numeration typical of fixed communications systems.

[4] Main examples are ringtones and wallpapers in the application side or personalised aspect of the mobile handset on the supplier side.

mobile devices, with about four billion people already using mobile phones worldwide at the beginning of 2009 [5], i.e., about three times more mobile subscriptions worldwide than Internet users. In fact, mobile Internet penetration [6] is steadily increasing. Penetration with respect to the total number of mobile subscribers (NIELSEN, 2008; WESTLUND, 2008) was 16% in the USA at the beginning of 2008, compared to 13% in the UK [7] and Sweden, 12% in Italy, 11% in Spain, 10% in France and 7% in Germany. In particular, mobile social computing is adopted by a fast growing small user base (PASCU, 2008b). The forecasts for the evolution of mobile social networking users are that it will reach the impressive amount of 1 billion users sometime around 2014, see Figure 1.

**Figure 1 - Forecast of mobile social networking users (Millions) in comparison with world mobile subscribers and mobile Internet users.**




*Source: own elaboration from 2008 data of ABI Research, eMarketer, ITU, Juniper Research, Informa Telecoms & Media, and Netsize.*

In addition to higher mobile penetration, mobile social computing will be more dependent on user's behaviour than conventional social computing due to the leverage of context. Context characteristics are typically derived from sensors-both users' bio-parameters and their physical environment-and

5 ITU World Telecommunication/ICT Indicators (WTI) database.

6 "Actively using mobile Internet".

7 Up to 23% if once a month (The Mobile Data Associations 2008).

from cognitive technologies [8] (KLEMETTINEN, 2007). Therefore, it is expected that user involvement in mobile social computing will open undiscovered usages and interactions. In practical terms, as mobile devices have rich sensing capabilities, they allow augmenting the real world commons with the Internet; they need only bear a small portion of the informational burden, while "the cloud" may carry most of it [9] (GRISWOLD, 2007). The mobile device will be, then, the natural tool to bridge the physical world surrounding us with the wealth of information on the net. However, it will be the user who is the one making decisions and using her/his preferences to create this link. It is in this sense that we could talk about an actual "user empowerment" in the mobile domain; it would be the user, through the mobile device, who will be placed at the centre stage connecting two previously separated "worlds". [10]

In summary, user empowerment will have a determinant role in the mobile ecosystem, not only because users are no longer passive consumers and have the possibility to become creators of content or to contribute to social networks, but mainly because they will put the many situations of their real daily lives at the core of mobile usage, using the mobile device as a tool between the real and the information/content/applications domains.

## ■ The new mobile usage patterns

At the end of 2007 (Ofcom, 2008a) there were 0.8 million mobile subscribers in the UK and 4 million in the US accessing social networking sites using their phones. Following this trend, the US has the largest

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[8] Cognitive technologies are used in a loose sense to "understand" user behaviour, user intentions and personal context. Strictly speaking, they are systems that perceive the environment and take actions that maximize the chances of success. For instance, semantic processing of text messages sent by the user would allow identifying whether the user can use voice communications at that very moment, she/he is in a professional situation, with friends, with family, planning to go to the cinema, to dinner, etc.

[9] An increasing number of solutions of the type "point and find" have been proposed to use the camera of the mobile device for instance to take a picture, carry out an audiovisual search ("cloud computing" style), match available information with the physical object and provide different types of information ("reality mining", "augmented reality") linked with the physical object.

[10] There are many examples of social computing and mobile augmented reality. One of the latest and more interesting concepts is Layar a “reality browser” where several layers of information originated in users (tweets, pictures, news, Wikipedia, social networks, etc) can be added on top of physical objects.

penetration of users accessing a social network *via* their mobile phones (4.2% of US mobile subscribers in March 2008), followed by Europe with 2.6% of mobile subscribers. In Europe, the UK leads (4.7%) followed by Spain, Italy and France (PASCU, 2008b). In comparison, (M:Metrics) 22 million users sent or received photos and videos in the US and 28 million in the EU in the same dates. All of these are very modest numbers compared to about a third of EU Internet users that engage in social computing activities, this figure exceeding one in two for people below 24 years of age.

