W3C Workshop Report: The Role of Mobile Technologies in Fostering Social and Economic Development

Maputo, Mozambique
1-2 April 2009

Executive Summary

This document presents the output of the W3C Workshop on the Role of Mobile Technologies in Fostering Social and Economic Development, held in Maputo, Mozambique on 1-2 April 2009. This workshop was organized by the W3C Mobile Web for Social Development Interest Group, part of the EU FP7 project Digital World Forum. During the two day event, the 70+ participants held discussions regarding the potential of mobile technologies in the development sector. The key outcomes that are expanded in this document can be summarized as follow:

- SMS is the technology that is the most easily accessible to NGOs, grassroots organizations and people seeking to deliver mobile services. However, in many cases, text can be a barrier (being inaccessible to people with low reading skills and being too limited for richer applications) and discovery is an issue.
- Voice applications are now attracting attention as they are providing a more natural way of interacting with people, and therefore lowering the barriers of ICT adoption. However, expertise, tools, and training are still lacking.
- Mobile browsing is now becoming a viable option to deliver richer content and develop more complex applications. Stable and reliable GPRS, when available, offers a relatively more affordable way of providing content to people. Richer applications, using images, and graphics such as icons, are also offering increased added-value services and easier access for underprivileged populations. Nevertheless, the lack of awareness both on how to use web technologies and build mobile web sites, and on the availability of tools is a blocking factor for a wider adoption by NGOs, grassroots organizations, and entrepreneurs. Roaming costs can also be seen as an obstacle in reaching the poorest sectors of the population.
- The lack of collaboration, cooperation, and sharing among people working in the field (NGOs, grassroots organizations…) is a major issue leading to the appearance of many competing systems and platforms to tackle similar issues. One - but not the only - major reason of this situation is the lack of visibility and awareness of what others are doing.
- Issues related to scalability, replicability and sustainability of ongoing and planned projects are quintessential and required the involvement of all stakeholders (government, entrepreneurs, NGOs, local communities). Providing services and information to the next billion users or so can only be accomplished in this fashion.

The participants acknowledged the importance of organizing such events gathering people working in the field, including technologists, industry representatives, and those

working in international organizations. A future instance of such events should integrate a pre-event session on demonstration, to show what is possible, as well as what are the existing tools, and how to use them. More focused themes might also be selected for discussion.

This document provides details on the audience, the organization of the sessions, the list of key outcomes, and the messages for the different types of actors in the domain.

Introduction

This document summarizes the activities and results of the W3C Workshop on the Role of Mobile Technologies in Fostering Social and Economic Development, held in Maputo, Mozambique on 1-2 April 2009. The workshop, part of the EU FP7 project Digital World Forum, was hosted by the Ministry of Science and Technology of the Government of Mozambique with the help of the University Eduardo Mondlane and Pandora Box Ltd, and generously sponsored by UNDP, Nokia, the World Wide Web Foundation and Bharti Telesoft (Gold Sponsors) and UNESCO, Opera Software, Microsoft Research and the Legatum Center for Development and Entrepreneurship (Silver Sponsors).

Background

After the first workshop in December 2006 held in India, and a second in June 2008 in Brazil, W3C has continued investigating the role that mobile phones and Web technologies could together play in providing life-critical services to underprivileged populations of developing countries. This led to W3C's participation in the EU FP7 project Digital World Forum which triggered the launch of the new W3C Interest Group Mobile Web for Social Development (MW4D IG). This group aims to identify the key issues and promising solutions to deploy Web content, applications and services on mobile phones to foster the social and economic development of rural communities and under-privileged populations of developing countries.

MW4D IG has 3 major objectives:

- Community Building: Create an inter-disciplinary community that gathers all the stakeholders: mobile players, academics from developed and developing countries, practitioners with field expertise (NGOs), international organizations with country-wide, continent-wide, or world-wide vision about the digital divide, ...
- Roadmap Definition: Identifying the key challenges and barriers of authoring, deploying and accessing ICT-based solutions on mobile phones is important, as well as investigating what are the potential solutions to address them
- Directory of Resources: MW4D IG also aims to develop a directory of resources that will serve as a tool for the community to share their projects and experiences.

