Chapter 11

User-driven innovation and communications development

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Improving access to communication networks in developing countries is a driver of their overall economic and social development. Over the past decade greater reliance on the market in many low-income countries has made owning and using a telephone increasingly affordable and accessible. This has helped create new sources of income and employment as well as encouraged innovation aimed at meeting local requirements. This chapter looks at some of the innovation surrounding wireless communications in developing countries and at how network effects and network externalities influence innovation in developing countries.

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Users and innovation

As access to networks has expanded, the use to which communication devices and services are being put shows extraordinary creativity. In Kenya, for example:

- elephants are being tagged with SIM cards and GPS, fitted to collars, so that when they stray from reservations into populated areas rangers receive alerts.
- inexpensive personal accident cover for 24-hour periods can be activated by sending an SMS with the premium deducted from a customer's mobile phone credit.
- more than 3.8 million users had begun using mobile banking services within 18 months of service initiation, a level it took the traditional banking sector more than a century to accomplish in that country.

Some of these services are further explored in this chapter, but it is first worth asking what role users played in the development of each. The example of geotagging animals shows that if users have the tools available they will develop applications that suit local requirements. The example of the insurance service shows that entrepreneurs will develop commercial services even where few existed. In both the benefit of expanded network coverage and access is clear, though no one could foresee that these applications would be developed following the liberalisation of telecommunication markets. Both are also examples of innovation stemming from users rather than network operators.

Mobile banking, which is growing rapidly in developing countries and is a service innovation offered by operators, also has its roots in user-driven innovation. The first to recognise the utility of mobile phones for transferring funds were users whose ingenuity found a way to send and receive money that was cheaper than other ways. A user purchases prepaid airtime and calls an airtime vendor in the location of the recipient. Following negotiation of the commission, the local vendor adds the airtime value purchased by the sender to its account and then pays cash to the recipient.

The success of this informal system soon attracted the attention of operators who recognised that users were obtaining value (*i.e.* a positive externality) which was not reflected in their prices. They realised they could internalise this externality and add value to their customer proposition by creating a commercial service. To do so they developed a mobile banking system with trusted agents, transparent pricing, service promotion, and so forth. The net effect was to create banking and payment services for the unbanked. To explore this phenomenon further it is necessary to step back and see how regulatory reform made it possible for the market to deliver innovation applicable to local needs and to better understand the role of network effects and network externalities.

Regulatory reform and network growth

Until the end of 1997 monopolies provided telecommunication services in the majority of OECD countries, and most developing countries. The following decade witnessed rapid liberalisation. Performance in both eras can be compared by considering the following global developments:

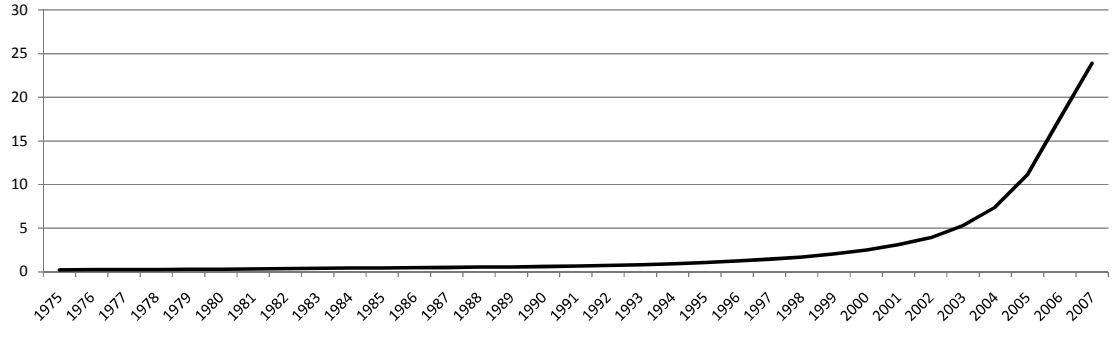
- The first billion telephone subscriptions, reached by the end of 1997, took more than a century to accomplish. It took just four years to add the second billion, three years for the third billion and two years for the fourth.

- In 1997 teledensity for low-income countries was just 1.5 fixed and mobile telephone subscriptions per 100 inhabitants. By 2007 this had increased to 23.9 per 100 inhabitants (Figure 11.1).
- Telecommunication revenue in low-income countries grew from USD 10 billion in 1996 to USD 60 billion in 2006. Over the period total foreign direct investment (FDI) in telecommunications, in developing and transition economies, was USD 100 billion.
- Between 1996 and 2006 annual investment in telecommunication infrastructure more than doubled in low-income countries, from USD 4.4 billion to USD 9.6 billion in an environment of falling equipment costs and a shift to less expensive wireless-based systems.

After a century of low growth in access in developing economies, progress in recent years has been little short of breathtaking, something of which those countries can be justifiably proud. It can, of course, be readily acknowledged that there is not a one-to-one relationship between the number of subscriptions and individual access. In fact, this is the case in both eras (monopoly and liberal) and in developed and developing countries alike. Some historical and contemporary factors to take into consideration, when thinking about overall access, include the number of second lines on fixed networks, the level of ownership of dual SIM cards, resale and shared access. They may, however, offset each other in terms of assessing whether policy objectives are being met. The ownership of dual SIM cards means that individual access is overstated when simply looking at subscriptions. On the other hand, particularly in developing economies, there is significant resale of prepaid subscriptions by micro-entrepreneurs as well as shared use by families, friends and neighbours. This means that access may be understated when only considering subscriptions. Be that as it may, it is clear that competitive markets have far outperformed monopolies in terms of expansion. For low-income countries almost half of the access growth to the end of 2007 had occurred in the previous two years (Figure 11.1).

Figure 11.1. Low-income countries (teledensity)

Fixed and mobile subscriptions per 100 inhabitants



Source: OECD based on International Telecommunications Union.

Policy and regulatory reform surrounding ICTs have been chiefly responsible for the gains over recent years. Liberalisation of communication markets was the critical step,

along with separation of policy and operational responsibilities, the creation of independent regulators, and privatisation. All of these initiatives aimed at providing the right incentives for operators to expand service, introduce new technologies and attract investment from capital markets. Just as important have been reforms to the principles underpinning international traffic exchange. These include recommended best practices, such as cost orientation and non-discrimination, as well as efforts towards greater transparency.

