Annenberg Research Network on International Communication
Annenberg School of Communication
University of California

Proceedings of the Workshop on

'Wireless Communication and Development: A Global Perspective'

By
C. N. Adeya, S. Constanza-Chock, S. Lee, L. Movius, N. Park and A. Sey

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Introduction

The workshop was organized by the Annenberg Research Network on International Communication (ARNIC) which studies the emergence of new communication infrastructures, examines the attendant transformation of government policies and communication patterns, and analyzes the social and economic consequences. The project is multi-disciplinary spanning North America and Latin America, Asia, Africa, the Middle East, the Pacific, Western and Eastern Europe. Each year, ARNIC organizes a high-level research workshop on one of its core research themes. The focus this year was on a global perspective of wireless communication and development.

The keynote addresses were given by Richard Fuchs, Director of ICT for Development (ICT4D) at the International Development Research Centre (IDRC) and Ashok Jhunjhunwala, Professor of the Department of Electrical Engineering at the Indian Institute of Technology (IIT). Mr. Fuchs had an opportunity to share work and experiences of IDRC worldwide focusing on '*It's the End of the World as we Know It: ICTs and Development into the Future*'. He was very concerned that OECD countries have reduced their funding on ICTs from 2.5% to 0.6%. Similarly, Prof. Jhunjhunwala's speech highlighted the ongoing activities related to wireless communications in rural India, he described many successful initiatives. His speech aimed to give recognition to such initiatives that could have implications for development, especially in developing countries.

The workshop was divided into four sessions focused on: reviewing the evidence; case studies on low cost wireless alternatives; wireless applications for rural development; and a users' perspective on wireless and development.

Session 1: Wireless Communication and Development: Reviewing the Evidence

Speakers for the session included Leonard Waverman who drew attention to an econometric model of the relationship between productivity and mobile phone adoption in some African countries, based on a Vodafone study. In addition, he explained how social overhead capital (SOC) is crucial for economic growth, with communication networks are a key part of SOC. Two models were used, the first a production function model shows that the impact of mobile phones is very high, although estimates are not robust. The second model, an endogenous growth model, shows that use of mobile phones is greater in developing countries as in developed countries. Mobiles play an important role in development, similar to the role that fixed lines played in the OECD in the 1970s and 1980s. The mobile sector is dynamic, even in the poorest countries. There are business models that prove two things: the role of communication systems as engines of growth and the crucial role of the private sector. The growth of the sector depends on the right institutional climate, regulation and transparency.

In the second presentation, Judith Mariscal in her remarks indicated that there are new trends in mobile communications in Latin America. In this regard, she told participants that these trends include:

- tendency towards the dominance of a few corporate players;
- mobile lines exceeding fixed lines; and
- access provided to underserved groups.

Mobile communications growth in Latin America is higher than that of fixed telephony since 1997. Drivers of growth include the same drivers of growth in other parts of the world. She reviewed some studies which showed the advantages of mobile telephony over fixed for low income users. The fastest growth in mobile communications is among the middle-income group. There is still little access amount the low-income group. She emphasized that significant attention should be paid to the role of the private sector in increasing access. For regulatory purposes, it may be better to focus on coordinating existing private sector activities rather than on public sector service provision.

The final presenter, Rohan Samarajiva, described a survey of mobile phone users in South Asia, highlighting on low and middle-income groups. The results showed that fixed lines and public payphones are still an important channel of access. He noted that wireless communication technology will not solve all problems, institutional issues must be addressed. In addition, spectrum management is important but not sufficient. For example, due recognition must be given to backbone capacity, market entry, regulation of competition and interconnection issues. An illustration is a situation where an incumbent telecom operator builds its own backbone and does not share with other operators. Then other operators also build enough backbone to keep their urban markets connected. This leads to inadequate and skewed investment. To foster the development of the sector, market entry should be permitted. There must be an enabling environment for investment and multiple suppliers should be allowed to operate on a level playing field.