MW4D IG has been running for 10 months and plans to release its roadmap during summer 2009. In order to provide feedback and material to the MW4D group, W3C organized this third workshop on the role of Mobile Technologies on Fostering Social and Economic Development to gather input from the community at large, evaluate evolution in the domain since last event, and capture specific input from people working in sub-Saharan Africa.

Format

The workshop met for two days and consisted of 7 substantive sessions, an opening and closing session, and the two keynote sessions. The aim of the event was mostly to brainstorm and discuss topics related to mobile communications and the mobile web. Each session consisted of two to five short presentations of about 15 minutes each, followed by a long discussion period, usually 45 to 60 minutes long about the topic.

The 7 sessions were:

- M-health: role of mobile technologies in providing health information
- Technology: what are the different potential technologies to deliver content on mobile phones and what are their respective strengths and weaknesses
- M-Activism: using mobile phones in civil society-oriented applications
- Enabling environment: what are the key issues to create an enabling environment that will enable entrepreneurs, NGOs or any other organization to easily develop and deploy m-services
- M-banking: issues around using mobile phones as a platform for finance services
- M-government: issues for government to deliver services to their citizen using mobile phones
- M-agriculture: issues of delivering agriculture-oriented information to farmers using mobile phones

The workshop was co-chaired by George Sadowsky and Stephane Boyera (W3C).

Participants

There were a total of 87 registered participants. The audience background was very diverse:

- Academics
- Representatives of international organizations (UNDP, UNESCO, W3C,…)
- Representatives from the mobile industry (mobile browser makers, handset manufacturers, operators, ...)
- Representatives from state and government agencies (Mozambique, Brazil) engaged in m-government projects
- Members of NGOs engaged in field activities and project using mobile phones or other ICT platforms
- People with an anthropology and ethnography background

In total, approximately half of the participants had an international background, and half came from African countries (Mozambique, Zimbabwe, Ghana, Tanzania, Kenya, South Africa, Malawi…).

Key Findings and Major Challenges

The discussion during the two days led to the identification of some major challenges and key findings. These are described below.

About Technologies

There are currently many technologies that are used to provide applications and content on mobile phones. The major ones discussed during the event were the following.

SMS

SMS remains the dominating technology for now. There are some free and open source tools available that can be used to establish an SMS hub. The ability for an automatic system to provide information to (a group of) people by SMS is a very powerful tool that can deliver life-critical information in many domains (health, agriculture,…). The availability of SMS in all past and currently released phones makes it the most ubiquitously available technology.

However, there are also a number of limitations to SMS. The three major ones mentioned a few times during the workshop were:

- Discoverability: there is no easy way to let people know what are the list of services available
- Text: SMS provides text-based information only, and this is an issue, particularly for illiterate people, or people literate in a language not supported by operators/handsets (very few non-latin character sets supported yet on SMS). See the content section of this report for a detailed presentation of this issue.
- Cost: SMS messages, compared to e.g. data services such as GPRS, are very costly (up to 1000 times more per character) for the end-user and the service provider.

Voice

Several voice applications were presented during the event. This is clearly a promising way to provide information to people as voice is the most natural way for people to communicate (provide and receive information). Among the advantages of the voice channel are the ability to provide services in any language, the ability to have services accessible from any phone (mobile or otherwise), and accessibility for people with low reading skills.

There is also a series of issues and challenges for this delivery channel:

- Lack of tools and guidelines
- Costs of voice platforms
- High level of expertise required to design voice applications
- Difficulty to monetize services

Web

There were a few presentations and lots of discussions around Web access. One of the major outputs of this workshop, compared to previous workshops in 2006 and 2008, is that now Web access on mobile phones is becoming a viable option. For example, there is a free J2ME/MIDP-based mobile browser available on most low-end phones released today. This browser, using a compressed data format, is able to perform well on a low-bandwidth link such as GPRS.

