



A research agenda for applying Mobile 2.0 solutions for base-of-the-pyramid user communities

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"ICT is the single most important new development tool of our generation... this technology is so incredibly powerful that we should think about proactive public investments to create the network of public information... [to] accelerate the uptake of these very important technologies in very poor areas."

Prof. Jeffrey Sachs, ICT Sector Week, January 28, 2009

Power cycling

Two final-year students in Kenya have developed a bicycle-powered charger for mobile phones.¹ It might appear surprising that such a development would come from students at Nairobi University rather than one of the research laboratories of a major mobile phone company. After all, an R&D lab would have the resources and all the necessary components within easy reach whereas the two Kenyan students -- Jeremiah Murimi, 24, and Pascal Katana, 22 -- had to scavenge for parts in their local junk yard. A mobile phone company would have the resources to test out the product among in focus groups whereas the students worked with security guards on bikes on their university campus.

But, on reflection, it is probably not a surprise because the mobile phone company would not have perceived a need

for such a device in their own local community which is probably well-supplied with both charging devices and electricity.

The cost of charging a mobile phone in, say, the USA, would probably be a fraction of a cent whereas in Kenya, roadside vendors would typically charge around USD2 per phone. To this should be added the transport costs of reaching the nearest charging point. This story is a good illustration of the adage that "necessity is the mother of invention" but it also shows that, as the mobile phone revolution reaches down to the base of the pyramid, the types of innovation that are likely to develop are not necessarily the same as those popular among the early generations of mobile phone users in the developed world. In other words, mobile "2.0" developments in the developed world today do not necessarily provide a good basis for predicting tomorrow's mobile 2.0 developments elsewhere in

the world, and for that reason a tailored research agenda will be required.

The world's largest distribution platform

"By the end of 2008, there were an estimated 4 billion mobile phones globally. No technology has ever spread faster around the world. Mobile phones now represent the world's largest distribution platform... The next billion mobile subscribers will consist mainly of the rural poor."

World Bank, Information and Communication for Development 2009: Extending Reach and Increasing Access

The World Bank's Information and Communication for Development Report 2009,² *Extending Reach and Increasing Impact*, recognizes that mobile phones now represent the world's largest distribution platform, extending beyond the global reach of the electricity network, the banking network or even retail shops. The seemingly unstoppable progress from the 4 billion mobile phones worldwide reached at the start of 2009 to reach five billion, which will probably be achieved before the end of 2010, will require reaching out to the rural poor at the base-of-the-pyramid (BOP)³. That implies that the creative skills of people like Jeremiah and Pascal will be much in demand. This paper looks at how BOP user communities will increasingly shape the future research agenda for the mobile communications sector

In fact, this is already the case. As Figure 1 shows, ever since the world reached one billion mobile phone subscribers, in 2002, the majority of the new users added around the globe have been in the developing world. As such, mobile phones can be a "leapfrogging tool" for economic and social development (i.e. fostering growth at a faster rate than might be predicted by measures of economic wealth). Furthermore, developing country mobile markets seem to be evolving in a somewhat different manner than developed countries ones (Figure 2) being on the whole even more open to competition (comparatively speaking) than fixed lines ones⁴. By contrast, in developed countries, fixed line markets tend to have a similar

² See <http://go.worldbank.org/DMY979SNPQ>.

³ BOP is usually transcribed as "bottom-of-the-pyramid" but "base of the pyramid" is a better term to acknowledge the scale of the potential of this market segment.

⁴ On this point, see also the results LirneAsia's six-country study of market competition and regulation at: <http://lirneasia.net/wp-content/uploads/2009/03/annex-8-analytical-framework-de-silva.pdf>.

¹ See BBC News (24 July 2009) "Pedal power for Kenya's mobiles", at: <http://news.bbc.co.uk/2/hi/africa/8166196.stm>.

level of competition as mobile ones. This may be one reason why the gap between mobile market growth and fixed line growth is much greater in developing economies than in developed ones.