Network effects and externalities

At the individual level the benefits of expanded access to communication networks is easily grasped. By joining a network a user can communicate with all other users on that network and, beyond that, on interconnected networks. In addition, the network itself becomes more valuable to participants as the number of users, or opportunities for communication, increases (*i.e.* the network effect). The network effect is sometimes termed a "network externality" though the two terms, strictly speaking, are not interchangeable.[2]

Externalities are side effects of economic activities in which those affected, positively or negatively, have not participated directly in the decisions which led to those outcomes (Baumol and Oates, 1998). They are sometimes categorised as market outcomes that affect parties other than the direct producers and consumers of a good or service. Textbook examples include a factory that pollutes the surrounding environment (a negative externality for those affected) or householders, who by painting their residence or tending their garden, improve the value of surrounding properties (a positive externality for neighbours). Side effects such as these, when not taken into account in the pricing of economic transactions, are a form of market imperfection. As the costs and benefits, for third parties, were not part of the calculations of those deciding to undertake these activities, too much or too little of this activity may be produced.[3]

For economists the solution to the problem of externalities is to seek a way to bring them into the financial considerations of decision makers. The aim is for the costs or benefits of actions to be accounted for in economic transactions (*i.e.* internalisation). A polluter, for example, may cease to pollute if it faces financial penalties or if consumers shun their products. A householder may be more inclined to paint his/her house if neighbours contribute to the cost of materials or maintain their own properties in a desirable manner. Economists also note that markets may evolve in ways that address imperfections and that internalising an externality is only optimal if the benefits outweighs the costs. An important consideration for policy makers is, therefore, whether markets are already acting to internalise externalities, as producers or consumers will endeavour to minimise their costs or maximise their benefits.

2. "First a definitional concern: Network effects should not properly be called network externalities unless the participants in the market fail to internalize these effects. After all, it would not be useful to have the term 'externality' mean something different in this literature than it does in the rest of economics. Unfortunately, the term externality has been used somewhat carelessly in this literature." (Liebowitz and Margolis, n.d.)

3. Farrell and Klemperer (2001) note that when a network effect is not internalised (*i.e.* it remains an externality) it can be argued that there would be under-adoption of a good (service). Under these conditions it has been argued that the network will be too small and adoption will tend to be too slow so that optimality requires subsidising the marginal adopter to the extent of his external contribution to others.

The potential for network expansion can be viewed as a positive externality. Those who make this case argue that when a user joins a network he/she takes into account his/her benefit but does not consider the benefit for others. The corollary is that if this additional benefit is not captured in the pricing of the service, network expansion will be less than optimal (*i.e.* there will be too little production of a positive externality). Their suggested solutions may range from premiums paid by existing users or subsidies from other sources (*e.g.* public revenue) to align the interests of the prospective subscriber with the benefit to others already on the network.

There are several pitfalls in thinking about network externalities instead of simply using the concept of network effects. All can agree that the expansion of networks (the network effect) is desirable, and policies can be crafted and assessed with that in mind. By way of contrast, a policy presupposing an externality starts from the premise that an imperfection needs to be addressed. It does not necessarily take into account whether the market is already acting to meet policy goals. In other words, even if an imperfection exists and can be measured (many externalities are widely considered not to be measurable), it is far from clear than any action will expand the network faster than pursuing market-based growth. This is why economists urge caution in using the concept of externalities because "to some it may imply the need for a public policy intervention when none is called for" (Crandall and Waverman, 2000).

Producers and consumers often do take externalities into account, even if not always at the aggregate level, and market solutions frequently evolve. By addressing network externalities, rather than network effects, actions may be contrary to policy objectives or impose greater costs than benefits. It leaves open the possibility, for example, that an externality will be paid for twice – once voluntarily and directly by the actors directly affected and a second time by a top-down subsidy scheme to which they may be forced to contribute. At the same time, analysis of network externalities has not kept pace with technological and service developments. Markets take externalities into account and interact with them. A further weakness is that the underlying academic literature is almost entirely predicated on domestic rather than international communication.

Internalisation of externalities

The decision of each user to join a network is, for the most part, independent of any other user's decision, although, if both do so, they share a common benefit. On the other hand, the existence of a "network externality" hinges on perceptions of value by individual users in relation to others. This includes the value users perceive from being part of a network and their willingness to compensate others for joining a network. The United Kingdom's Competition Commission has defined a "network externality" as the benefit users derive from calling and being called by new users, which people often do not take into account when deciding whether to subscribe to a service (United Kingdom Competition Commission, 2003, pp. 225-226). They point out that social welfare is maximised if the price of joining a network takes into account externalities (*i.e.* internalises them) in a way that optimises the network effect.

One of the challenges in dealing with externalities is the difficulty in identifying those affected. In contrast to the network effect (where it can be argued that all users benefit equally from an expansion in calling opportunities), the strength of network externalities will be relative to each user. In defining the network externality, Crandall and Waverman (2000) observed:

> "The network externality in telephone networks may be characterised fairly simply. What I am willing to pay to join a network is a function of how many others I can call (and can call me). The standard economic analysis of this externality concludes that the nth person to join a network should pay a price below her costs to induce her to subscribe. She does not, in evaluating the costs and benefits of a telephone, consider the benefits she provides to others. As a result the externalities [relate to] the impossibility of identifying the beneficiaries, who otherwise might be induced to compensate her directly."

If producers or consumers make decisions, which incorporate the costs or benefits of side effects on others, these are not properly speaking externalities. As Liebowitz and Margolis (n.d.) point out:

> "Although the individual consumers of a product are not likely to internalize the effect of their joining a network on other members of a network, the owner of a network may very well internalize such effects. When the owner of a network (or technology) is able to internalize such network effects, they are no longer externalities."

In other words, "The difference between a network effect and a network externality lies in whether the impact of an additional user on other users is somehow internalized." (Liebowitz and Margolis, n.d.) In seeking to address one phenomenon (*i.e.* the network effect) operators may alter related factors (*i.e.* network externalities). Network operators, for example, in recognition of the network effect, co-operate on the creation and use of standards to permit communication across different networks. They do so because the benefits (interconnectivity) outweigh the costs (making standards). Their actions reflect demand from their customers, who would be quick to complain if their communication options were limited and who ultimately bear the cost of the standardisation. An important point, which needs to be recognised in all discussions of network externalities, is that network operators have incentives to internalise the phenomenon as they strive to enhance the network effect.