Session 1 Discussions

The contributions from the participants included these:

- Comparison of Regional Trends

- Macro- and Micro-Level Issues
- Bandwidth/Backbone Issues
- Industry Trends
- Government/Regulatory Issues

Comparison of Regional Trends

Participants tried to identify commonalities in the different regions covered in the session. Similarities included issues to do with high growth rates among low-income groups, mobile lines exceeding fixed and the growth of new businesses around mobile phone access and maintenance. There was an observation that some traditional challenges in the provision of telecommunications service are being resolved in ways that constitute attractive business models. These represent a change in perception of the market, for example, consideration of some form of subsidies. The main issue lies in offering the right incentive and strategies to private operators. Other similarities noted were the institutional challenges, the importance of strong institutions, the importance of competition and the tendency towards consolidation of operators.

Macro- and Micro-Level Issues

The need to link macro and micro stories was emphasized. Participants agreed that it is essential to clearly understand the linkages in the general growth of telecommunications with patterns of economic growth. The importance of identifying demographic variables (other than income) related to adoption patterns was also highlighted. Some suggested that it would be useful to correlate anecdotal information with the macro-economic variables.

Bandwidth/Backbone Issues

The provision of adequate bandwidth was identified as a challenge. Participants wondered about the best way to achieve investment in backbone, possibly, through a monopoly, through shared investment by operators or developing policy to make it easier for new market entrants to build their own backbone. Apparently, building one's own backbone is not a solution but it is wrong to prohibit it. It will be important to observe the efforts of countries to develop bandwidth in the different regions. For instance, are there policies that will change bandwidth capacity in medium-sized cities?

Industry Trends

There was a query on why costs for mobile phone use are lower than those of fixed lines in Latin America; and enquiry on per minute charges within the region. One of the reasons offered for low costs was that provision of mobile telephony is

less risky for operators than the fixed line. There was a further suggestion that the per capita income needs to be taken into account when assessing the cost of mobile phone use.

In Latin America, there is tendency towards consolidation and a participant argued that this is in contrast with the belief that liberalization and competition are important drivers of growth.

A participant proposed that regulators need to address situations of duopoly in the telecommunications industry, but wondered what accounts for the success of Celtel in Latin America? For example, did the company face competition? It was suggested that analyzing the market share of various companies would be interesting to respond to this concern. It was noted that Celtel was not a monopoly provider but has developed the reputation of entering markets that other providers seemed unwilling to operate in. In some countries such as Brazil and Chile, foreign investment was not a big issue initially. However, in Mexico, fierce competition and the prepaid system were important contributors to the increase in penetration rates.

Sri Lanka was given as an example where the incumbent telecom operator refuses to provide interconnection to competing operators. A participant wondered how competitors can operate where the incumbent is the only company that can afford to invest in backbone. In response, apparently the decision in Sri Lanka was to provide licenses to all applicants. In addition, there was a lot of negotiation to come to a consensus with the incumbent to enable interconnection. Therefore, existing operators benefited from the liberalization.

A participant wanted to know the contribution of fixed line PCOs to development in India. For example, the peri-urban areas had little economic activity but after PCOs were established, economic activity became vibrant. It was suggested that the dichotomy between fixed and wireless communication impacts may be artificial.

Some observed that where tariffs are low, adoption and use among low-income users will naturally explode like in India. The challenge for operators is to lower tariffs to the level needed to enable adoption among the very poor. However, more research needs to be done on the total cost of ownership to operators in the wireless communication industry.

Government/Regulatory Trends

The different regulations for fixed and wireless operators make investment in wireless more attractive. Wireless operators are generally unregulated and are able to experiment with different pricing packages. Fixed line telecommunications, on the other hand, is viewed as a public service and has political underpinnings. Therefore, pricing is usually not at the discretion of the

operator, making investment in fixed line operations less attractive. The reluctance of governments in Africa to put pressure on operators to reduce telecommunication tariffs was linked to the fact that a large proportion of their revenue comes from taxing this sector.

Government policy is vital in addressing the issues of rural connectivity. For example, in Uganda, it is government policy on rural deployment (universal service obligation) that made telecom operators provide service in rural areas. Finally, participants raised the issue of operators functioning outside the regulatory system. They said there are systems that may be are more susceptible to hacking because of this and it allows the development of adaptations to address deficiencies in service provision.