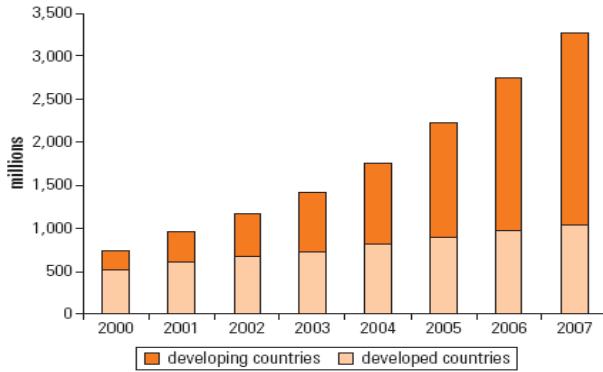


Figure 1: Mobile phones in developed and developing countries worldwide, 2000 – 2007, in millions

Source: ITU, World Telecommunication/ICT Indicators Database

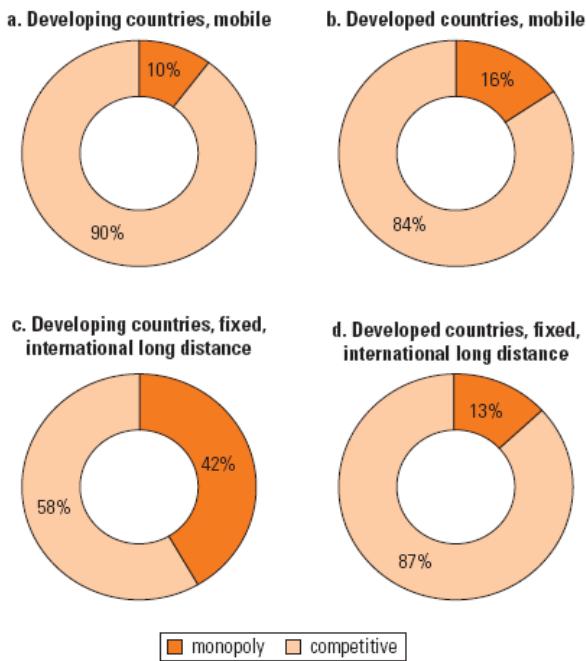


Figure 2: Percentage of markets open to competition, mobile and fixed worldwide, 2008

Source: ITU, World Telecommunication Regulatory Database; based on World Bank classification of economies

Why are mobile phones proving so popular in the developing world and is there any evidence that they are positively impacting socio-economic development? Evidence comes from both macro-economic and micro-economic sources:

- A study by Deloitte⁵ shows the high and rising contribution of mobile phones to GDP, reaching above 5 per cent, for instance, in Bangladesh, the Ukraine and Pakistan (Figure 3). The same study showed that mobile phones were also generating productivity increases, in particular through facilitating business expansion, employment search, entrepreneurship, mobile payments and reduced transaction costs;
- An Ovum⁶ study of the mobile sector in India suggests that some 3.6 million jobs have been created by the industry;
- Work conducted in India by Vodafone⁷ suggests that the benefits of mobile phones increase once a certain critical mass is passed, which is estimated at around 25 per cent of the population;
- The GSM Association⁸ has shown how mobile phones contribute massively to the tax revenues of governments in developing economies.
- At the academic level, there is a collection of recent research on “wireless applications for the next billion users” in a special theme issue of *info*⁹, with case studies of the benefits of mobile phone use in Liberia, Sri Lanka, Ghana, Jamaica and elsewhere.

Evidence of the beneficial effects of mobile phones comes also from micro-economic studies:

One of the best-known studies of the value of mobile phones was carried out by Robert Jensen¹⁰, in the early 2000s, which looked at their role in reducing information asymmetry among members of the fishing community of Kerala, in India. The extension of the mobile phone signal out to the inshore fishing grounds meant that boats out at sea could optimize the selection of which market to land their catch, thereby reducing waste, improving the profits and

⁵ Deloitte & Touche LLP, 2007, Economic Impact of Mobile in Bangladesh, Malaysia, Pakistan, Serbia, Thailand & Ukraine.