Internalisation of network externalities by network owners

The introduction of Short Message Service (SMS) provides a good example of operators internalising externalities and taking the network effect into account. Initially, SMS was not planned as a commercial service. The original purpose was for operators to share information with customers as well as staff (Wray, 2002). The unplanned side effect was to enable users to text message each other but for operators not to be able to bill users for this service. This meant that the economic value of a positive externality, for consumers, was not being captured by producers. As an unplanned side effect, rather than a commercial service, SMS also had limitations. These included users on one network not being able to text users on another network (BBC Online, 2002). Struck by the growing popularity of the phenomenon, operators internalised the externality by introducing pricing and billing systems for SMS and added value by enabling transmission across networks to enhance the network effect.

The solution to the positive externality generated by SMS would not have surprised Ronald Coase. Professor Coase was the economist who pointed out, in the 1960s, that property rights provided incentives for their owners to tackle inefficient outcomes resulting from externalities (Coase, 1960; Crandall and Waverman, 2000, p. 24). The problem for universal application of this principle, as recognised by Coase, occurred in

situations where high transaction costs acted as a barrier to efficient resource allocation (Coase, 1960, p. 7). Among these costs is the identification of those affected by any externality and creating a solution (*e.g.* negotiations, contracts, etc.). Network operators, it can be argued, played that role in the case of SMS. This raises the question of whether they perform the same role with other externalities and whether markets are already acting to internalise network externalities.

The classic problem for network externalities is the challenge of identifying beneficiaries that might otherwise directly contribute to the cost of adding new telephony subscribers. In the monopoly era, network externalities tended to be dealt with obliquely. Universal service polices were largely justified on the basis of social externalities associated with having a telephone service (*e.g.* ensuring widespread availability of the ability to call emergency services) or, more broadly, the economic and social benefits of the network effect. In fostering cross-subsidies from one broad group to another to meet these goals, network externalities were addressed to an extent but arguably in a haphazard fashion. In other words very broad groups (business/consumer, urban/rural, long distance/local) met the costs or reaped the benefits. If such policies had been applied only in respect to network externalities there would have been more limited intervention. As Crandall and Waverman (2000, p. 25) point out, it would only have been necessary to intervene for those individuals whose private benefits did not exceed the cost of serving them, but who generated sufficient external benefits to make up the difference.

Enter the innovation of prepaid cards

There is, however, a different way of looking at the problem of network externalities in a market-based environment. Consider a situation in which a mechanism is introduced with the effect that the private benefits to the user almost always exceed the price they are willing to pay. Consider further that, while someone joining the network does not internalise the benefit to others, this benefit is well recognised by network operators. The solution, therefore, is a system that enables a network operator to charge users whatever they are willing to pay. In fact, this is what a market-based approach has delivered through prepaid cards.

The introduction of prepaid cards has also gone a long way toward internalising, and in some countries eliminating, network externalities. Few of those writing about network externalities in the previous century envisaged that teledensities would exceed 100%, let alone 200%.[4] Fewer still would have expected developing countries to be surpassing 100%.[5] This does not, of course, mean that everyone in these economies has a telephone. It does show, however, that competitive markets, in contrast to monopolies, are rapidly expanding access and, in the course of doing so, are internalising network externalities.

During the monopoly era operators typically charged a connection fee, a fixed monthly line rental and usage charges. There was little flexibility in these arrangements. In this context, the network externalities for a traditional telephone service, as described by Crandall and Waverman (2000), represented a larger consideration or barrier than they do today for users considering joining a network. Markets are better able to determine

4. At the close of 2007 Hong Kong, China, recorded teledensity of 200% as reported by the ITU.

5. Gabon may have been the first Sub-Saharan African country to surpass 100% mobile penetration. Gabon's regulatory authority reports quarterly updates at *www.artel.ga*. Based on 2007 population data, the country exceeded 100% during 2008. These data include users with dual SIM cards and operators may not always remove inactive subscribers from their databases.

price sensitivities, and network operators, like any business, will endeavour to charge consumers the maximum amount they can for any good or service (Harford, 2008, p. 35). Consumers have, of course, different propensities to pay. Prepaid cards not only eliminated credit barriers to joining a network but enabled operators to introduce a means for consumers to signal how price-sensitive they were to paying the fixed fees of traditional telephone service. Moreover, the new strategy had the advantage of internalising network externalities (*i.e.* people who would not otherwise have joined a network became subscribers).

For price-sensitive consumers, the innovation of prepaid cards as a result of competition turned the traditional pricing model on its head. Not only were connection fees commonly waived but joining a network could be considered in terms of what may be called the minimum cost of subscription (MCS). The MCS is the lowest possible charge a user can pay and still remain connected to a network. In some developing countries this can now be less than USD 2 a month for wireless service (OECD, 2007, p. 24). This is why in developed countries it is increasingly common to see nominal mobile penetration rates greater than 100%, indicating that at least some consumers, attracted by the MCS, have more than one mobile service (Sutherland, 2008). The advantage for the low-usage or low-income user, whose private benefit may not have justified subscription under a traditional pricing model, is that they can now rationalise having service. Their private benefit, in other words, will always exceed the cost of joining the network (*i.e.* what they are willing to pay).

At the same time, many mobile users continue to be billed on a post-pay basis. They generally pay fixed monthly fees, have higher network usage and a reduced unit price (a lower per minute rate or unlimited service). In this way post-pay users, who are less price-sensitive, make a greater individual contribution to meeting a network's joint and common costs. The issue here, however, is not one of cross-subsidisation. Both prepaid and post-paid users pay their way but the market has found a better way for them to signal how price-sensitive they are. Users may give little or no thought to the network externalities being addressed but the effect is the same. Both post-paid and prepaid users benefit from the internalisation of network externalities and the resulting growth of the network effect.