Session 2: Low-cost Wireless Alternatives: Case Studies

Jack Qiu presented the first paper of the second session '*The Accidental Accomplishement of Little Smart: Understanding the Emergence of a Working Class ICT*.' *Little Smart* is a "wireless local loop" technology that resembles the European and Indian CorDECT technology and Japanese PHS system. Most backbone infrastructure is actually on landline with base stations for local wireless. The technology gives limited connectivity, only within a limited urban area and no access in a moving vehicle. It is an example of hybrid modes of connectivity with wireless and landline services. It is also referred to as the 'working class ICT'.

The presenter was concerned that people sometimes frame development as exclusive to the nation state. Some of the salient points of his presentation include the fact that *Little Smart* began as semi-legal or marginal service in 1998. Starcom introduced *Little Smart* to China, deliberately to bypass Chinese national policy. Based on official policy from Beijing, this technology was banned until 2003. It has been claimed that low income regions purposely violate the rules set by government.

He attributed that there is an emergence of 'information have-less' in contrast to the traditional linear model approach from 'have-not' to 'have'. The main users of *Little Smart* in China are micro-entrepreneurs, migrants, unemployed, college students and retirees. Their information needs increased due to more social mobility arising from rapid urbanization and development of an information economy. For example, many micro-entrepreneurs now make a living by selling *Little Smart* phones. There is a new value chain which includes manufacturers of base stations and handsets.

The growth of *Little Smart* highlights the importance of public/private interaction and scalability. The deployment of the technology was accelerated by the

liberalization of China's telecommunications sector. It was initially designed for small residential areas. The profitability of *Little Smart* is now declining due to increased competition, increased price to cover value added functions and the attempts of UTStarcom to make *Little Smart* more of a middle-class technology. The question currently is about the sustainability of *Little Smart* considering the manufacturer's lack of commitment for working class ICTs.

In the second presentation, Eric Brewer argued that wireless technologies (ICTs) can make a difference, but industrialized nations' technologies are a bad fit for developing regions. ICTs, in these regions, are not necessarily for web access but for real development problems, such as, health, education and commerce.

From the presentation, it emerged that there is an NSF project that undertakes small technology deployments in developing regions every six months, mostly to India. The project, TIER (Tech and Infrastructure for Developing Regions), is being undertaken with other partners including Intel, MS Infineon, Vodaphone, Grameen, UNDP and Markle. One example is a tele-medicine initiative in rural health centers networked through long-distance wireless, which enables low-cost and low-power deployment. He asserted that developing countries networks rarely need two-way end-to-end networking and can be satisfied by 'intermittent networking'. This is based on the principle that the network will not be steady due to power, weather and reliability issues.

There were suggestions for policy makers. First, cellular telephony is not enough. It is primarily an urban model that requires high population density. Since low density areas cannot yield high profit, cellular technology has a fundamental problem for profit making in rural areas. Second, connectivity without mobility is sometimes the best solution in rural setting. For example, Kerala (India) has one of the largest wireless networks in the world connecting 400 rural centers with non-mobile wireless mesh. For mobility, it is necessary to have higher frequency, higher power, more bandwidth and greater range of coverage. This requires tall towers, instead of small antenna, deployed in long-distance Wi-Fi solution for rural areas.

Third, it is important to have unlicensed spectrum in order to encourage innovation and experimentation at the beginning. Eventually, it is necessary to license the spectrum for long-term quality of service. Finally, there is a need to explore wireless instead of fiber as backbone link. Although fiber is a good long term solution, wireless point-to-point link can be a lower-cost solution with low but enough bandwidth.

The presenter summarized by introducing the 'Space Program' problem. With technological changes, long term plans often result in deployment of obsolete technology due to the delay between ideation and implementation. This is why hacking has gained recognition; hackers are always making last minute decisions and use a variety of latest tools.

Session 2 Discussions

The discussions from this session revolved around these issues:

- Technological issues in rural wireless solutions;
- Working class ICTs and nation-state; and
- Wireless applications and sustainability.

Technological Issues in Rural Wireless Solutions

Participants felt that the impacts of wireless technologies are yet to be felt as they are still undergoing huge improvements. Instead of using fiber for high traffic, a suggestion was made to use higher bandwidth wireless with gigabit ethernet that will go several kilometers while using old satellite dishes. Wi-Max has good technological underpinning but has two big problems. First, it is low-volume and expensive, the cost can only be lowered if it is deployed widely in cities. The second problem is that the equipment is focused on mobile data use; and the usefulness of sensor networks is questionable.