A current major issue with Web access is the low level of awareness of the community, particularly among NGO and grassroots organizations, that such access exists and that tools to utilize it are available.. The discussions at the workshop, as well as some exploratory field studies that were presented during the event, showed that:

- The general perception is that data connections are expensive, while the reality is that GPRS can cost up to 1000 times less per character that an SMS, although there remains confusion around the billing model.
- The general perception is that the configuration of a data link like GPRS on phones is a very complicated set of actions, while the reality is that it is very easy, usually just an SMS to the mobile operator who configures automatically without human intervention the phone over the air.
- The general perception is that it is complicated to make a mobile web site online and available to all, while there are already integrated authoring tools, and no advanced technical ability is required to complete the task.

It is therefore essential to focus in the future on raising awareness on the potential and ease of exploiting the Web platform.

Another critical point is the low availability at the global level of stable and reliable GPRS connectivity. Many operators are now focusing on broadband coverage, while the reality is that GPRS would be sufficient at present to enable the market and the enabling of GPRS access does not require additional investment in infrastructure.

The potential of the Web was also mentioned as a way to advertise the work of grassroots organizations, NGOs, and local entrepreneurs by offering a wider visibility of ongoing projects, and potentially leveraging access to funding opportunities and to existing tools. It is also a way to share and collaborate with other organizations and projects. See the detailed analysis of this aspect in the Mobile ICTD Ecosystem section of this report.

Native Applications

A few applications based on Java and using GPRS were presented. Like for the Web, such technology, while offering a weaker abstraction layer from the operating system of the phones compared to the Web, allows the development of richer applications allowing e.g. transfer of annotated images, or use of icons, graphics or forms in the user interface.

However, the expertise required to develop such services — proficiency in the use of programming languages — is a strong barrier for those who are not technical experts.

Others

The use of USSD as a technology to deploy content was also discussed, and some pilots presented. Like SMS, this technology, while available on all phones, and not requiring any user configuration, has issue around discoverability of services. Moreover, the very low level of usage among phone users is another barrier.

Infrastructure Issues

There were a few discussions around the type of infrastructure and phones available all over the developing world.

Clearly the penetration of mobile phones is still growing very quickly in Africa, and mobile network coverage is also expanding quickly. As mentioned in the previous section, data connectivity is also improving, and now GPRS is often available, but is usually not very stable or reliable, particularly in remote areas. While mobile broadband connectivity is most probably the long/middle term future, there was a large agreement on the fact that the availability of those technologies is not a critical enabler for Web access.

Affordability of mobile services was also mentioned few times, particularly in the context of people earning few dollars a day only. Some potential solutions to reduce the costs of infrastructure and energy requirements through e.g. active and passive network sharing were presented.

Content Issues

A great deal of discussion took place around the challenges of delivering useful and usable content to people. Three major aspects were identified:

Locally relevant information is critical
Useful services are those which are providing locally relevant information. It is critical to have information services developed by people who are working closely with targeted communities, so that the needs of those communities are clearly identified, and local knowledge is used. Related to this point, a key aspect discussed is trust. People trust information if it is coming from a source seen as knowledgeable, and this is a critical point to leverage adoption of ICT-based services. This also underlines the importance of local ownership, which is a point developed in the Mobile ICT ecosystem section of this report.

Use of local languages is critical in most cases
One of the barriers to access information is the language in which the service is provided. While in some countries like South Africa English may be sufficient for most people,

most of the participants underlined the importance of the use of local languages and the mother tongues of targeted people to improve access and use of services.

There are still issues in that regard related to the availability of specific character sets, the support of Unicode by mobile operators, the tools (authoring tools and client-side tools), and the support of specific character sets by input devices (keypad).
Even in a context in which character sets are available, service developers are lacking expertise and guidelines on how to develop services that would be able to exploit them.

Text is a barrier
Many applications in different domains underlined the difficulties and limitations of using textual information. Text is a barrier in two aspects:

It is too complicated for people with low reading skills. This is a challenge that particularly affects underprivileged populations in developing countries where it is not unusual to have a 50% illiteracy rate. With such groups, the use of icons and voice content is often more effective in conveying information to people. In that regard, further work is needed on guidelines regarding how to develop meaningful icons, and deploy them using methods such as widget technology. How to mix audio annotations with graphical representations should also be explored.