⁶ Ovum. 2005. Report on economic benefits of mobile services in India – a case study for the GSM association.

⁷ Vodafone and Indian Council for Research on International Economic Relations 2009. India: the impact of mobile phones, available online at: http://www.vodafone.com/start/media_relations/news/group_press_releases/2_009/icrier_report_on_india.html.

⁸ See, for instance, Vodafone 2009 “Taxation and the growth of mobile in East Africa, 2009, available at: http://www.gsmworld.com/our-work/public-policy/regulatory-affairs/policy-recommendations-for-developing-countries/taxation_and_growth_of_mobile_east_africa_09.htm.

⁹ Info, Vol 11, No. 2, 2009 “Network development: Wireless applications for the next billion users”, Guest editors Amy Mahan and William Melody, available at www.emeraldinsight.com/1463-6697.htm.

¹⁰ Jensen, Robert. August 2007. The Digital Provide: Information Technology, Market Performance and Welfare in the South Indian Fisheries Sector. The Quarterly Journal of Economics. Volume CXXII, Issue 3. pages 879 to 924.

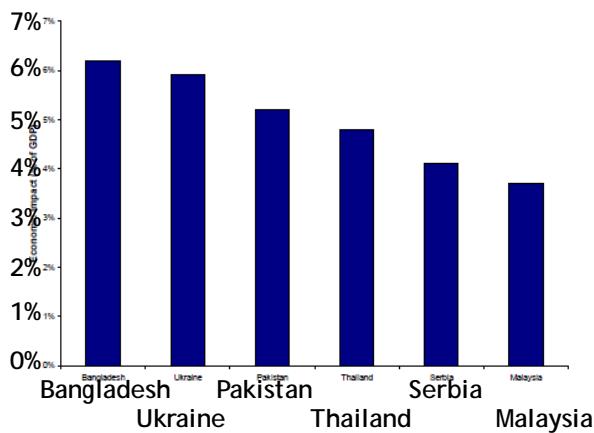


Figure 3: Contribution of mobile phones to total GDP, selected economies, 2007

Source: Deloitte, cited in World Bank (2008), "The role of mobile phones in sustainable rural poverty reduction"

- reducing the level of price dispersion between markets;
- Mobile phones can also be used to reduce market inefficiencies, as illustrated for instance by the case of

the Palliathya helpline¹¹ which uses mobile phones to increase access to information among rural communities in Bangladesh and to stimulate economic opportunities for under-privileged women;

- A McKinsey study¹² in China has showed how mobile phones can substitute for travel among itinerant workers, thereby reducing costs and delays;
- A growing number of applications optimized for the needs of developing economies is now emerging in fields such as mobile payments (such as M-Pesa in Kenya), agricultural market information systems (such as TradeNet in Ghana) or disaster relief (for instance, in Aceh Province, Indonesia).¹³

Towards a research agenda

Nevertheless, although a growing body of research is available on the impact of mobile phones in the developing world, it is

¹¹ See Communication Initiative Network, at: <http://www.communit.com/en/node/132155/36>.

¹² Enriquez, Luis; Schmitgem, Stefan; and Sun, George. February 2007. The true value of mobile phones to developing markets. Research in Brief. McKinsey Quarterly. <http://www.mckinseyquarterly.com>.

¹³ See World Bank, 2008, The role of mobile phones in sustainable rural poverty reduction, available at: http://siteresources.worldbank.org/EXTINFORMATIONANDCOMMUNICATIONANDTECHNOLOGIES/Resources/The_Role_of_Mobile_Phones_in_Sustainable_Rural_Poverty_Reduction_June_2008.pdf.

clear that there is much still to be discovered. To take a case in point, consider the recent widely-reported claims that more than half the world's population now has a mobile phone. This statement is derived from the fact that the number of mobile phone subscriptions (more than four billion) in use worldwide is now greater than half the population of the world (which would be about 3.4 billion).