The prepaid model is also being applied to fixed network services in some countries. In India, Bharat Sanchar Nigam Ltd (BSNL) has introduced a scheme whereby subscribers can have a fixed line telephone connection on a prepaid basis (Thomas, 2006).[6] The service differs from telephone cards in that no PIN code is needed, making it simpler to use. The scheme aims at making fixed lines more attractive relative to mobile services. The MCS for this service is less than USD 0.50 per month.[7] Further discounts are available in rural areas for exchanges serving fewer than 1 000 users, effectively setting the price of the MCS at zero.

6. Brazil Telecom offers a prepaid service that integrates cellular, fixed line and public telephony. Users buy credit which can be used on mobile phones and make calls from fixed lines, including public telephones. Brazil Telecom, "Brasil Telecom GSM announces launch of operations", 2004, *www.secinfo.com/d17EG1.197.htm*.

7. Users have two options. Under Option 1 they pay an upfront fee of USD 5.44 for 24 months. Under Option 2 they pay USD 0.43 per month for 24 months. Option 2 includes USD 0.43 of included calls. Calls under both options are charged at USD 0.02 per unit. The length of units varies according to several distance bands with local calls including 180 seconds.

India's highly competitive access market has also delivered the innovation of lifetime prepaid cards for wireless service. Aimed at low-income people the prepaid cards have no fixed validity period. In other words the cards enable users to continue to receive calls even in months when they cannot afford to top up their cards with credits for making calls. Competition, therefore, not only acts to expand access for low-income users but also to retain them as customers when they might otherwise leave the network.

Network investment and externalities

It is not just in pricing that operators may take network externalities, or the network effect, into consideration. Operators invest in networks, for the most part, in anticipation of future growth. The economics of building and maintaining networks in relation to that growth is also a significant factor. The cost of putting in place capacity for future requirements may be marginal compared to adding that capacity, or replacing a system, at a later stage. Nevertheless, the investment must be paid for by shareholders, in anticipation of future growth and returns, or increasingly, as the network grows, by subscribers. Thus, network operators already act to internalise network externalities by addressing network effects. By getting today's subscribers to contribute to a network's joint and common costs, they lay the foundation for new subscribers. Operators have arguably identified the beneficiaries of future growth, at least in part, as people who are already on a network. As such, existing subscribers are compensating new subscribers even if they may not directly benefit from any particular subscriber joining a network or take the benefit for others into account in their own decision to subscribe.

Internalisation of network externalities by consumers

Consumers also internalise what may otherwise remain externalities when they perceive a direct benefit for those they call and those who call them. In some countries fixed lines may be retained by people with mobile phones because of lower termination charges and consequently, lower call charges for other users who call them. On mobile networks individuals who share a relation may select the same network to benefit from reduced "on-net" calls. Some may purchase SIM cards for more than one network for the same purpose. Consumers also buy telephones or telephone service for each other. Family members routinely buy service for each other in recognition of the benefits of calling and being called. While this is well recognised at the national level, a growing international element acts to internalise network externalities. Needless to say, the strongest positive network externalities are geographically local, with family and friends, or with local business intermediaries, accounting for many tariff plans which take this into account.

Migrants and offshore workers provide an international dimension to the issue of network externalities, particularly for developing countries. Diasporas are making increasing use of services which enable them to purchase telephone service for others in countries in which they do not themselves reside (Table 11.1). By inputting a user's telephone number, such services enable customers to send credit to that mobile phone.

Anywhere in the world, for example, people can use "mamamikes" to purchase telephones and airtime for friends and relatives in Kenya and Uganda (*www.mamamikes.com*). A spin-off from the same company, Kikwe, offers a top-up service in Kenya, Ghana and Sierra Leone and offers users the chance to send a complimentary SMS to the recipient when they remit the airtime (*www.kikwe.com/*). Another service provider, aryty, enables people in Canada and the United States to purchase airtime for users in the Philippines through the Internet or their mobile phones

(*www.aryty.com/*). The aryty service, started in 2007, is currently being expanded to India and the Gulf Region (*The Economic Times*, 2008). Global Topup already enables users around the world to purchase prepaid airtime for people in India. In 2007, Telecom Malaysia also began a service enabling migrant workers in that country to top up the airtime of people in Indonesia and Bangladesh.

Table 11.1. Selected services offering direct international payments for telephone service

Name of Service	Description	URL
mamamikes	A service for anyone around the world to top up airtime for users in Kenya or Uganda. The recipient can choose to collect their airtime from a Nairobi or Kampala office or it can be automatically loaded onto their phone. Airtime PIN numbers can also be sent via SMS to the mobile phone.	*www.mamamikes.com* *www.kikwe.com*
RechargeBrazil	Introduced in July 2008 and aimed at people the United States paying for airtime for users in Brazil. Real-time top-up via a website using PayPal in co-operation with mobile providers.	*www.recargabrasil.com*
Mexico En Linea	Introduced in 1998 and aimed at people in Canada and the United States paying for fixed lines for users in Mexico.	*www.telmexusa.com/us/ret_mexlinea.html*
aryty	Introduced in 2007 the service is aimed at people in Canada and the United States paying for airtime for users in the Philippines. Real-time top-ups can be made via a website or SMS from a previously credited card.	*www.aryty.com*
Paybox, Transfer To and Telecom Malaysia	Paybox and Transfer To provide tools for international remittances and mobile banking. Working with Telecom Malaysia they created a service which enables Indonesian or Bangladeshi workers, living in Malaysia, to send airtime to their relatives abroad by SMS. A similar service MoneyBox Africa has been announced for Nigeria.	*www.paybox.net* *www.transfer-to.com* *www.fixedandmobile.com*
Primissimo	A service for the Cameroonian diaspora to buy airtime for people in Cameroon.	*www.primissimo.net*
Global Topup	Enables users around the world to purchase prepaid airtime for users in India. Plans to expand to other markets.	*www.globaltopup.com*

Source: OECD.