It was agreed that mobility is not the key attribute for low income users, so the underlying question is what this means for policy. Some suggested the need for transparency in spectrum assignment regulations. This could involve every country publicly publishing a chart of spectrum allocation and licensed users. In some instances, governments want to handpick technologies yet technology neutrality is fundamental.

Some questions were related to the move from unlicensed spectrum to licensed spectrum. It was argued that for quality control on services unlicensed spectrum needs to be licensed. However, unlicensed spectrum operators have already invested a lot of resources in certain frequencies so how would they recoup this. In addition, interference issues may not be a real problem for unlicensed spectrum.

A participant wondered about the appropriateness of Wi-Fi solutions with reference to voice vs data services, suggesting that GSM might be the most efficient technology.

Working Class ICTs and Nation-State

With regard to working class ICTs, there are many alliances being formed not based on the concept of the nation-state. Although political mobilization is heading in this direction, the key question was whether regulation and policy is

still bound by nation state politics. It was suggested that transnational alliances are starting to undermine national level decision-making, for example in China. The local governments have taken the initiative in telecommunications issues. Small cities are increasing links with the international community.

One cannot ignore the importance of the diaspora in these developments in the nation state. It was suggested that this is an accidental accomplishment compared to the traditional way of government driven development. The issue of the clash between top-down governance and information control in contrast to the new market-driven innovations was queried. This was with reference to the continued investment of big companies like Google and Yahoo in China.

In the USA context, incumbents are shutting down possibilities for municipal wireless solutions; if successful it may influence regulators in other regions. In addition, USA incumbents are 'shopping' for legislation to block municipal and community networks. Therefore, a participant wondered what is happening about surveillance of *Little Smart* networks.

Wireless Applications and Sustainability

Sustainability can be enhanced by using connectivity for multiple services. This suggestion came from a participant who was of the opinion that if one can get connectivity to a rural area they should ensure that it can be maximized. For example, on of the presentations described connectivity to an eye hospital in India but this is underutilizing resources; other services should capitalize on this connectivity. In developing countries, rural connectivity costs should also include training, maintenance and electricity. There was a suggestion to use entertainment to get deployment. For example, in Rwanda some of the centers offer movies at nigh and telemedicine during the day.

Some participants felt very strongly that there is not enough learning from past initiatives. For example, rural networks deployed in 1999 give lots of data on costs and challenges. Yet some argue like information does not exist and they have to start from scratch. Sometimes they are solving problems that do not really exist. Contexts are also different, for example, one participant said he was not persuaded with the $20-50 radio versus the $500 Wi-Max tower. Yet, there is no real comparison and one must understand the context to argue about the business models for these.

In 1990, there was decision to build fiber network in India. Many people suggested alternatives but one participant reckoned that he was glad they chose optical fiber. At that time, short term solutions would have been detrimental. Currently, India has a great backbone network that is being utilized effectively. One recommended that technology projects should not have 3-5 year planning cycles because the lifespan of the technology cannot augur well for such planning. This can contribute to bad decision making.

One participant said that issues are constantly raised about sustainability of community projects even before they begin, yet who really assesses the sustainability plan of hackers. The main argument for 'hacker approach' is that it allows parallel experimentation.

Session 3: Wireless Applications for Rural Development

Rural areas are a fertile ground for the application of wireless communications. This proposition served as a useful starting point for Hernan Galperin's presentation on '*Diversifying Network Development: Microtelcos in Latin America and the Caribbean*'. He argued that reforms during the 1990s resulted in access gains across board, but persistent gaps had existed within countries in Latin America and the Caribbean. While incentives and subsidies are the typical answer to this problem, the presenter suggested that micro-telcos can help extend ICT services in the region.

Micro-telcos include local entrepreneurs, local governments, and cooperatives and community-based organizations. Instead of relying on public subsidies, they depend on local entrepreneurship, local inputs, hybrid arrangements and innovation. They have incentives and flexibility lacked by large operators which enables them to serve the rural poor. Growth factors include market liberalization, strengthening of regulatory capacities and new low cost technologies, such as, WLAN or VoIP WLL (corDECT).

Some of the business strategies of micro-telcos are:

- economies of scope;
- different price and quality points;
- scalable and flexible networks;
- building their own demand through training; and
- co-production strategies.