But that assertion is based on the easily disprovable notion that mobile phone users only have a single subscription, or SIM [subscriber identity module] card each. If that were the case, then no country would have greater than 100 per cent penetration. The latest 2008 data¹⁴ on mobile phones suggests that more than 60 economies worldwide, including developing ones like Dominica, Panama or the Ukraine, now have more than one mobile phone subscription per person. In 2008, the United Arab Emirates became the first economy to exceed the 200 per cent penetration mark. As the technology advances, a growing number of mobile phone subscriptions will actually be used for communication between devices rather than directly by humans, such as a device embedded in a car that might send out a distress signal in the event of an accident, so these penetration rates will no doubt continue to grow.

So, we know that the number of mobile phones in circulation greatly exceeds the number of current subscriptions (old phones tend to end up in a drawer somewhere rather than being recycled) and we know that the number of current subscriptions exceeds the number of people owning them. But we can't say with any certainty that the number of people owning mobile phones exceeds half the world's population. Most likely it is above 2 billion but below 3 billion. On the other hand, the number of people with access to a mobile phone is almost certainly in excess of half the world's population, because of the phenomenon of couples, families or even whole villages sharing subscriptions.¹⁵

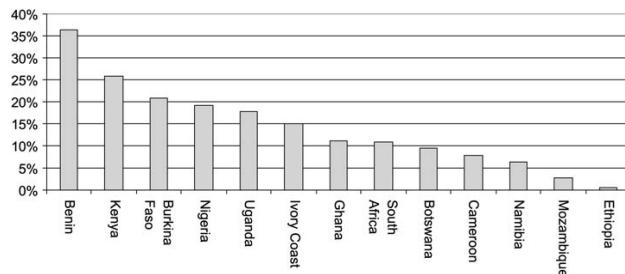


Figure 4: Ownership of multiple SIM cards, selected African economies, 2007

Source: Research ICT Africa Network (2008)

¹⁴ See <http://www.itu.int/ITU-D/ICTEYE/Indicators/Indicators.aspx>.

¹⁵ A more detailed discussion of this issue can be found in Sutherland, Ewan (2009) "Counting customers, subscribers and mobile phone numbers", Info, Vol. 11, Issue 2, pp6-23, available at: <http://www.emeraldinsight.com/insight/viewContentItem.do;jsessionid=A19BBC69E6AF8DBDE9A76753A9C57A3?contentType=Article&contentId=1775805>.

The issue of how many people own, or have access to, a mobile phone is of particular significance in developing countries where it is often the only form of ICT access available in many households. Operator data is useful, but discrepancies in how dormant subscribers are treated for statistical purposes may make it difficult to make comparisons. Assessing the extent to which universal service is being provided therefore requires using survey data, at the household or individual level. Work carried out by the Research ICT Africa (RIA) network (<http://www.researchictafrica.net>), based on household surveys, reveals a large range of variation in the ownership of multiple SIM cards, from 1 per cent in Ethiopia to over 35 per cent of the user base in Benin (see Figure 4).

As suggested in Figure 5, there is a considerable gap between what we know (or can find out relatively easily) for a particular market and what we don't know. Without accurate information on the actual number of subscribers, it is not possible either to derive statistics such as the age, gender or employment status breakdown of subscribers. Nor is it possible to assess the true number of non-subscribers, whether by choice or circumstance. For developing countries, estimating the level of affordability of mobile communications is also a challenge. Affordability does not necessarily equate to ownership. Some low-income subscribers may own a mobile phone (perhaps an older, second-hand model) but may use it only for incoming calls and may not have credit to make outgoing ones. Actual levels of access often greatly exceed those predicted by household income statistics, though usage may remain low.

