

# *Actor-Network Theory and the Adoption of Mobile Communications*

NEIL MCBRIDE

Centre for IT Service Management  
De Montfort University  
The Gateway  
Leicester  
LE1 9BH

0116 207 8500

[nkm@dmu.ac.uk](mailto:nkm@dmu.ac.uk)

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*ABSTRACT: This article examines the process by which mobile communication technologies are adopted within different countries and seeks to explain the phenomena using concepts drawn from Actor Network Theory (ANT). Patterns of mobile technology adoption are clearly affected by geographical factors, both human and physical. Government policy, current physical infrastructure, technology availability and ease of use, economic models and culture all affect the spread of mobile phones. ANT provides a framework of ideas for describing the process of technology adoption and developing stories which explain technology take-up. ANT suggests that technology is as much a product of social construction as of technical innovation. Technology adoption results from the building up of fluid networks of heterogeneous associations between actors both human and non-human. ANT does not differentiate between the social and the technical and attacks the division between large scale and small scale phenomena. Actor networks which support mobile communication adoption are established as the interests of different actors are aligned. This requires the creation of inscriptions which attach particular meanings and benefits to the technology, and enrolment of actors into the actor network. As mobile communications become an essential part of the life of human actors, irreversibility is established where the technology is embedded in the physical and social landscape, and it is impossible to undo the standard technical infrastructure or go back to society in which that technology is not used. The paper considers the descriptive use of ANT in describing the process of mobile communication adoption. It concludes by suggesting possible ways of using ANT prescriptively to encourage the embedding of mobile communications within geographies.*

THE CONSTRUCTION AND IMPLEMENTATION of effective mobile communication infrastructures is a major concern of information technologists and has significant implications for geographers. It may be insufficient to implement a physical infrastructure without an understanding of the processes by which the technology is adopted. The wide diversity in diffusion and use of mobile communication technology raises questions concerning the forces that influence technology take-up and the factors that may enable the technology to be quickly embedded in one community but not another.

This article raises questions from an information technologist's viewpoint which require geographical explanations. A key question is: 'what is the process by which mobile communication infrastructure is embedded and usage established within a culture and geographical area?' This question is clearly of interest to information technology practitioners who want to see a return from investment in infrastructure. However, the investigation of how physical and human geographies affect mobile technology take-up and what effect such technology adoption has on human and physical landscapes is a concern of geographers.

Rather than explore the entire range of explanations and approaches to technology adoption, this article focuses on one particular theoretical approach, actor-network theory (ANT), which has been extensively applied in both geography and information systems to explain the process of design and adoption of technology. ANT is offered not as a definitive explanation for the phenomenon of mobile communication adoption, but as a set of concepts or ideas which provide a sensitising tool for interpreting some of the stories which will emerge in this special edition of Geography. To this end, no attempt is made to describe the whole domain of ANT; rather the key concepts are distilled in a way that may be helpful to any geographer or information technologist reading stories of technology adoption.

For information technologist, there is a strong incentive to move from academic explanations of observed phenomena to activity which applies the theory to promote change. This article then speculates on how the distilled concepts might be applied prescriptively to exploit markets and spread technology.

### *Factors affecting mobile communication adoption*

The spread of mobile technology has varied significantly between countries. While a majority of mobile subscribers are still in developed countries, take-up of mobiles has accelerated in some developing countries (ITU, 1999). In Japan, the use of mobiles to access the Internet using i-mode has been substantial whereas in the main European countries, mobile access of the Internet has yet to take off (Eurotechnology, 2001; Commweb, 2001). In Africa mobile phone adoption has far outstripped Internet adoption and landline telephony (BBC Online, 2002a). While Chinese mobile phone take-up is currently concentrated in the cities, in some African counties, mobile phone take up is

significantly a rural phenomenon (BBC Online, 2002b). Cambodia and Finland lead the world in mobile telecommunication adoption. Cambodia lacked intact fixed network structure and, with foreign investment leapt straight into a wireless network. In Finland, mobile communication take-up has been driven by low tariffs, an apparent cultural affinity to adopt new technology and early adoption, starting in the 1980s (ITU,1999).