In the policy environment, the lack of technological neutrality discourages low-cost solutions. In addition, he pointed out that cumbersome and discriminatory licensing procedures, weak enforcement of interconnection rules and little access to financing had negatively affected ICT access. Despite a less than favorable policy environment, micro-telcos have been able to extend access to underserved areas. Therefore, he recommended that there should be more support for further experimentation with the micro-telco model.

Michael Best followed with a proposition on the how to unleash the Internet for rural development under the title '*Licence-exempt Wireless Policies: Unleashing the Internet for Rural Development*'. He highlighted three keys to connectivity:

- low cost technologies (especially wireless);
- micro and small enterprises with institutional support; and
- supportive public policy including unlicensed spectrum.

The findings from their study show that there is considerable variation among countries in their regulation on frequencies. The Internet penetration of countries that permitted use of unlicensed spectrum was significantly higher than that of the countries that did not. Evidently strict licensing regimes had lower Internet penetration rates.

He raised questions for participants to think about which included the issue of correlation versus causality with reference to spectrum policy in relation to Internet penetration. In addition, there was the need to assess the capacity of regulatory institutions and transparency of regulations.

In the final presentation, Francisco Proenza provided an argument that '*The Road to Broadband Development in Developing Countries is through Competition Driven by Wireless and VoIP*'. He gave an account of the rural character of the broadband frontier in developing countries. This includes the high risk for sustainability in rural areas and suggested that VoIP and wireless technologies can be important tools for development in the areas.

His thesis is that wireless technologies have cost advantages compared to wire network so they are the best solution for low income people and rural areas. However, there are some regulatory challenges, such as, licensing or interconnection issues in wireless and VoIP technologies. It is noteworthy that facility based competition might not work well in rural markets where there are few profits to be made. For instance, Korea has a well-established facility based competition, but this was possible because the country is basically suited to an urban model.

Currently, wireless and VoIP technologies are being availed to small companies, social activists and consumers in general. Reverse subsidy auctions were suggested as a means to providing subsidies to encourage investment in rural areas.

Session 3 Discussions

The question about where to locate the 'individuals' in these presentations was raised. There are legal and illegal operators, the question is the gray area in between, strategically what can be done about this maybe using tools like 'Little Smart' to move into legal areas. Furthermore, how do ICT stakeholders devise strategies to put together coalitions that will allow them to move from the gray

area to legal area? Is it possible to marry the academic discussions with more strategic analysis with what the actors are actually doing on the ground so that the results of best practices can be used in training programs and availed in the public domain?

The need to learn from failures was viewed to be critical. There should be more research on unsuccessful operators. For example, a study could be conducted on why some micro-telcos succeed and others fail. Understanding the failures is part of the process of innovation. Doing things the wrong way is part of learning, it is often not treated with respect. Failed initiatives need to be positioned more successfully with presence of change. There has to be a system of understanding how people can learn more from things done the wrong way. The importance of building economic models of successful micro-telcos was also highlighted to move beyond the qualitative studies. In addition, an international program of training is necessary because local residents' efforts to set up their own wireless networks – in collaboration with expert know-how – would enhance capacity building.

Low power FM radios should be considered in addition to wireless technologies since small providers would know the needs of the poor. Low power stations set up for the Katrina refugees distributed useful information; however, they were blocked by local city governments. It highlights the importance of including small providers/hackers into the policy discussion. Policy change is not just a result of technology but of organization. Enough people must adopt the technology. Early innovation is part of the whole process of change. Since policy change is not only about the technical issues involved but also politics and user needs, studies should be conducted systematically reflecting these two areas. Reverse subsidy auctions may not work if there is no clear result on whether reverse auctions are successful or not.

Some questioned why wireless communications are the answer to rural connectivity. From the presentations, it appears that it is less about lower costs, but the value rests in enabling scalability and flexibility. The biggest value in wireless is that it is possible for a small roll-out and growth while experimenting. If the primary benefit of wireless is this ability to experiment, then unlicensed regimes are the best approach and better suited for experimentation schemes of micro-telcos.