Similarly, in the emerging field of m-Applications, it may be relatively easy to enumerate the types of applications available, the number of downloads, the traffic they generate or the number of customers. But it is much harder to evaluate their potential, for instance when transferring an application from one market to another, or to assess their likely socio-economic impact. Consider, for instance, the development of mobile payments systems, which have had mixed success in different African countries, depending, for instance, on the level of engagement or opposition from the traditional banking system. A particularly difficult methodological issue is to estimate displacement effects, such as the substitution of making calls for physical travel, or whether information obtained through an agricultural market information system might have been obtained in a different means (albeit with less accuracy or timeliness) or not at all. Displacement effects are important in calculating the mitigation effect that mobile phones might be having in reducing greenhouse gas emissions. While mobile phones may reduce the need to travel to find out information¹⁶, they may actually increase the need to travel to exploit the new

¹⁶ See, for instance, Akers, Jenny (2008) "Does digital divide or provide? The impact of cell phones on grain markets in Niger", available at: <http://www.cgdev.org/doc/experts/Aker%20Cell%20Phone.pdf>.

market opportunities that are discovered by making the phone call.

Sometimes the simplest questions are the hardest to answer. For instance, what is the global market size of revenue from SMS messages? It is probably more than US\$50 billion and less than US\$100 billion, but between those two it is hard to provide any more precision. Part of the difficulty is that mobile operators sell mobile services as bundled packages which include both calls and text, but increasingly they are also unwilling, for reasons of commercial confidentiality, to reveal details about their business models. Yet estimating non-voice data is a crucial component in forecasting the potential market for other, more advanced services, like mobile broadband, mobile TV or other applications. The price of an SMS message varies by orders of magnitude from one country to the next, but there is evidence of a high-level of demand elasticity. The Philippines, for instance, has some of the lowest prices worldwide for SMS traffic but it also makes some of the highest contributions to operator revenues. In South Africa, the MXit (www.mxit.com) application for social networking over mobile phones has gained more than 10 million users and generates some 250 million messages per day using a form of instant messaging over GPRS-equipped or 3G mobile phones that is similar to SMS but with a wider functionality. This suggests that there is considerable scope to grow this segment of the market.

One of the factors that make forecasting the development of the mobile applications market in developing countries so difficult is the fact that the basic platform continues to evolve. Like the fixed line network a decade earlier, the mobile network is now undergoing a transformation in bandwidth, and in available devices to make use of that bandwidth. For instance, developing country markets are likely to skip whole stages in network evolution, jumping straight from 2G to 3.5G. Also, it can be observed that user-friendly devices like the iPhone can have a dramatic effect on user acceptance of mobile data applications.¹⁷ This will greatly increase the number of applications that become viable.

In the developed world, the experience of moving from narrowband to broadband on the fixed line network provides some sort of guide for what is likely to happen once mobile broadband becomes widely available at affordable prices. But in the developing world, the shift to higher bandwidth networks is largely new territory. Indeed, the MXit phenomenon in South Africa, or the success of the M-Pesa mobile payments system in Kenya, are both examples of what can occur where there is no pre-existing alternative platform for the service. There will undoubtedly be other applications

¹⁷ See, for instance, Ling, Richard and Sundsøy, Pål Roe (2009) "The iPhone and Mobile Access to the Internet", available at: http://lirneasia.net/wp-content/uploads/2009/05/final-paper_ling_et_al.pdf.