In Latin America, Unpaid Systems launched a service (RechargeBrazil) in July 2008 which enables people in the United States to top up the phone cards of their friends and family in Brazil (*www.recargabrasil.com/recarga.do?method=load*). Working with PayPal, RechargeBrazil allows users to make direct payments, for others, on any of Brazil's mobile service providers. While the majority of schemes are recent and focus on wireless services, Telmex has offered "Mexico En Linea", aimed at fixed services, since 1998 (Luxner, 2002). People residing in Canada and the United States can pay for the installation of a Telmex line in Mexico and pay a portion of or the full amount of the recipient's monthly telephone bill (*www.telmexusa.com/us/ret_mexlinea.html*). There is no monthly subscription fee for the service. Between 1998 and 2002, TelmexUSA received about 1 million applications for connections under the scheme, of which around 70% were approved. Mexico's largest wireless operator offers "Telcel Amigo", a service which allows people in the United States to top up airtime for its subscribers in Mexico (*www.usatelcel.com/Recarga%20Aqui.html*).

In September 2008 Digicel, in partnership with Western Union, launched a service enabling US residents to buy airtime and send it to mobile phone accounts belonging to its users in Jamaica, Haiti, El Salvador and Guyana (CNN, 2008). In the future, the companies plan to add the service for Anguilla, Antigua, Dominica, Grenada, St. Kitts,

St. Lucia, St. Vincent, Barbados, and Trinidad and Tobago. Western Union has also partnered with Orascom Telecom which operates six mobile networks in Algeria, Pakistan, Egypt, Tunisia, Bangladesh and Zimbabwe to offer remittance services.

An example of an alternative or complementary service, which internalises international network externalities, is provided by TracFone Mobile. Tracfone, a network reseller owned by America Movil, offers low-cost post-pay and prepaid wireless service to users in the United States. TracFone's "International Neighbors" service allows users to obtain, at no cost, three Mexican or Canadian phone numbers (*www.tracfoneild.com/?AID=ILDHPB*). A user's family and friends in those countries can then call a TracFone user in the United States by dialling a local number in their own country, without paying for an international long distance call. The TracFone user in the United States pays for the incoming call at their standard airtime rate with no additional charge. The price they pay depends on their plan but may range, by way of example, from USD 0.17 to USD 0.30. The Canadian or Mexican user only pays the cost of a local call.

The advantage of the foregoing schemes is to enable beneficiaries to directly compensate other users. In turn, this provides demand-side encouragement for network expansion and use. As noted earlier, one of the challenges of externalities is to identify the parties affected and to apply an efficient means of internalisation. Services such as the foregoing enable the market to address both these challenges. They are more efficient than possible alternatives as there is far less risk that funds will be mislaid, misdirected or appropriated by an intermediary. In addition, the problem of corruption is vastly reduced or eliminated. For much the same reasons, mobile networks are now emerging as a platform for financial remittances of all types (Box 11.1). Policy makers and operators should encourage greater diffusion of such schemes because they directly and efficiently act to internalise positive externalities. Policy makers can also look to innovation in other areas to see if the market is addressing internalisation of network externalities.

Innovation and network externality internalisation

The literature dealing with externalities in communication markets has, for the most part, a 20th century perspective. It views telephones and networks solely as a means for making and receiving telephone calls. It largely does not take into account different ways of paying for telephone service (*e.g.* prepaid cards), although these have figured in discussions of network externalities in the United Kingdom. For the most part it locates the pricing of telephones in a single country. As a consequence, for an industry characterised by rapid technological and service innovation, the textbook examples do not always fit how telephones are used in practice. This is particularly true for network externalities in developing countries and the calculation of the private benefits of owning a telephone.

Box 11.1. International financial remittances

Some have proposed that international traffic between developed and developing countries should be subject to a network externality premium. The stated aim is to fund further network expansion. The effect of a network externality premium, imposed on users, would be to raise the price of financial remittances over mobile phones. It would penalise users who already contribute revenue to the terminating carrier and add costs to making more numerous small remittances. By way of contrast, a policy that aimed to reduce the price of telecommunication services through competition would enhance the opportunity for people without bank accounts, in both developed and developing countries, to increase the use of communication networks for financial remittances. The benefits for broader economic and social development stand to be far greater than the financial flows from the foreign purchase of airtime. Yet, both will contribute to network development through direct and indirect stimulation of demand.

The World Bank estimates that international financial remittances towards developing countries totalled USD 251 billion in 2007.[1] The phenomenon is challenging to measure for a variety of reasons including the harmonisation of definitions and data collection as well as financial remittances that take place outside the banking system.[2] It represents, however, a larger financial flow than foreign direct investment and a much higher total than official development aid (Gupta *et al*., 2007).[3] As a ratio of GDP it typically ranges from 4% to 8% in African countries. In relation to export earnings it can range from 15% to 40% (Gupta *et al.*, 2007).[4] That being said, the flows of financial remittances to Africa are lower than towards other developing regions.[5] While undoubtedly reflecting a number of factors, the lack of an efficient means to remit funds and its high cost have acted as a barrier for Africa. ICTs can be used to address this barrier if the right policy and regulatory frameworks are in place.

Mobile phone networks are an emerging platform for international financial remittances. There are a number of advantages, including much less expensive transactions than traditional banking or remittance services, and the fact of being an enabling technology for people without bank accounts. Additionally, because transaction costs are lower, particularly for small sums, it enables users to send smaller amounts of money more regularly and ensure payment is made directly to the beneficiary. It also has the effect of drawing money that would otherwise have gone via informal remittances into systems that are observable and measurable. The service also generates revenue for operators. Each remittance is responsible for at least two SMS, between a remittance company and the sender and the receiver, to ensure the transaction.

The IMF has defined the remittance process using mobile phones as below:

Information flow: A sender visits a remittance company and fills out an information sheet. The remittance company in the sender's country submits to its partner bank in the recipient's country all relevant information provided by the sender. At the same time, the remittance company assigns an account number to the beneficiary's mobile phone and credits the number of the beneficiary. The service sends a text message to both the sender and the recipient, notifying them that the money has been transferred. The beneficiary can now get cash from the partnering institutions or through an ATM at a participating bank.

Funds flow: The remittance company in the sender's country maintains a pre-funded account at a local bank in the receiving country. When a sender remits, the funds are transferred to the beneficiary's money card. Meanwhile, the beneficiary receives a notification through a text message that the funds are credited to his money card. The beneficiary then claims his cash at accredited encashment centres by showing the text message in his mobile phone (Gupta *et al*., 2007).