The interrelationship between micro-telcos' adoption of wireless technologies and organizational/institutional considerations was an item for discussion. Some wondered how to develop micro-telcos and entrepreneurship in individual countries. In addition, there has been a failure of reverse auctions. Vendors will take part and have aggressive bidding but are not sustainable. In essence, there is a lack of managerial skills in micro-telcos. It was recommended to have pre-qualifications though this may hinder innovation. Other limitations include lack of interconnection agreements and the need for more transparency in this.

The discussions on technology have to integrate development issues in a better way. There is a need to consider the actual effects of telecommunications on the poorest of the poor. Policy makers want evidence of the impacts of these technologies. Without evidence, it is difficult to make ICTs a priority. The challenge is how can the get evidence that would help policy makers at the local level who have limited resources and would like to know how maximize these. In Latin America, there are national monopolies and little collective action between micro-telcos and cooperatives in terms of resources or expertise.

Session 4: Wireless and Development: A User's Perspective

Through the presentations in this session, participants were made aware of how wireless communications are being used from a user's perspective.

Jonathan Donner's main area of focus was on how mobile phones are being used by micro-entrepreneurs in Kigali (Rwanda). He was able to show how the use of mobile phones changed the social and business networks of the users, like micro-entrepreneurs involved in baking and hair braiding. Mobile telephony is the most important ICT to these micro-entrepreneurs as they have seen their profits and client base increase. The presenter emphasized the role of ICTs for economic and social development. This includes access to information, reduced isolation, lowering transaction and travel costs. These ICTs have strengthened existing relationships and enabled new relationships.

Through interviews on micro-entrepreneurs' calling behaviors in Kigali, the presenter found that 2/3 of calls were to friends and family. While early adopters were more focused on business calls, they shift more to friends and family. They found that the increase of social ties was higher among those who only have mobile phones than those with landlines. Lastly, 'beeping' was discussed as an innovative way for low-income users of mobile phones. 'Beeping' is a "coded behavior" that gives various meanings including call back. It was inspired by the economic scarcity and high tariffs in these regions.

The final presenter, C. Nyaki Adeya, gave an overview of how mobile phones are being used in various parts of Africa with some anecdotal evidence from her own experience living in Africa. She noted that the most documented form of wireless use in Africa is mobile telephony. The mobile phone is first and only phone for most Africans and demand for mobile phones is higher than fixed telephone. There are 104 mobile networks serving 52 million people in the continent.

The presenter concentrated on the unique methods for mobile phone deployment in Africa, which included prepaid systems, village and community payphones, bicycle phones and resale of minutes. Mobile phone use in Africa can be high if

one considers that Nigerians use 200 minutes per week, compared to 154 in France, 149 in Japan, 120 min in Britain, 88 min in Germany.

Some of the user-driven practices aimed to cope with high prices include sharing phones and SIM cards, 'flashing'/'beeping' and cell phone towers. Access to mobile phones is possible to all income levels due to these innovative ways of usage. In rural areas, it is common to have SIM card but no phone, where "having a phone number" is perceived as a form of identity, a status symbol. Network effects operate differently when mobile phones are shared, as two-way communication is difficult in this setting. There were examples of how people build high tree houses in Congo and charge others to climb up so they can get better signals. There are also many ways to charge batteries so lack of electricity is not a barrier to mobile phone use in Africa.

She discussed Vodafone research that found that mobile phones are used to manage strong links but do not replace face-to-face communication. On the other hand mobile phones maintain weak links and they are gradually replacing face-to-face communication. Mobile phones have also helped overcome some physical challenges. They are used by deaf employees in Cape Town, and *Simu ya Jamii* in Kenya has given access and created jobs for wheelchair users. The most used application of mobile phones for development is SMS-related and there are numerous examples about this in Africa.

In conclusion, the paper suggested that more research needs to be done from a user perspective. There is a need to develop new mechanisms that distinguish 'access' from 'subscription'. In addition, there are lots of pilot projects and anecdotes that need to be scaled up and some should be shifted to empirical research. The presenter was concerned that there is little empirical information on the impact of mobile phones in rural communities.

Session 4 Discussions

The issue of the extent to which researchers are addressing the convergence of communications with anthropology and other inter-disciplinary issues was a key area of concern from some participants. They felt the presentations should challenge researchers to think about how real human beings in particular circumstances choose to use ICTs. There has been a failure to link learning from the two areas which have very different methodologies.