At the opposite end of the spectrum, text is also a barrier for richer applications, and might not be sufficient to convey an appropriate level of information. In some applications, e.g. remote diagnosis of plant disease as demonstrated during the workshop, the use of images is critical. Such applications require more general data connectivity in order to work.

Considering the complementarities of different channels (audio/graphics/text), the Web is the only family of technologies (HTML, VoiceXML, SVG…) which allows an author to easily manipulate and display all of these types of information.

Mobile ICTD Ecosystem Issues

There was much discussion about how to enable entrepreneurs, NGOs and grassroots organizations to develop and deploy services/content on mobile phones. This section summarizes the key factors and challenges that have been identified.

Innovation
The most innovative services are coming from the ground up, operated by people who are working closely with communities, who can easily identify how a mobile service can enhance an existing way of working/living and/or providing a basic service to the communities. Relying on local knowledge is critical as is local ownership. It is essential that those working in the community can directly develop what they need, as simply and quickly as possible. If people are aware of the ease of developing m-services, and have access to training and tools that enable such services, those factors are most likely to simultaneously leverage the number of entrepreneurs, as well as the number of life-

critical services available to underprivileged populations. Enabling and empowering people are therefore critical steps. Essential actions here are raising awareness, training people on existing technologies, establishing guidelines that help them to achieve their goals, in addition to creating and making available tools which are appropriate, i.e. easy to use in the environments in which these people operate.

Scalability & Sustainability

Creating the conditions for new services to appear, as well as leveraging contribution from NGOs, grassroots organizations and entrepreneurs is essential as mentioned above. How to scale-up and extend a simple local pilot to cover a greater number of users and regions, and deliver an increasing amount of basic services to under-served populations are important issues. Extensive discussions took place on this topic during the event. There are in practice two competing options: vertical growth (i.e, top-down approach) and horizontal organic growth (i.e, bottom-up approach).

In regards to the former, a few systems, particularly for agriculture, were presented. Here, the idea is to design and test a pilot project on a specific area, and then increase the size of the pilot to cover a greater number of people and regions. By increasing in size, project complexity may well increase (e.g. differentiating what is relevant in one place and not in another) in parallel to the need for more expensive technical solutions (e.g. highly available, more powerful hosting servers) may arise. The advantage of such approach is the possibility to transfer the management of such systems to the public sector, and to have government taking an active role in service deployments and in insuring the sustainability of the system. Here, the principle of economies of scale is at work - while the unit cost of reaching additional users accessing public services decreases substantially. It is also a good way to get a macro view of what is happening in a region or a country on specific topics. The issues with such approaches include the challenges of replicability of these systems due mostly to their costs, the lack of local ownership, the lack of flexibility in extending the system, and the problem of adoption and trust by local communities.

With respect to horizontal growth, the concept is based on simple and cheap but powerful solutions that fill a well-identified need in a community. The scalability is achieved through replication. A few systems of this kind were presented during the event in different domains (health, activism…). The simplicity and the low cost of such solutions ease their adoption by organizations in the field and in communities, and also ease the customization. The development and adoption of specific systems is also needs-driven. The solution is replicated only when the need exists. However, the effectiveness of this option relies on two dimensions:

- The ability of organizations that are investigating a specific problem to identify existing solutions and how they can replicate and customize them. The current lack of documentation, collaboration, and sharing among organizations working in the field is one issue that retards this process. New projects usually redevelop complete solutions where they might have reused different existing modules or a slightly modified existing solution. As of today in different areas (health,

agriculture, activism…) there are dozens of competing platforms. One way to overcome this issue is to strongly encourage organizations to advertise their work on the Web, allowing people to complement and extend existing solutions. A modular approach might also help people to reuse pieces of technologies in different contexts (e.g. as presented, tracking events on a map, providing images for expert advice…).