Age is equally relevant in new mobile usage patterns. Those under 25 are currently the most active users of mobile social networking. In France, Germany, Italy and Spain, the age demographic with the largest percentage of use is 13-17-year-olds, whereas college-aged consumers (18-24) are the most avid users in the US and the UK (M:Metrics, 2007a). Gender issues are less explored but the few data available - UK, July 2008 - show that the proportion of male to female is 59% to 41% in mobile Internet general usage, a proxy for mobile social computing, compared to 52% to 48% in PC Internet (ComScore, 2008).

In the mobile domain, unlike Internet social computing, there are not many independent providers of information about the levels of data traffic that different sites are getting. As a proxy for that information, traffic from smartphones has significantly increased from 2008 and accounts for 25.8% of worldwide mobile traffic. The distribution of sites where this traffic is directed mimics that of the Internet, including the primacy of search engines and long-tail effects. Among the 10 most popular sites in the US, UK and Germany were 2 social computing sites and 2 user-generated content sites on average (Opera, 2008). Interestingly, there were no social computing related companies among the top 10 mobile Internet sites just a year previously (M:Metrics, 2007b). The most comprehensive data available about the mobile usage of the web come from the monthly reports published by Opera Software (McCATHIE-NEVILE, 2009). They originate in actual data about usage of Opera Mini [11], one of the major mobile browsers. Results are not representative for smartphones, since it is a browser for the so-called "feature phones", mobile devices with low and medium capabilities. However, these monthly surveys show, among other findings, that: web browsing is increasing with a yearly growth of 300% in the number of users; search and social computing are the most popular activities; local providers have leading positions, such as Vkontakte.ru - a Russian networking site;

[11] Opera Mini had in 2008 about 20 million users.

specific sites for mobile use are not in the first positions, suggesting that the users are more interested in having an experience similar to that of the Internet; and the long tail is highly significant, in only two of the first ten countries analysed, the first 100 sites represented more than 60% of visits.

In terms of activities of users as co-creators of content, using M:Metrics data from March 2008, mobile blogging seems to be the least common activity while uploading videos or photos is by far the most popular activity, in both the US and Europe. A survey (LAI, 2007) run amongst US students revealed that mobile phone and social networking usage are correlated, in terms of intensity and scope of use. Those people that spend more time on their mobile phones would spend more time on their use of online social networking. In addition, those who have broader use of mobile phones are likely to have more diverse activities in using online social networking. In the same vein, an online survey of 500 social networking users done by ABI Research in October 2008 displays that 46% of them have visited the main social networking destinations *via* a mobile device. The main activities (more than half of them) were checking for comments and messages from their friends, and about 45% have also posted status updates. The report suggests that consumers do not wish to create new and separate social networking profiles for the mobile platform, but instead prefer to access their existing social networking accounts on the go.

On the device side, LING & SUNDSØY (2009) have analysed how iPhone devices are used in comparison with other handsets. The data for their analysis was generated from anonymous records derived from actual traffic data of a total of 3917 Norwegian users. They conclude that users of the iPhone clearly used more mobile Internet data than did users of other phones. iPhone users downloaded approximately 35 megabytes per month, while general users downloaded about 2 megabytes. While nearly nine out of ten iPhone users had become mobile Internet users, about half of the general users never did so. They further come to the conclusion that iPhone users do not only use mobile for Internet more than other users, but they have altered their behaviour as a result of the adoption of the iPhone. They provide a threefold explanation: the socio-demographics of the iPhone users, the data plan subscriptions associated with them, and the usability innovations of the iPhone devices.

At this point, it is worth remembering that we are still seeing the profile of early adopters of new mobile applications and that there is a visible gap between intention to use and actual use, notable even in mature mobile markets.

In Finland, VERKASALO (2008) used a panel of 579 active smartphone users to show that the long-term intention of usage of web 2.0 solutions on a mobile device is a meagre 26.6%, falling to just 7.4% for short-term intention, and to a practical 2.5% for any type of usage (trials and active usage). The case of Finland is particularly relevant since it is considered to be a leading EU mobile market, technologically advanced and with a population ready and willing to adapt to new services. The explanation for these low results seems to lie in the combination of three factors: no value perceived (no need), pricing, and the existence of alternative devices, i.e., mobile devices have an advantage only in those situations that derive value from the ubiquitous nature of the mobile handset, and when alternative devices are not accessible or available. Gender and age seem to be mainly correlated with the no need factor. KOLMONEN (2008) has confirmed that flat-rate tariff pricing is a driver for the diffusion, while low usability is a barrier, especially the small screen resolution and the difficulties involved in typing.