1. World Bank Migration and Development Brief 5, Development Prospects Group, Migration and Remittances Team, 10 July 2008, *http://siteresources.worldbank.org/INTPROSPECTS/Resources/334934-1110315015165/MD_Brief5.pdf.*

2. The IMF's Statistics Department, together with the Luxembourg Group, has completed a draft of the new "International Transactions in Remittances: Guide for Compilers and Users" (RCG), September 2008. See in particular pp. 19-20 at *www.imf.org/external/np/sta/bop/remitt.htm*.

3. For some caveats on comparisons, OECD, "Remittances as Development Finance", *www.oecd.org/dataoecd/62/17/34306846.pdf.*

4. The totals are higher relative to GDP and export earnings for Lesotho and Cape Verde.

5. Gupta *et al.* (2007), note that Africa received just 4% of total remittances, by far the smallest share to developing countries in 2005.

The theory of network externalities presupposes that users do not take into account the benefits they provide others when they join a network and therefore are not compensated. In fact, in developing countries, telephones are commonly shared by many individuals, and compensation for use is paid to the telephone's owner. These may be micro-entrepreneurs who resell airtime from street stalls or bicycles, or friends and neighbours who share the cost of a telephone. In an interview, Michael Joseph, chief executive officer of Kenya's Safaricom, says: "If you want to go and buy airtime now, for instance, you won't go to a big shop. You'll likely go to some shop on the side of the road. That person probably didn't get the airtime from one of our dealers. He bought it from another person, who bought it from another person, who bought it from another person. It's this creative distribution channel selling our products and services that's created a tremendous amount of work apart from all of the other things we do, like building our base stations, maintaining them, and things like that." (Gabel, 2008). In India, Pakistan, the Philippines and Thailand, for example, more than 50% of all mobile subscribers in rural areas share mobile phones with friends, relatives and acquaintances outside their households.[8]

Resale of telephone service also occurs in OECD countries. Prepaid cards selling below face value are routinely bought and sold on eBay. This may be because micro-entrepreneurs can buy cards, in bulk, at wholesale rates. In addition various promotional offers from wireless operators offer lower introductory prices for prepaid service. From the operator's perspective such promotions lower the barriers to joining a network particularly for low-income users. Once a user has purchased a card they may become a customer and purchase additional airtime. Other users may prefer to use such offers as a form of disposable service. They use the minutes for as long as the card is valid and then bid on or buy a new card. The benefit to low-income users may be relatively inexpensive rates compared to normal prepaid service (*e.g.* USD 0.03 or USD 0.04 instead of USD 0.10). Purchasing prepaid airtime through auctions offers a further avenue for some price-sensitive users to lower the minimum cost of telephone access. The downside of "disposable service", in terms of network externalities, is that each new card comes with a new telephone number. Even here, however, markets may act to externalise externalities as mobile phones interface with Internet-based call-forwarding services. In the United States "Grand Central" (*www.grandcentral.com*) currently offers a free service which provides users with a single number towards which they can direct up to six other numbers. Grand Central may, in future, charge for this service, which could limit its attractiveness to low-income users. However, during 2008, a prepaid user could purchase a single card with a longer duration (*e.g.* one year) and have a constant number which can be redirected to their Grand Central number. At the same time they could purchase multiple other "disposable" cards in online auctions with lower rates.

Nor is it a simple matter to determine the proportion of the overall benefit a user, as part of a network, derives from telephony. Making and receiving telephone calls is, of course, only one application on today's multi-functional devices. Examples of other applications include communicating text (SMS, email) receiving broadcast services (radio and television), playing games or personal entertainment (music, video), accessing information services (news, weather, commodity prices), taking and transmitting photographs or videos, social networking (*e.g.* Twitter) as well as interaction with other

8. LirneAsia has documented significant sharing of mobile phones outside the household by poor people in some developing countries: *http://lirneasia.net/wp-content/uploads/2008/07/shared-use-of-mobiles-in-sri-lanka-3.png*.

devices (*e.g.* from slingboxes to personal computers). Mobile phone users also interact with the Internet in a myriad of new ways. Examples include uploading photographs to websites such as Flik'r or video to Youtube or text to blogs. Mobile phones can be used to indicate presence (*e.g.* Loopt, Wrrl, Zintin) or determine location, using the cellular networks themselves, WiFi or GPS, and provide associated maps or information (*e.g. www.navizon.com*, *www.whrrl.com*, *www.loopt.com*, *jaiku.com*, *zintin.com*).

The uses to which mobile phones are being put show extraordinary creativity. One illustration of the variety of uses of such devices is illustrated by Apple's iPhone. In early October 2008, there were more than 2 600 applications for the iPhone available for downloading on Apple's website. Examples included applications which informed motorists of local fuel prices in their location; price checks for products through ISBN and UPC codes against online vendor alternatives; social networking; entertainment; as well as all manner of news and information services.

Innovation surrounding networks in developing countries is also readily apparent from the work of a growing number of "ICT anthropologists". Companies such as Nokia and Intel are devoting more resources to looking at how people are using ICTs in order to improve their design and applicability (Palmer, 2008; Corbett, 2008). Because people share mobile phones in developing countries, for example, Nokia introduced the option of multiple address books on devices to enhance privacy. The fact that users are highly price-sensitive and that others share and resell service prompted the introduction of prepaid and cost-tracking applications.[9] Increasingly, however, phones are put to uses that were not anticipated by manufacturers and service providers. The ICT anthropologists document the customisation (hacks) of phones for various purposes and local conditions and feed the information back to design teams.[10] Some uses may have little to do with telephony. Examples in developing countries include:

- In mid-2008, a Kenyan teenager received a great deal of publicity after he was reported to have developed a car immobiliser operated by a mobile phone.[11] The system can be used as an anti-theft or tracking device. If the ignition is started when the car is supposed to be locked, the device communicates via SMS with the owner's mobile phone requesting a PIN code to enable the vehicle to start. Similar services have emerged in other countries such as India (Parthasarathy, 2007).
- Mobile phones are being used as broadcast technologies for text services and document exchange. NGOs and other groups, for example, have used the Frontline SMS software to broadcast text messages to users for purposes ranging