- The second key aspect is aggregation. In order to provide a global view regarding specific issues, or to aggregate different sources of information for a better service, it is essential to gather information collected and used in the numerous small systems. For that aggregation to be possible, each platform or solution has to use an open standardized data format, and offer access to this data by others.

It was evident from presentations that NGOs were clearly being successful in launching and operating small scale services that were directly helpful to their constituencies, and that often some degree of horizontal replication of the technology to provide such services was possible and effective. However, the issue arises when a service reaches the status of a clear public good or is a basic public service (health, education) governments are supposed to provide. In this case, it is generally financially and operationally unsustainable for an NGO to scale its user base to the entire country. Providing public goods and public services to the billions of people that today have no access to them is the role of governments, and generally only government can sustain such a role. This does not mean that the private sector or NGOs do not have a role to play.

There is no doubt that the role of NGOs and governments are complementary. Government might wish to regard the NGOs as prototype laboratories for new and useful social and economic services, recognizing its responsibility for the ultimate scaling up of those that should be adopted nationally. Conversely, NGOs might see wisdom in becoming involved in public policy design and implementation, providing more voice to local and poor communities, identifying priority services and thus creating fertile ground for scaling up projects and reaching millions if not billions.

Business Model

Many of the meeting discussions focused on the sustainability of projects. While the issue of sustainability goes beyond service payments and cost recovery, in many cases, it is essential that providers of services[1] have a way to monetize their work. However payments should not be a barrier to the users.

How to monetize services largely depends on the technology used. The Web today does not support instruments like micro-payments that might be part of a solution. On SMS, while peer-to-peer payment is sometimes available, the implementation of payments without going through the operator is a challenge. The same is true for Voice applications. Further work on this topic is required.

[1] This is particularly the case for private services. However, as mentioned in the previous section, its rationale for mobile public service provision might be different.

With respect to the payment aspect, the choice of technologies is largely impacted by the business model. The voice channel is the most flexible one, where providers can either push content to people (e.g. callback, or sending content to voice mail boxes of users), and have people pulling it (calling a number to get the information). In mobile browsing, the user pays the connection to the service provider through his data service, while in SMS it is the opposite, in that providers pay for the information to reach the user.

Regulation and Policy

Outside of the technical barriers that could prevent people and organizations to develop and deliver life-critical services on mobile to underprivileged populations, there are also some regulatory context issues that impact positively or negatively on the domain. This was also discussed during the event. Intelligent regulation is a necessity to create an enabling environment that will maximize the abilities of entrepreneurs to expand the market with services, and minimize the negative effect of competition on consumers. Barriers such as a monopoly operator, excessive licensing regimes in some contexts (e.g. community local networks required to have licenses) can impact negatively the potential of entrepreneurs. At the opposite end, a supportive fiscal and financial environment, and the ability of entrepreneurs to access financial services can enable and increase the number of social-oriented services.

In terms of regulation, there is also an interconnection between financial regulations, financial institutions, and telecommunication regulations, and it is essential to create an environment that integrates these different dimensions, particularly in the domain of finance services implemented on mobiles.

Many developing countries have also established policies and strategies related to either ICT for Development and/or e-government. Although most of these policies predate the explosive growth of mobile technologies, many of them provide the enabling environment and framework to explicitly link ICTs to core development issues – and many of them such as Mozambique for example have already identified priority areas of work. Mobile technology initiatives focused on development should piggyback on these efforts if the ultimate goal is to reach the next one billion users.

Key Messages for Stakeholder Groups

This section structures the output of the workshop and summarizes its key messages based on the type of actors in the domain.

Operators

- The availability of data services is critical for content-rich (e.g. multimedia) applications. Low-bandwidth links such as GPRS are sufficient to enable many of these types of applications and should be expanded as quickly as possible
- It is essential that these links are stable and reliable, and available at low cost, for prepaid options as well as subscriptions
- GPRS access should be very easily configurable on all handsets
- Networks should be Unicode compliant, particularly for SMS transmissions, and should support the transfer of text in any language of the world

- Given the available income of targeted populations, it is essential for operators to work on models (e.g. active or passive networking sharing) to reduce the cost of mobile services and make then affordable for those earning less than few dollars a day.