Governmental control and legislation at a national level may both inhibit and encourage technology adoption. While European governments have sold telecommunication licences for huge fees, Japanese telecommunication licences have been provided to key players and their competitors for a fairly nominal fee. (Funk. 2000). Market openness, promoted by governments may lead to rapid penetration.

The technology itself needs to be perceived as useful and easy to use. Low performance, and the long series of key presses needed to activate WAP have inhibited its use. In contrast, the 'always-on' Internet connection provided by i-mode has been one factor in accelerating its use (Noam,2001). Technology usage may be affected by local culture. Geographical issues concerning culture, ethnic groups and the relationship between local social geography and the spread of mobile communication need to be considered.

Mobile technology has been successful where local physical infrastructure is weak. Since no wires need to be laid, communication networks can be established rapidly and generally are cheaper than fixed networks.

Mobile communication adoption is affected by the economic models that drive the technology. For example, mobile texting may be cheaper than fixed line voice calls. Pricing models for the services delivered over the mobile phone will also have an important influence. Where mobile operators co-operate with service providers, collecting income for the service providers, as in the case for example with i-mode in Japan, then service providers can thrive and phone usage increases as services wanted by users proliferate.(Noam,2001) The spread of mobiles phones in India has been attributed partly to low tariffs and innovative service packages. (BBC Online, 2002c)

Cultural effects are also of significant importance (Dholakia and Kshetri,2001).Culture will influence resistance to technology, while in other cultures, the spread of mobile usage may be promoted by a sense of community ownership of the technology.

However, such factors are only part of a process by which technology spreads. Explaining these processes requires a more dynamic approach which actor network theory provides.

## *Actor Network Theory*

Actor Network Theory (ANT) arose from French sociologists' efforts to understand how scientific theories spread within scientific communities, become embedded in the community and are then taken for granted as a basis for further scientific progress. Latour (1987) showed that scientific theories are not simply rational, objective and external to

the scientists who use them, but are socially constructed, and become established through social interactions within networks of people. The social process is then just as important as the laboratory work in establishing the legitimacy of a theory.

The use of ANT quickly extended to providing explanations of how technology is accepted within communities and organisations. Technology is as much a product of social construction as of technical innovation and advancement. Hence its success and take-up within an organisation or group will depend on both the technical and social aspects. Technical excellence however does not necessarily guarantee social acceptance of the technology. The social perception of the technology, the prevalence of messages such as 'everybody's using it', and the presence of a critical mass of users will determine its success. As people take a positive view of a communications technology, they begin to use it as part of their work and everyday lives and they recommend its use to friends and colleagues. People start using mobile phones, booking tickets over the Internet, using email, without exactly understanding how it happened. (Latour, 1987, paraphrased).

The use of ANT has extended across disciplines. In geography, ANT is used to interpret cities as urban actor-networks and to gain insight into the power of cities and the global networks linking them. Murdoch (1997) proposes a geography of associations which traces interactions through time and space. Indeed such tracing of interactions or following circulations is a key element of the use of ANT as a basis for a research method. Martin (1999) uses ANT in research to understand the implementation of geographical information systems in Ecuador (Martin,1999). Among many geographical studies, ANT has been applied to the fluoridation of public water suppliers (Nash, 2002) and global warming (Demeritt, 2001).

The theory has been expanded into a language that supports the joining together of technical and social explanations and description of the phenomenon of human - technology interaction. Ideas concerning how one group's concerns are aligned with another's (Callon, 1986), how control is exercised over resources (Law, 1986) and how boundaries are established to separate one commodity from another (Callon, 1999) are amongst many added to the theory. ANT is seen as a way of telling stories about networks of actors - both human and non-human and about the processes by which technology is established. The protagonists of ANT have also identified the risk of simplifying complex phenomenon too much, and trying to make the technology processes fit into simplified explanations. Even Latour has tried to distance himself from ANT. Aware of the dangers of using ANT as a simple passkey to explain all technology adoption, he has suggested the recall of ANT like a faulty car, criticising 'actor', 'network' and 'theory' and questioning its use as alternative social theory (Latour, 1999).

However, the philosophical focus of ANT on spaces and flows within fluid networks encourages the use of ANT as an interpretive tool within geography. If the essence of geography is connections (Smith, 2003), then ANT's theme of circulation within fluid networks will resonate with geographers. Indeed, the mapping of connections within networks and the metaphor of travelling are part and parcel of ANT (Latour, 1996).