9. "Nokia unveils two handsets that offer a range of useful features and colours aimed at consumers in emerging markets", 22 January 2008, *www.nokia.com/A4136001?newsid=1183854*; Johanna Liukkonen, Manager, Government and Industry Affairs, Emerging Markets, Nokia Corporation, "Innovating for the local needs of low-income consumers at the BoP", *www.hse.fi/NR/rdonlyres/FA89FD84-74F8-4BB5-90B1-9DC37B16A1E0/0/Johanna_Liukkonen_BoP_Helsinki.pdf.*

10. See for example the blog of Jan Chipchase, one of Nokia's anthropologists, *www.janchipchase.com/*. A selection of Chipchase's photos are also available at: *http://technology.newscientist.com/data/images/ns/av/mg19826602000V1/mg19826602000V1.html*. Intel has also recognised that local hacks of ICT equipment can sometimes make inexpensive substitute products available. Craig Barrett's interview with Dr Johnny Chung Lee shows how he uses a "hacked" Nintendo Wii to create an electronic whiteboard system for USD 50, *http://download.intel.com/pressroom/kits/events/idffall_2008/CraigBarrett_keynote_transcript.pdf*.

11. Kenyan television coverage of this story is available at: *www.youtube.com/watch?v=j_dR-nh5tvg*.

from monitoring elections, corruption and human rights to providing information on healthcare (*www.frontlinesms.com/*; Zuckerman, 2008). By using the Episurvey, for example, health authorities can collate information on the spread of disease by sending questionnaires across mobile networks, and data can be gathered from people on their phones (BBC, 2008). Perhaps the best example is the mPedigree service which enables users, after purchasing a drug and scratching a panel, to text the number to see if the product is genuine and prior to its date of expiry (http://mpedigree.org/home/). Authorities have also used text services to broadcast information about natural disasters.[12]

- Mobile phones are used as a substitute for the services and tools provided by financial intermediaries or institutions. This can range from acting as a store of value, a payment mechanism or a tool for financial remittances. Safaricom's M-PESA service, for example, enables users in Kenya to transfer money with the use of a mobile phone (*www.safaricom.co.ke/index.php?id=228*). In the first 18 months of service it transferred funds valued at over USD 500 million (Rosenberg, 2008). In that time the service registered 3.8 million customers, a figure the Kenyan banking system took a century to reach (Kinyanjui, 2008). These unanticipated services, pioneered in developing countries, are now being made available by mobile providers to "unbanked" people both in developing and developed countries.[13] At the same time application developers are taking successful models from developed countries and adapting them to local requirements such as services similar to PayPal for mobile phones.[14]
- Mobile phones are being used for the delivery of government services. In India, for example, pensions are delivered through a combination of RFID-enabled cards and mobile phones with Near Field Communication (NFC) (D'Monte, 2008; Menon, 2008). Under this scheme pensioners have a chip-enabled card which includes their personal information together with a fingerprint. On presentation of the card the information is scanned by the mobile phone and the agent is authorised to dispense the pension entitlement. The scheme is reported to have significantly reduced transaction costs and eliminated opportunities for corruption and fraud, as well as provided users a more efficient service. Accordingly, the Indian government aims to expand the use of mobile phones to provide services to people without bank accounts.
- Mobile phone networks have become a platform for commerce. CellBazaar in Bangladesh is a service which has been described as a Craigslist for mobile telephones. People advertise a wide variety of things from agricultural produce and real estate to jobs and services. The GSM Association has noted, "While common telephony establishes one-to-one communication, CellBazaar links many-to-many using the same basic mobile infrastructures."[15] In Africa, mobile phones can be used to access TradeNet, an agricultural market information and

12. In Sir Lanka, LirneAsia's research, for example, explores the use of mobile communications for disaster warnings in two types of models: community-based and public warning models, *http://lirneasia.net/projects/2008-2010/mobile20bop/vertical-aspects/mobiles-for-disaster-warning/*.

13. Trumpet Mobile, in co-operation with Western Union, offers remittance services, in the United States, aimed at users without bank accounts, *www.trumpetmobile.com/customerportal/index.aspx*.

14. *http://whiteafrican.com/2008/10/04/local-software-for-local-needs/*.

15. *www.globalmobileawards.com/winners.shtml#winner_cat5*.

trading service for farmers and their suppliers (*www.tradenet.biz/?lang=en*). The service, pioneered in Ghana but now available across Africa, mostly uses SMS to enable trade and information dissemination. Co-operatives and partners have the option of subsidising SMS messages for their constituents or customers. Senegal's Manobi offers a similar platform for farmers and fishermen (*www.manobi.net/worldwide/*).

The foregoing raises the question of how innovation surrounding the use of networks can inform debates about externalities. One obvious aspect is that the revenue opportunities for operators are no longer limited to telephony. Operators can share revenue with third-party service providers (as occurs with NTT's i-mode) or act as intermediaries themselves to sell products and services (terminal devices, ringtones, music, information, applications, financial remittances/mobile banking and so forth). They can also sell access to their subscriber base to advertisers. Some mobile service providers, for example, provide SMS and MMS advertising to their subscribers in return for lower telephony prices. For example, Blyk is a free European mobile operator for young people, funded by advertising. Advertisers pay Blyk to help them reach their customers and Blyk members get free texts and minutes (*www.blyk.co.uk/about*) (Moses, 2008). In the Philippines, U-mobile is a service owned by two network operators (*www.umobile.com.ph/*). It is aimed at 15-to-35-year-olds, by invitation only, who are willing to accept advertising in return for free calls and texts.

In India, mGinger offers advertising on SMS received by users. In return for signing up for the service and providing personal information users receive a payment for each text they receive and payment for texts read by the people they have referred to the service (*http://mginger.com/*). They are free to indicate the number of messages they are willing to receive and the time of day. Cheques are sent to these users when the amounts they accumulate exceed USD 6.11. Dubbed "permission-based advertising", mGinger has spawned a number of competitors offering advertising-supported SMS (*e.g. www.mgarlic.com/*, *www.admad.mobi*/, *www.m-earn.com/* and *www.160by2.com/*). Opportunities for revenue growth such as these may be taken into account when operators consider or address network externalities. The value of the customer to the operator is, in other words, no longer limited to their use of telephony.