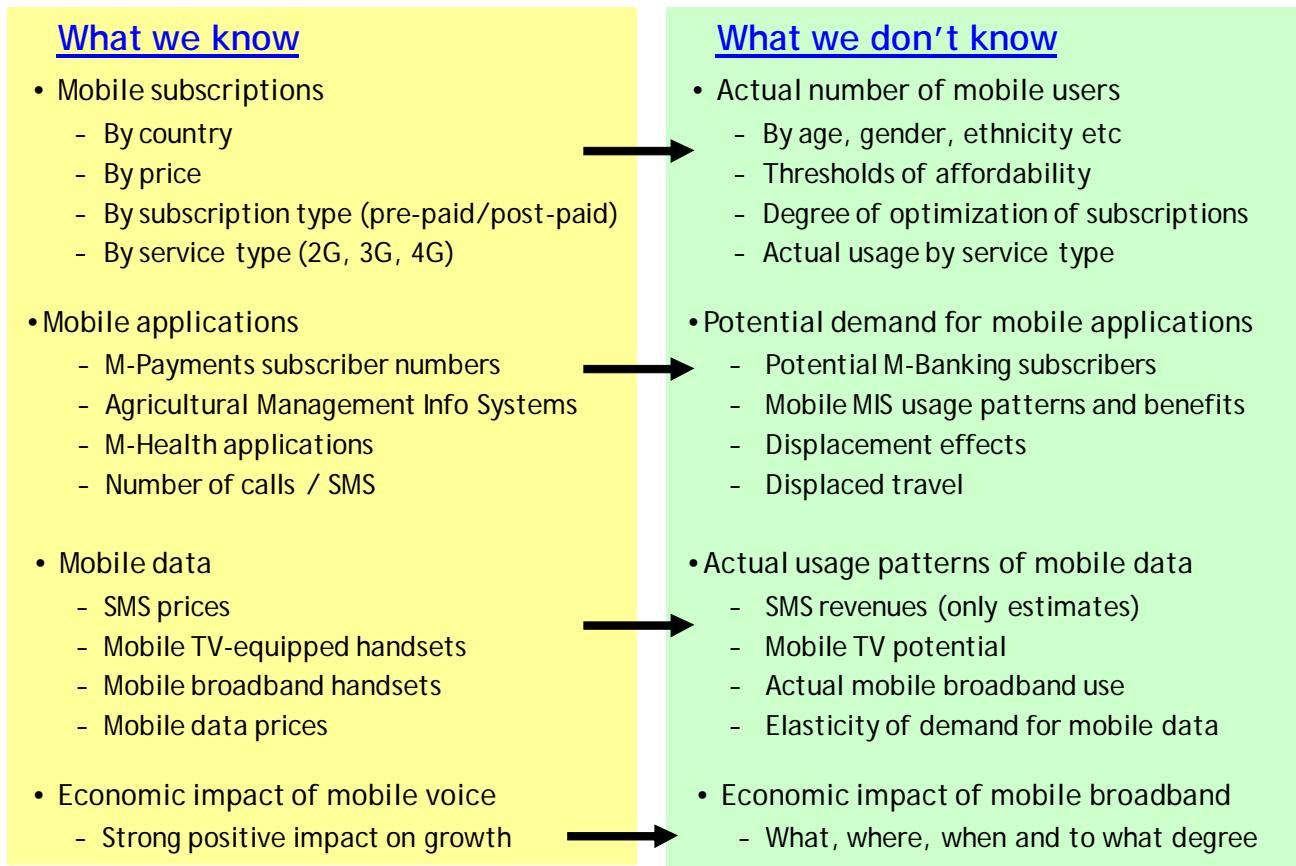


Figure 5: What we know and what we don't know about developing country mobile communications

Source: infoDev / World Bank

that flourish in the developing world without any precursors from the developed world.

This is one reason why it makes sense for mobile operators and equipment manufacturers to establish local, culturally-specific research operations in developing regions. An early example is the applications laboratory established by the Grameen Foundation in Uganda, in association with Google and MTN Uganda (see www.applab.org). It was formally launched on 29 June 2009 and is specifically targeted to meeting the needs of those at the BOP. Another mobile applications laboratory, with a regional focus, has been announced by infoDev, the Government of Finland and the Nokia Group, under a joint programme of work on *Creating Sustainable Business for the Knowledge Economy*. The M-Apps Lab will leverage infoDev's existing regional network of business incubators across Africa. infoDev will also work with the social networking organization *Mobile Monday*¹⁸ in developing networking activities for the mobile community in Africa, establishing new chapters in a number of cities across the continent.