A somewhat older study by AKESSON & ERIKSSON (2007) with 4339 respondents in Sweden, a similarly mature mobile market, also shows this gap between mobile users of any type beyond voice and SMS (38.3%) and users of 6 or more simple mobile services (6%), a proxy for the mobile advanced services users. Here, the main four reasons for non-regular use were the complications of mobile usage, lack of interest in trying out new technologies, pricing, and no interest in the services. Also in Sweden, carried out by WESTLUND & BOHLIN (2008), a representative survey of the whole population showed that mobile Internet use has an adoption gap of about 20% (people expressing their interest but not using it). They also highlight that a staggering 67% of Swedes do not show any interest at all in mobile Internet usage. The reasons lie along two dimensions: cost and user-friendliness/usability, including in the latter, again, the use of alternative devices.

As an example outside the EU, a survey of 1163 US respondents (RICE & KATZ, 2008) done in 2007 showed that demographics (digital divide factors, social support), privacy concerns, and prior communication technology use should also be included as factors explaining the interest of users in advanced mobile services. Japan is also a good example in highlighting the influence of demographics, culture and lifestyles. For example, BARNES & HUFF (2003) state that mobile Internet is highly compatible with the Japanese cultural values, in particular, enthusiasm for novelties and group conformity, which helps adoption once a technology reaches critical mass. Other authors (HERES, MANTE & PIRES, 2002) have

concluded that mobile Internet use has had a wide diffusion because the Japanese spend much time outdoors due to their small living space, which offers little privacy.

In addition, security, privacy and data protection are among the most cited concerns for social-location applications (IACHELLO, SMITH, CONSOLVO, CHEN & ABOWD, 2005); in particular, user control of the level of disclosure of her/his position (and other context data) is a key element in the adoption of these services, as recent surveys in the EU confirm (IPTS, 2008).

Summarising the results of this section, it can be said that new mobile applications are still in a very early stage of development and that mobile social computing, as a main instance of them, is being used mainly as a mobile extension of social computing and that the users therefore typically behave as co-creators. They also show that usefulness and ease of use are the most important aspects for service adoption, mobile services are still too complicated to use in general, and show, as well, the influence of the cost level.

## ■ Users as innovators and industry approach

The role of the user is given increasing importance in innovation processes (KEMP & FOXON, 2007). Especially with respect to ICT-driven innovation, the user is able to influence design processes and plays a crucial role in adoption of new services (SILVERSTONE & HADDON, 1996; SURKOWIECKI, 2005). User innovation, user-driven innovation, or, more generally speaking, value creation from users, refers to innovations developed by consumers and end users, rather than industry (VON HIPPEL, 2005). Users of products and services, both firms and individual consumers, are increasingly able to innovate for themselves and they enjoy an increasing range of creativity support tools, both at the individual and social levels (SCHNEIDERMAN, 2007). Using the social computing paradigm, individual users do not have to develop everything they need on their own: they can benefit from innovations developed and freely shared by others. On the firms' side, user-driven innovation could help companies develop products more quickly and well adapted to user's preferences. An increasing number of studies point to the need for firms to open up their boundaries

(BARANES, LESCOP, MADDEN & XU, 2009; CHESBROUGH, 2003; CHRISTENSEN & KJÆR, 2005; GASSMANN, 2006).

VON HIPPEL (2005) presents several examples in which users have been the main locus of innovation, mostly related to developing new characteristics of products in order to make them fit better with the ways in which these products are actually used. In the mobile ICT domain, PASCU *et al*. (2007) highlight that the key features of user innovation in mobile social computing are significant emphasis on communication, and the role of the user as a supplier, co-producer or even innovator of the service. Therefore, we could talk of three levels of user-driven innovation originated in mobile social computing: the results of mass social communication, the leverage of context and the production of new services. The first is the consequence of the "transference" of social computing to the mobile domain, the second uses specifically the mobile context as a differential feature and the third is related with the new open innovation practices of companies. Of course, in practice, all of them blend to a certain extent.