In South Africa, Vodacom offers an SMS-based service that generates about 20 million messages a day (Morris, 2008). "Please Call Me" is Vodacom's free call-back service aimed at prepaid users. Users can send an advertiser-funded SMS for free to request a call back from another user. Vodacom also offers a service called "AdMe"; users give their permission to receive advertising with promotional offers from which the operator derives revenues (*www.adme.co.za/*).The genesis of the service is related to externalities. In developing countries highly price-sensitive users will signal others to call them back, for example through information on missed calls. This represents a positive externality for the user and generates a cost for the operator. Vodacom's solution internalises this externality by adding value to the caller (*i.e.* through improved information) and creating an opportunity for revenue (*e.g.* generating a new call, call termination or advertising).

Advertising on mobile phones still represents a relatively small share of the overall advertising market. However, it is a rapidly growing market segment with a potential reach exceeding 4 billion users in 2009. One of the largest firms serving advertisements to mobile devices is AdMob (*www.admob.com/s/home/*). The company reported that requests for advertisements increased from 1.5 billion in September 2007 to 5 billion in

September 2008 (Table 11.2). AdMob data cover only the mobile sites, applications and publishers that are part of its global network. It is, therefore, not representative of the entire market. Nonetheless, as one of the largest players in this market, the data reveal some interesting characteristics. One is that OECD countries' share of advertising requests for the top 20 countries was 51% of the total, down from 63% in 2007. Moreover a number of developing countries had many more advertisements served over mobile phones than OECD countries. These data suggest that advertising on mobile networks is developing rapidly outside the OECD area.

Table 11.2. AdMob mobile advertising

	September 2008		September 2007		Sept. 2007-Sept. 2008
Country	Requests	% of requests	Requests	% of requests	Request increase
United States	1 992 732 034	39.3	734 272 875	46.1	2.7x
Indonesia	1 135 977 186	22.4	84 390 452	5.3	13.5x
India	391 278 541	7.7	166 297 747	10.4	2.4x
United Kingdom	197 404 623	3.9	89 726 007	5.6	2.2x
Philippines	144 663 278	2.9	11 110 124	0.7	13.0x
South Africa	107 451 198	2.1	116 342 069	7.3	0.9x
Nigeria	89 848 935	1.8	2 884 122	0.2	31.2x
Romania	62 286 761	1.2	30 044 024	1.9	2.1x
China	54 403 922	1.1	7 471 365	1.1	7.3x
Malaysia	47 201 472	0.9	5 859 766	0.4	8.1x
Brunei	39 272 572	0.8	15 657 179	1.0	2.5x
Saudi Arabia	35 622 323	0.7	3 723 609	0.2	9.6x
Israel	33 906 466	0.7	21 748 162	1.4	1.6x
Australia	32 267 923	0.6	11 390 551	0.7	2.8x
Canada	30 846 195	0.6	26 110 308	1.6	1.2x
Kenya	30 547 361	0.6	10 343 288	0.6	3.0x
Italy	29 488 307	0.6	7 605 276	0.5	3.9x
Pakistan	28 849 805	0.6	8 127 478	0.5	3.5x
Bangladesh	26 267 624	0.5	24 051 999	1.5	1.1x
France	22 797 962	0.5	13 454 907	0.8	1.7x
Other countries	538 586 636	10.6	203 041 854	12.7	2.7x
Total	5 071 701 124	100	1 593 653 162	100	3.2x

Source: AdMob.

In competitive markets operators will seek to internalise externalities for particular groups of people. At the same time, the multi-dimensional nature of today's telephones is making adoption by these communities more rewarding. Africa's TradeNet provides one example. Another example comes from India where Bharti Airtel has a noteworthy agreement with the Indian Farmers Fertiliser Cooperative Limited (IFFCO). Bharti Airtel

is a network operator in India with over 64 million subscribers. IFFCO is a co-operative of just under 40 000 societies which provides fertilisers and agricultural services to India's farming communities. The agreement, announced in May 2008, makes available to IFFCO members low-priced handsets bundled with Airtel mobile connection and discounts on calls to other IFFCO members (calls between IFFCO members cost around USD 0.01 a minute). The farmers also get access to five free voice messages on market prices, farming techniques, weather forecasts, animal husbandry, rural health initiatives, fertiliser availability, and so forth, on a daily basis. In addition, the farmer is able to call a dedicated helpline, staffed by people with expertise in various fields, for answers to specific queries. The stated aim is to promote community building in rural areas. There are, of course, other advantages for both parties. Bharti Airtel gets to set up towers at sites provided by IFFCO societies and has an advantage over competitors in marketing services to rural consumers. At the same time, IFFCO is able to strike a better deal for its members than might otherwise be available along with information and services targeted towards their needs that include, but also go beyond, telephony.

Today, calculating the benefits of owning a telephone, which was complex for telephony, takes on an air of impossibility. Some proportion of the private benefit and external benefit from having a telephone will obviously be telephony. But users interact with other people or machines through communication networks in increasingly multifaceted ways. This includes using mobile phones to interact with communication networks in ways not originally intended by the suppliers of services. This changing perception of the value of owning or using a mobile phone will be reflected in many things that relate to network expansion from word of mouth recommendations by consumers to the strategies of operators. In short network externalities are no longer a simple function of being able to call or be called but the result of the range of applications which users can use.

Why is this significant? Simply put, in a competitive market operators have an incentive to add value which internalises externalities whether in device functionality or in services. For their part consumers add value to services in ways that range from contributing user-generated content to social networking. The content may range from the Los Angeles Fire Department's use of Twitter to provide information on emergencies (*http://twitter.com/LAFD*) to a Bangladeshi farmer using CellBazaar to find the price of commodities. The user who was once unaware of and unrewarded for the external benefit they generated for others in joining a network may today be compensated financially (*e.g.* a lower price through acceptance of advertising or resale of their airtime) or in kind (*e.g.* information or content provided by other users which provides a financial or social benefit).

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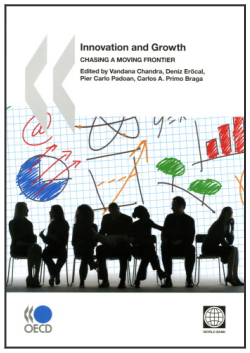

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