Handset Manufacturers

- Access to services through icons or widgets is critical to decrease the barriers for a large number of potential users. Handsets should offer an open platform for such technologies
- All handsets should have at least GPRS access and a J2ME/MIDP stack or a standards-compliant browser
- Handsets should be extensible to support external/new character sets and to be usable in all languages of the world

NGOs/Grassroots Organizations

- It is possible today to use the mobile platform to develop services very easily. The leading technology for now is SMS, but it has lots of issues. Some richer options such as voice and web applications are alternate viable options. Organizations should make themselves aware of the possibilities and learn to exploit them.
- It is essential for NGOs and grassroots organizations to share, cooperate, collaborate and document their work and projects so that the whole community could benefit from the experience of others. In that regard, before engaging in new projects, organizations should investigate what is existing and what extensions are needed, without redeveloping pieces that are already available
- Projects and pilots should rely on documented open data formats that would allow aggregation of information from different small systems as well as provide a global overview on what is happening locally

Donors

- Donors should be careful in funding competing projects and in funding the development of pilots. Pilots should investigate new technologies or new usage, but should not focus of the development of new platforms that will compete with existing platforms with the same functionality. Such competition could lead to an increasingly expanding set of alternatives containing numerous non-interoperable non-compatible systems.
- Donors should focus on funding actions that would leverage local ownership, and empower and enable NGOs, grassroots organizations, and entrepreneurs to develop content and services on their own, without external help/funds. Such actions includes the development of modular, interoperable, free and open-source tools for authoring, deploying or accessing services, the development of local capacity building through training, and establishment of curriculum and training materials and modalities regarding the exploitation of mobile technologies.
- Donors should further explore the issues of scalability and replicability and work with national and local governments and local partners to make this happen on a public-private partnership basis.

- Donors should also be supporting information sharing in the space

Governments

- Government should ensure that regulations are not a barrier for the creation of development-oriented mobile services and related businesses.
- Governments should align their current ICT for Development and e-governance strategies with mobile technologies and basic public service provision.
- Government should focus on the mobile delivery channel as an increasingly useful and powerful alternative to deliver services to its citizens
- The Government and public sector should focus on building capacity in their country at the entrepreneurial, grassroots and NGO levels that will contribute to the development of services in cooperation with the public sector.
- Governments should view the development of mobile applications by NGOs favorably, and should understand that some provide a public good that should ideally be made available to the entire population of the country. The best way to ensure that such scaling occurs and that the resulting service is sustainable in the long run is for government to become involved in providing it.
- The availability of specific fiscal and financial help for entrepreneurs willing to enter the domain might leverage the number of available services.

Academics / Standardization Organizations

- Monetizing services is an issue, particularly on the Web, and micro-payment mechanisms within a mobile telecommunications context might well be an important research/standardization topic
- Icons and widgets offer interesting and useful capabilities to leverage access to services for computer-illiterate people. Further work on how to design culturally relevant meaningful icons is needed, as well as how best to design and deploy widget-based applications
- Voice applications have great potential, but further work on e.g. authoring tools, and guidelines are needed
- Further work on how to author, deploy and access content in many languages of the world is needed
- Further work on using open linked data in mobile services to leverage aggregation and cooperation is needed

Education

- Training and capacity building is critical to enable and empower potential contributors of development-oriented services
- Curricula on mobile technologies for development should be developed in universities and elsewhere, both in developing and developed regions

Next Steps

As mentioned in the introduction, all the points discussed during the workshop will be included in the MW4D IG roadmap that will be released during the summer of 2009.

There were some discussions about organizing a future similar workshop and what form such an additional workshop or workshops would take. It might be useful to have a more focused event, either through a vertical approach (agriculture, health, or a horizontal one (tools, training…). It might also be interesting to include in a future event a pre-workshop session that would demonstrate practically how to implement applications using one or more of these technologies.