Citizen journalism, where users collect, report and distribute information about events, is arguably the major example of mass communication (CASTELLS, FERNÁNDEZ-ARDÉVOL, LINCHUAN-QIU & SEY, 2007). Also belonging to the user-generated content segment, using the mobile device as a camera is the most common form of content capture, followed closely by recording video clips (Ofcom, 2008b). Socio-political mobilisations are another effect "of network technology to horizontally distribute messages that resonate with the public consciousness in ways that are trustworthy" (CASTELLS, FERNANDEZ-ARDEVOL, QIU & SEY, 2004). All of these innovations profit from mobile being the device "at the point of inspiration" (JAOKAR & FISH, 2006).

Digital mobile footprints, where the user's activities and position in time and space are exposed, belong to the innovations derived from context awareness. The exchange of these footprints brings a new dimension to social computing. In fact, knowing when your friends are around and meeting people sharing the same interests is expected to drive the adoption by users of mobile social computing. The capabilities of mobile devices as environment sensors make possible the contribution of users to "reality mining" where all types of information are placed on top of physical entities.

Involving users as producers of innovation typically follows the well-known strategies of open source software development. It contributes by finding completely unexpected solutions that could not have been envisioned

by the provider alone (HÄMÄLÄINEN, 2008). It makes sense to build a community, since the innovation by users tends to be widely distributed rather than concentrated among just a few very innovative users. As a result, it is important for user-innovators to find ways to combine and leverage their efforts. Innovation communities can increase the speed and effectiveness of testing and diffusing innovations. They also can greatly increase the ease with which innovators can build larger systems from modules created by community participants. This model has been embraced by mobile operators (e.g., Vodafone's Betavine collaborative mobile innovation portal [12]), application providers (Google supported Android to provide an open operating system on mobile phones, so that programmers can jointly develop their own applications for specific needs worldwide in a free open source fashion) and device suppliers (Nokia is opening Symbian, its mobile operating system, and creating open research centres resembling start-ups [13]). The benefits of these user-centric environments are manifold (MAGNUSSON, 2003): users can contribute to achieve the precise service they want and players can reduce development expenses, learn about users, vitalise the innovation process and fulfil the large range of customer expectations.

This last effect -"long tail"- is what the authors believe will be more relevant to the impacts of user-driven innovation in the mobile ecosystem. Users may innovate immediately if they want something that is not available on the market and are able and willing to pay for its development (VON HIPPEL, 2005). Analysis of market-segmentation studies suggests that users' needs for products are highly heterogeneous in many fields. The recent success story of applications stores is an excellent example of the adequacy of the long-tail theory applied to the mobile ecosystem [14] and, again, of the relevance of the user in the mobile context.

Of course, mobile industries are responding and adapting to this shift. There are many (and increasing) examples of the supply of both open and proprietary platform products that offer user-innovators a framework upon which to develop and use their improvements. The main examples lie in the

12 http://www.vodafonebetavine.net/

13 See the interview with J.P. SHEN, Head of Palo Alto Nokia Research Centre in *COMMUNICATIONS & STRATEGIES*, no. 74, 2nd quarter 2009, p 117-123.

14 In July 2009, there were 65,000 applications in the iPhone App Store that have been downloaded 1.5 billion times. The iPhone App Store is being replicated by many other players in the value chain, for instance device suppliers (RIM's Blackberry) or software platforms (Android).

current race for the software framework to develop and distribute mobile applications. Interestingly, the practical strategies are very different; such as a proprietary scheme for the iPhone, an open platform approach for Android and an open development strategy for Symbian.

This "platformization" (BALLON, 2009) of the mobile industry introduces a new focus for control of the mobile value chain: the gatekeeper role. There are four main gatekeeper roles on the value chain (BALLON, 2009; BALLON, WALRAVENS, SPEDALIERI & VENEZIA, 2008): development environment, a set of development and hosting tools for third-party service developers; profile/identity management, a component that manages user data and user preferences for different situations; provisioning/brokerage, representing the reference point for end-users to retrieve, subscribe and use content and applications; and charging and billing. Control over one or a combination of these four roles can cause platform dominance within the mobile ecosystem. Therefore, new platforms are emerging trying to include as many of these roles as possible within them.