## **Networks**

The concept of networks is important for information technologists and geographers. The IT concept of networks concerns the transport of information between nodes and hence actors without any change in that information. If errors are introduced and information changes when traversing a physical network, then the network has failed in its task. Information should be transported without deformation or change. In actor network theory, the network of social, technical and physical actors involves a series of transformations, transductions and translations such that change occurs. The network is dynamically changing its structure and content. ANT views networks as a set of heterogeneous associations.

Significantly, ANT attacks the division between large scale phenomenon and small scale. There is no hierarchy (Callon and Latour, 1981). Networks are seen as complex arrangements of space with no clear centre or dependence on hierarchical relationships. Neither is there any clear differentiation between the global and the local. Local networks of actor interactions join with and are part of global networks.

These networks define spaces through actor-actor interaction which connect to define pathways which may bind quite unlike things together (Thrift, 2003). They support flows of information, goods and people within spaces both defined by the networks and dynamically changing as the network changes. They may be stable or instable and physical or virtual.

In Geography, the idea of networks has become fashionable (Smith, 2003). The spread of networks through which resources can be controlled and distributed is at the heart of the human intervention in the physical landscape. These physical spaces are constructed from the existing landscape and then alter the existing landscape through human intervention. The control of water through canals and dykes in Southern Mesopotamia provided the basis for capitalising on the economic potential of the southern plains and led to the emergence of early large-scale communities in which culture could develop and people could move beyond subsistence living (Leick, 2001). Similarly the spread of canals in England enabled the development of the textile industry, and the movement of coal (Clarke, 2002). The new networks of the information age may be of similar geographical significance. The laying of an undersea fibre optic cable encircling Africa may herald an African renaissance, supporting new industry and the exploitation of local resources as well as the incorporation of Africa into global manufacturing and service supply chains. (ITU, 1998). The laying of Internet cabling throughout India changes the relationship between the cities and the rural areas, enabling, for example, illiterate farm workers to use e-mail to request land records. (Cecchini and Shah, 2002)

## **Actors**

ANT focuses on the stakeholders, or actors, within the socio-technical network and how they are involved in shaping the form, the social spread and the geography of the

technology (Monteiro and Hanseth, 1996; Walsham, 1997). Actors can be defined as entities which serve as an intermediaries between other actors. Actors are not limited to humans, but may include technology, texts and organisational groups. This is a key concept of ANT. There is no differentiation between the human and material or the social and the natural (Murdoch, 1997).

Ecological and environmental actors may also be considered part of the actor network. Broken infrastructure may act as a text, lending weight to a case for mobile infrastructure. Rail networks may provide an intermediary within the actor network. Physical landscape may also participate in an actor network for mobile technology, providing a barrier to mobile usage or a justification for mobile usage.

In the actor-network within which Senegalese farmers start using mobile phones, actors include: the farmers, the company that provides the pricing services, the mobile phone company, and the mobile phones themselves (See Table 1 for description of this example). Both human and non-human actors have interests and properties which need to be aligned for the technology to be successfully adopted within a network.

### **Translation and Inscription**

The interests of the actors may vary widely and may encourage or constrain the technology. A Senegalese farmer may be interested in increasing the price he gets for his crops and reducing the role of the middlemen. The Nigerian trader may be interested in contacting potential customers before other traders and reducing travel time. The telephone company is interested in increasing revenue, which may be done by creating partnerships with potential service providers.

Establishing technology requires the aligning of the interests of actors within the network. As the interests of actors within the network are aligned, the network becomes stable and the technology is then firmly established. ANT suggests that the aligning of the interests of actors in the network involves the *translation* of those interests into a common interest in adopting and using the technology. Thus the Nigerian's commercial interests must be shown to be linked to, and fulfilled by, the interests of a social network involving mobile communications. The trader's interest is *translated* into an interest in promoting mobile communications. This translation is achieved in the network through common definitions, meaning and *inscriptions* attached to the technology.

Inscription or definition of its properties, usefulness or desirability may be used to support the translation of interests. Geographical inscription may include maps which define distance or define a representation of a landscape. The interpretation placed on the map and the way it represents geographical phenomenon may act as a text supporting the translation of actor's interests and hence the aligning of the actor network.