There are gaps in research from experiences in the local context and users' perspectives. Some of the issues are:

- How do people learn about the technology?
- Why do they choose to adopt it?
- What are they choosing to do with it?

- Why? How?
- How does it fit to other communication technologies, especially those that are supposed to 'leapfrog'?
- What do people think about a market where companies are selling SIM cards not handsets?

It is also worthwhile to think about the continuous shift of leapfrogging technologies in the development paradigm. There is a need for a long-term effort to keep track of investment in technology.

It was argued that there is a need to bridge these disciplines and encourage conversation across boundaries. There is lots of anthropological work that is not bridged with the macro discourse. All the perspectives are important. What is lacking is the ‘larger than the individual’ contextual determinants of these behaviors. If one does not understand these contextual factors they cannot effectively interpret the macro data.

It is important to put research results in public sphere. A participant emphasized that doing research in Africa is difficult but doable. However, locating useful studies done in Africa is very difficult. Africa has 54 countries which complicates research and hard to figure out the commonalities. More effort should be taken to avail the research that is available at country level that can be compared with others.

A participant wanted to know the usefulness of localized connectivity systems. It was argued that on the one hand, lots of these calls are local so village or small city level connectivity would be helpful. However, driving down tariffs further and enabling people to make more calls outside could be more important. The village phone model in Uganda and Rwanda is successful because of low cost hardware and infrastructure that can cover a broad range. Local connectivity is not considered to be that important, as most people cannot afford the handset so it is not useful to forward incoming calls around the village to different handsets. Rather, most calls go back and forth to the urban areas.

Finally, attention must be paid to the shared use practices, which enables access to ICTs in Africa. Once the technology is available people will always find creative ways to use it, for example, ‘beeping’ is also common in Europe. It is assumed that let those with the money do the calling.

Closing Remarks

In his closing remarks, Francois Bar emphasized that the workshop was a step in the right direction, as one of their aims was to encourage network collaboration among participants. He justified why the user perspective was brought at the end and why it is still an area that needs to be addressed. He highlighted that user experience with new technologies is important especially in understanding the different ways they use it as this has implications for development of the technology and local development in general.

He gave an overview of issues raised by participants during the workshop and said there is a need to know more than just how much ICT has contributed to GDP. In addition, it would be useful to understand alternative organizational and institutional patterns, for example, the micro-telcos, kiosks, and Grameen phone models.

Finally he thanked all the participants and organizers; but added that this was not the end hoping that more collaborative studies would emanate from this workshop.

Workshop Agenda

Wireless Communication and Development: A Global Perspective October 7-8, 2005
The Ritz-Carlton, Marina del Rey, CA.

Proceedings

Friday October 7

Session 1
Wireless Communication and Development: Reviewing the Evidence
Chair: **Jonathan Aronson** (USC)

- **Leonard Waverman** (London Business School), *Mobile Telecommunications and Economic Growth*
- **Judith Mariscal** and **Eugenio Rivera** (CIDE-Mexico), *New Trends in Mobile Communications in Latin America*
- **Rohan Samarajiva** (Lirne.net), *Wireless communication and development in the Asia-Pacific: Institutions matter*

Lunch Keynote address:
Richard Fuchs (Director ICT4D, IDRC), *It's the End of the World As we Know It: ICTs and Development into the Future*

Session 2
Low-cost Wireless Alternatives: Case Studies
Chair: **François Bar** (USC)

- **Jack Qiu** (Chinese University of Hong Kong),*The Accidental Accomplishment of Little Smart: Understanding the Emergence of a Working-Class ICT*
- **Eric Brewer** (UC Berkeley),*Technology Insights for Rural Connectivity*

Saturday October 8

Session 3
Wireless Applications for Rural Development
Chair: **Manuel Castells** (USC)

- **Hernan Galperin** (USC) and **François Bar** (USC), *Diversifying Network Development: Microtelcos in Latin America and the Caribbean*
- **Michael Best** (Georgia Tech) and **Raul Roman** (USC), *Licence-exempt Wireless Policies: Unleashing the Internet for Rural Development*

- **Francisco Proenza** (FAO), *The Road to Broadband Development in Developing Countries is through Competition Driven by Wireless and VoIP*