To complete the picture, there are three general possibilities to directly profit from user-driven innovation for (new) players in the value chain (VON HIPPEL, 2005): produce user-developed innovations for general commercial sale and/or offer custom manufacturing to specific users; sell kits of product design tools and/or "product platforms" to ease users' innovation-related tasks; and sell products or services that are complementary to user-developed innovations. Many of the new start-up companies in the mobile ecosystem are using one or several of these strategies. There are literally hundreds of examples [15] of companies offering custom development for any of the application platforms, selling their own platforms to ease the development in several of these platforms and, of course, marketing all types of testing facilities or application management tools.

[15] For a good sample of the latest activities of start-ups and innovators in the mobile domain check, for instance, the Mobile Monday community: www.mobilemonday.com

## ■ Conclusions and future challenges

Mobile industries have great expectations in mobile social computing. Market analysts [16] forecast that world revenues will grow from about 1 billion € in 2008 to 7-8 billion € in 2013 when this market segment of mobile content and applications will be third, after music and gaming. A part of these expectations is based on the advent of new enablers: the availability and increasing affordability of mobile broadband connections and the usability of mobile devices. Another part is a wish to translate the success of social computing to the mobile domain. This could remain more a desire than a reality, unless a number of transformations happen in the mobile ecosystem. Some of them are already in place. Ideas are flourishing in the supply side and innovators are definitively looking at the mobile side of social computing. A survey showed that, already in 2007, almost half of the mobile content and applications start-ups were aimed at this area (FEIJÓO *et al*., 2008). However, three main challenges persist from the authors' perspective due to the increasingly relevant role of users in the mobile ecosystem: how to tackle the complexity of their personal involvement, the unresolved issue of their impact on the mobile value chain and business models, and meeting their expectations while safeguarding their trust. These are discussed below.

In contrast with the paradigm of mobile communications, centred in voice and sms, the mobile 2.0 domain consists of a heterogeneous and fragmented digital ecosystem, according to FEIJÓO *et al*. (2009). In addition, the ecosystem comprises a diversity of users' involvements derived from the personal usefulness, or personal value for users, obtained from mobile social computing solutions as mentioned. Therefore, the heterogeneity of the ecosystem and the same "long tail" effect that attracts user-driven and open innovation are responsible for the difficulties in achieving the appropriate economies of scale that render profitability of investments. There is one apparent solution to this problem: the already-mentioned "platformization" of the mobile industries. We could even think about a number of standardised (open or *de facto*) platforms for the development of mobile social computing applications as an even better solution. This leaves, however, some hurdles pending. Many of the most interesting mobile social computing applications require information from other domains to be highly appealing to users and/or they need information either not available in the appropriate format or

[16] Own compilation from data of ABI Research, Berg Insight, eMarketer, Gartner, Idate, Informa Telecoms & Media, iSuppli, Juniper Research, Netsize and Strategy Analytics.

simply non-existing. There are many examples: a city council's information about free parking spaces, health records for wellness on-the-go applications, real-time traffic congestion information, detailed personal and user profiles that are private and secure enough, meaningful -and again secured- user bio-parameter information, and so on. Several actions would be needed then for mobile social computing applications to thrive further in the mobile ecosystem: developing the missing information, making it available and achieving an adequate (loose) framework for interoperability with a number of other domains.