### **Enrolment**

The process of alignment of actors' interests with the actor network occurs as actors *enrol* others into the network. A trader may encourage another to take up mobile communication and, if successful, enrolls her into the actor network. In doing this, the trader may also call on other actors to support his case. The trader may call on texts (e.g. mobile phone company literature), stories (e.g. stories of successful use and benefits gain) and the technology itself (e.g. demonstrations). Texts, stories and the technology itself behave as actors because they are passively enrolled into the network. Such texts could include 'Huge billboard ads in Africa [that] have made mobile phones as popular there as Coca-Cola.' (Lopez, 2000).

As actors are enrolled, the network becomes larger, more established and the use of the technology more common. The successful embedding of mobile communications requires that a large actor-network emerges such that there are sufficient actors to justify its use.

### **Irreversibility**

The actor network must firstly grow to reach a critical mass and then reach a state of stability. If the network remains unstable, it can disappear as quickly as it emerges, taking with it the technology which then becomes obsolete. In order for stability to be established so that the mobile network becomes part of the physical and human geography, notion of *irreversibility* must be established. At some point the use of mobile communications becomes an essential and standard part of the person's life. The technology becomes part of the physical landscape as well as the social landscape. It then becomes impossible or very difficult to go back to not using it.

Irreversibility is a natural consequence of establishing physical networks. Once the rail network is established and built, moving or changing the structure becomes difficult. Once a network is established, other geographical changes will be aligned with the network. With a mobile network, which is less depended on fixed infrastructure in the landscape, irreversibility may be more difficult to establish, and more dependent on social networks and the interaction between the social network and the geography.

Of particular importance in establishing IT infrastructure is the defining of standards and protocols. These are established within actor networks by negotiations, translation, inscription and the alignment of the interests of major stakeholders. Such standards definition may occur at an international level, while having local consequences. Hence there are distinct but fluid associations between global concerns and local concerns.

### **Black Boxes**

Once standards are adopted by the actor network they become difficult to reverse. Hence users become locked into the network and its standards. In a stable network, the shift to using mobile communications is irreversible. The technology and communication standards become a *black box*, whose contents and operation no longer need to be

considered and are a matter of indifference. The technology is then treated as part of everyday life, embedded in social activity and taken-for-granted. Only input and output matters. Both the technology and the social network are sealed, regular and stable. The mobile communication technology is then accepted without questioning how it works, or whether it represents the best way to do things. It is no longer exciting or new; just an extension of self, part of the geographic environment, embedded in the social and physical fabric.

Mobile base stations are then accepted as part of the landscape, their presence taken for granted. While base stations may become established black boxes, such black box status is not necessarily irreversible. Black boxes can be opened and their content examined. For example, the placing of base stations on school roofs may be taken for granted. However, if health concerns are raised, new texts concerning studies of health risks may become part of actor networks at a certain time. Then the presence of base stations on schools is questioned and the black boxes are opened. It is in the nature of an actor network that it is dynamic. Even irreversible networks may only be stable within a particular time and space.

### **Application**

The set of concepts or ideas which constitute ANT may be used to highlight significant elements of the technology adoption process. Table 1 summarises some recent stories concerning the spread and use of mobile communications and highlights some aspects of the adoption process which can be explained in actor-network terms. Several of these cases illustrate the key importance of aligning the interests of actors within the network. The translation of the interests of Senegalese farmer looking for market information and Nigerian traders communicating across Lagos is important in mobile communication adoption. Conversely where the interests of the actors do not align, as was the case in Gabon, the network disintegrates and mobile adoption is halted.