Lunch Keynote address:
Ashok Jhunjhunwala (IIT Chennai), *Wireless Communications and Development: Rural India Focus*

Session 4
Wireless and Development: A Users Perspective
Chair: **Jonathan Taplin** (USC)

- **Jonathan Donner** (Columbia University), *The use of mobile phones by micro entrepreneurs in Kigali, Rwanda: Changes to social and business networks*

- **C. Nyaki Adeya** (Visiting Scholar, USC), *Wireless Technologies and Development in Africa*

Participants

Catherine Nyaki Adeya,
Independent Consultant ICT4D, Kenya (n_awino@hotmail.com)

Yochai Benkler
Yale Law School (yochai.benkler@yale.edu)

Michael Best
Berkman Center for Internet and Society, Harvard University (mikeb@media.mit.edu)

Eric Brewer
University of California, Berkeley
brewer@cs.berkeley.edu
Associate Professor of Computer Science, UC Berkeley

Peter Cowhey
University of California, San Diego
pcowhey@ucsd.edu

Jonathan Donner
Researcher, Microsoft Research
India jcdonner92@alumni.amherst.edu +1

Laurent Elder
Pan Asian Networking Program Leader,
IDRC
lelder@idrc.ca

Richard Fuchs
Director, ICT4D, IDRC
International Development Research Centre
rfuchs@idrc.ca

John Gage
Sun Microsystems, Inc.
John.Gage@Sun.COM

Scott Huddle
MCI
scotthuddle@mci.com

Mizuko Ito
University of Southern California
mito@annenberg.edu

Dr. Ashok Jhunjhunwala
TeNet, IIT Madras

ashok@tenet.res.in

Michael Kleeman
University of California, San Diego
mkleeman@ucsd.edu

Dr. Motoo Kusakabe
European Bank for Reconstruction and
Development, London
kusakabm@ebrd.com

Judith Mariscal
CIDE
judith.mariscal@cide.edu

Francisco Proenza
Food and Agriculture Organization
Francisco.Proenza@fao.org

Jack Linchuan Qiu
Chinese University of Hong Kong
jacklqiuJ@.cuhk.edu.hk
Dr. Qiu is assistant professor at the School of Journalism and

Raul Roman
University of Southern California
rroman@u.washington.edu

Christian Sandvig
University of Illinois, Urbana-
Champaign
csandvig@uiuc.edu

Rohan Samarajiva
LIRNEasia
samarajiva@lirne.net

John Seely-Brown
University of Southern California
jsb@johnseelybrown.com

Larry Smarr
California Institute for
Telecommunications and Information
Technology
lsmarr@ucsd.edu

Leonard Waverman
London Business School
LWaverman@lecg.com
lwaverman@mobileemail.net

Ernest J. Wilson
University of Maryland
Professor
ewilson@cidcm.umd.edu
Ernest J. Wilson III holds a joint appointment as Professor in the

Tim Wood
Technical Program Manager
Grameen Technology Center
Grameen Foundation USA
Seattle, USA
Twood@gfusa.org

Jonathan Aronson
Annenberg School for Communication &
School of International Relations
University of Southern California
aronson@usc.edu

Francois Bar
University of Southern California
fbar@usc.edu
François Bar is Associate Professor of Communication in the

Manuel Castells
University of Southern California
castells@usc.edu

Jeff Cole
Center for the Digital Future
cole@usc.edu

Hernan Galperin
University of Southern California
hernang@usc.edu

Jonathan Taplin
University of Southern California
jtaplin@usc.edu

Amelia Arsenault
University of Southern California
aarsenau@usc.edu
Ph.D. student
.
Arul Chib
University of Southern California
chib@usc.edu
Ph. D Student

Mireia Fernandez-Ardevol
University of Southern California
mfernandezar@uoc.edu
Ph.D. Student

Seungyoon Lee
University of Southern California
yoonlee@usc.edu
Ph.D. student

Namkee Park
University of Southern California
npark@usc.edu
Ph.D. student

Araba Sey
University of Southern California
sey@usc.edu
Ph.D. student

Yadav Kavya
University of Southern California
kyadav@usc.edu
Master's Student

Lauren Movius
University Of Southern California
lmovius@usc.edu
Ph.D. student

Sasha Costanza-Chock
University of Southern California
schock@riseup.net
Ph.D. student