¹⁸ www.mobilemonday.net.

Spectrum allocation

- How to reduce progressively the degree of centralised planning of spectrum management in favour of markets?
- What is the optimal number of players in a particular market segment?

Evolving business models

- How can operators arrest declining ARPU?
- Will VoIP and IM over mobiles have a big impact on operator revenues?
- Is WiMAX a competitive or complementary service to cellular mobile?

Base of the pyramid usage patterns

- What is the cost benefit analysis of mobile phone usage for the very poor?
- To what extent are BOP usage patterns of mobiles culturally determined?

Policy issues

- Why are Universal Service Funds so often left unspent and how can mobile benefit?
- What level of policy intervention is desirable in roaming and termination prices?

Applications

- What killer applications for BOP use of mobiles have not yet been invented?
- What factors prevent the spread of certain applications in some countries?
- How popular will location-based services be?

Mobility and climate change

- What can be done to stabilise or reduce the carbon footprint of the mobile sector?
- How can increased mobile usage mitigate carbon emissions in other sectors?
- How should mobile eWaste be handled?

Figure 6: A selection of under-researched topics in Mobile 2.0

Source: infoDev / World Bank

Where to focus research resources?

Mobile communications continues to be a highly profitable business despite declining average revenue per user (ARPU) and cut-throat competition. It also generates huge sums in government revenue, both directly through license auctions and spectrum fees and indirectly through sales tax and corporation tax. For that reason, the industry should generate fresh funds for research, both in the public and private sectors, at least if it wants to continue to grow.

The most radical innovations of Mobile 1.0 were often profoundly simple – such as SMS messages, pre-paid billing or the near-universal shift to calling-party pays billing (though North America is still a hold-out and consequently has much lower penetration rates than its relative levels of GNI per capita would predict). The coming era of Mobile 2.0 is likely to be more complex and harder to predict, if only because of the greatly widened possibilities that come with extra bandwidth, location-based services and the extended geographical spread of mobile signals. So where should research resources be focused if they are to benefit developing economies?

A good starting point would be the six areas of focus identified in Figure 6. Some of these are primarily of interest to policy-

commercial parties. But all of these areas should interest users, and therefore researchers. Some topics are likely to be of general concern, such as how to arrest the decline of ARPU, while other topics are likely to be country-specific, such as the factors that prevent spread of certain applications in certain countries. The success of MXit in South Africa would probably not be possible in other countries where teenagers have less disposable income or where parents exercise greater control over their use of mobile messaging. Similarly, the particular set of conditions that have enabled agricultural market information systems to thrive in India might not allow similar success in countries where market prices are not so transparent. This points to the need, on the one hand, for greater policy coherence among policy-makers and the donor community, and at the same time also for a greater commitment to locally-based research.

The LIRNEasia research on BOP teleuse, especially the third phase which is presented in this volume¹⁹, provides an excellent launchpad into mobile applications that move beyond voice. The research shows quite clearly that sophisticated mobile applications are no longer the preserve of developed countries.

¹⁹ See also the more detailed papers and downloadable data, videos and media coverage at: <http://lirneasia.net/projects/2008-2010/bop-teleuse-3/>.

In fact, because there is often no substitute for mobile phones in developing countries, their use for applications that supplement livelihoods is often greater in developing countries than in developed ones, where early mobile data applications seemed to revolve around ringtone downloads and games. Indeed, this can be seen as part of a new wave of innovation in mobile use which is more likely to come from the developing world, where more than three quarters of all mobile users now live, than in the advanced economies of the OECD.²⁰ One thing is for sure; mobile 2.0 researchers have plenty of work ahead of them.

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²⁰ This point is well made in the *Economist* special feature "Beyond voice: Telecoms in emerging markets" September 24 2009 edition, available at: http://www.economist.com/specialreports/displaystory.cfm?story_id=14483848.