The next challenge in the domain is the different origins and cultures of mobile market players and the clash among them for control of the value chain and business models derived from mobile social computing. In general terms, it can be said that the mobile industry focuses on how to generate additional revenues from mobile applications. Application providers on the contrary try to figure out how to use the mobile channel as an additional source of revenue. Nevertheless, in a story that has lately been repeated many times, mobile business has been traditionally characterised by the operators' prominent position, controlling things from network and services to applications and content. The problem is that the bottom-end rationale for this "walled garden" approach in the mobile domain persists: mobile infrastructures are a scarce and costly resource and, even more challenging, they are still not fully deployed with respect to coverage and capacity. However, the increasing pressure from demand to enjoy an unrestricted and wide choice of content and applications is causing an evolution of the business model for mobile carriers. This driver leads to envisaging the opposite model: the mobile operator as a mere provider of connectivity or a "dumb pipe". Here the revenues for mobile social computing applications would accrue to providers, enablers and brokers, in a scheme similar to that of broadband access to Internet. Between the walled garden and the connectivity models, there are intermediate possibilities, attractive enough since they could represent having, at least in part, the best of both worlds. All of them use, to some extent, the opportunity open to mobile operators to become wholesale providers of services for applications/content-related players. Additionally, mobile operators can also offer their own private brands to users [17]. The result of using this model resembles that of department stores or shopping malls. However, it has been the mobile

[17] Every major mobile carrier in Europe, i.e., Vodafone, Telefonica, Orange, T-Mobile, etc., has a portal of this type.

device suppliers that have first put this model into practice [18]. Nowadays, all of them are looking for new profits from the combination of innovative mobile content and applications with their portfolio of products and services. As stated by FEIJÓO *et al*. (2006), this introduces new paths in market evolution, but above all it is strongly influencing the users' perception in the value of mobile applications, increasing their expectations and the pressure for unbounded fruition of them. We could say that market power is rapidly shifting away from carriers and into application providers and stores. It is interesting to note that compared to the fixed ecosystem, there are some notorious differences. In the first place the net neutrality debate has not taken place in the same terms and both regulators [19] and players [20] reacted more rapidly to explore the alternatives. Secondly, the "platformization" of the industry and different players using different gatekeeper roles could lead to a much distinct ecosystem structure, potentially reaching a -delicate- equilibrium, although it could be the case of the platforms being just a transition stage leading to a flatter, i.e. like Internet today, structure where simply de facto standards are trying to be imposed on the market.

The final challenge is related to the serious difficulties of users appreciating the added value of advanced mobile services as presented in the section on usage patterns and discussed by several authors (AKESSON, 2007; DE VOS *et al*., 2008; VERKASALO, 2008). These barriers are there even though "smart" mobile devices, which enable the services, are increasingly well spread and accepted among the consumers. In this regard, Jenson (2005) has criticised the traditional mobile industry in general for applying a default thinking summarised in the phrase:

> "MMS is an extension of SMS and therefore a natural progression for the industry".

However, reality has shown it to be more complex and:

> "it seems all too easy to create products that misinterpret the true needs of the consumer and engender little enthusiasm […] marketing failures of both WAP and Instant Messaging [in the mobile world] should be an enormous cautionary tale".

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[18] Three of the most relevant examples are the iPhone – iTunes – App Store, the Android open operating system platform, and Nokia's Ovi platform for mobile services.

[19] FCC spectrum auction of digital dividend spectrum imposing “open application” conditions in one of the blocks (still to be seen its practical implementation) as a main example.

[20] Using as a main strategy the software in the device as a differential element in the mobile domain with regard to the fixed one.

In the same line of reasoning, the experience of the broadband fixed domain is not necessarily replicated in the mobile one (KIM & SUGAI, 2008). Reading the results on the positive side, these data also suggest avenues for future development: have enablers in place - mainly pricing and devices, and provide usefulness and value adapted to the (long tail of) user expectations. In fact, these surveys have found that the main motivation for using mobile for advanced uses was the experience of connecting to other people and to learn about new things, rather than to be entertained or surprised. Another finding of relevance from these studies was that the consumers need to find a context (place, environment, emotional situation, social relationships, etc.) for using these advanced services. The recent research of de VOS *et al.* (2008) confirms that "context aware service bundles with utilitarian elements have a higher perceived value than bundles with hedonic elements". As a summary, the fundamental driver for adoption of mobile advanced services seems to lie in the value perceived by users, and not in the traditional communication of technological innovation.

Overall, mobile is arguably the next strand in the evolution of social computing and it has an essential characteristic - the increasingly relevant role of the user. To reap its benefits poses significant challenges for the mobile industry. Learning from users (user-driven innovation), providing value for them in their daily activities and eliminating the still-existing barriers in the mobile ecosystem are the potential responses that, in addition, could build on the mass of early adopters of mobile social computing.

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