The application of ANT to the Grameen Telecoms (GTC) case study (see panel) further illustrates the relevance of the concepts. The village phones actor network involves interactions between a variety of human and non-human actors. The physical network of mobile technology and fibre optic infrastructure cannot be separated from the social and human networks involving GTC, unit offices, village phone operators and customers. The technical and social networks must be considered together. The village phone network is a network of heterogeneous associations between human and non-human actors including the railway fibre optic network, Grameen Bank, GTC unit offices, existing and potential village phone operators and customers. The network will also include money, documents and texts which support and advertise the village phones scheme and maps showing network coverage, issued by Grameen, which may act as inscriptions encouraging the enrolment of village operators and users. By targeting Grameen Bank customers, GTC is identifying actors whose interests are already to some extent aligned with those of the village phone actor network. The enrolment of new village phone operators, a task for Unit officers, may involve the telling of success stories, the identification of benefits and the demonstration of how the potential operator's interests can be aligned with the

network. Once established, the increasing dependence of villagers on the village phone and changes in social life and working life will result in the embedding of the village phone as an essential part of village life. The technology becomes socially embedded. GSM technology becomes a standard and gains the status of a black box, although it is inefficient and more expensive than fixed wireless loop technology (Cohen, 2001).

The GTC case study also illustrates two further concepts which are part of actor network theory. Latour (1987) introduced the idea of the Centre of Calculation as a location where accumulation, synthesis and analysis of observations enables greater understanding of the network. In the case of GTC, the central office monitors charge rates, tracks trends in phone use and takes an overall view of the network. In addition to a centre of calculation, an actor network may have an 'obligatory point of passage'. The obligatory point of passage is the situation that has to occur in order for all the actors to satisfy the interests that have been attributed to them by the focal actor (in this case the Unit officer). It is not possible to become a village operator without interacting with the Unit officer. The strong passage point exercises control over all the GP resources and may claim responsibility for the success of the village phones network.

### *Prescriptions for establishing mobile communications networks*

The use of ANT has been primarily descriptive. Latour's exhortation to follow the actors and their movement, travels or circulation within an actor network, highlighted by Bingham and Thrift (2000), provide a basis for describing the phenomenon of technology adoption, but provide no basis for improving the process or supporting a proactive approach. For both governments and companies there are strong incentives to get mobile technologies accepted and embedded; in other words, to catalyse stable actor networks in which the technology and its application are adopted, extensively used and become black boxes, embedded in the geographical and cultural landscape.

The concepts of ANT point to a need to address the social infrastructure as well as the technical infrastructure when establishing mobile networks and embedding them in the local geography. ANT suggests a number of questions that need to be asked: What are the characteristics of the stakeholders groups or actors in the network? What are their economic and social interests? What meaningful inscriptions might be generated which would translate their interests into the interests of the network? The design of a mobile network involves reaching conclusions concerning who will use it, how they will use it and what service processes will be involved.

ANT as a methodology for description requires the recording of actor's interactions, connections and effects (Latour, 1987). Actor interactions are traced through documents, skills present or developed, money and control structures. Studies of networks before the technology is adopted or during adoption may equally provide clues as how to advance technology adoption.

## **Following actors and circulations**

The potential actors within the network need to be identified and profiled. Their culture and values must be considered. Furthermore an analysis of their interests should be carried out. Actors should be examined as individuals as well as groups. For each actor, through interviews with representatives of the groups and analysis of documentation, interests, attitudes, relationships, roles, power and influence and involvement in the historical context should be examined. In addition, perceptions of the usefulness of the technology and the ease of use need to be considered. Relationships between actors in terms of current communication, power distribution, levels of trust, resource control and influence need to be considered. The relationship between actors and local economic and natural resources may also exert an influence on the developing actor network. The importance of the relationships or connections between actors or groups of actors needs to be examined since the strength of these connections may influence enrolment strategies. Interactions between actors need to be traced. Texts, technical artefacts, people and money circulate within the network; interactions between actors involving these intermediaries should be traced. The complexity of the actor-network can then be assessed. This will have an influence on strategies for aligning the actor-network with the desired outcomes. Alignment may involve simplifying the actor-network since the more complex the actor-network, the more difficult it is to align (Monteiro and Hanseth, 1996).

## **Designing Inscriptions**

Inscriptions which will support the alignment of actors' interests in the network need to be developed, taking into account not only the interests of the actors, but also the geographical and historical context. Previous exposure to technology, history, culture and politics may have a significant effect on the development of the network though the attitudes and values which have been laid down within the social groups. Inscriptions will include both the messages and marketing associated with the technology and the services designed for the technology. Services will also act as inscriptions, providing a view of what the technology should be used for. In Japan, the availability of entertainment services provided a catalyst which encouraged the use of i-mode. In Nigeria, pricing services inscribed meaning, usefulness and desirability to the mobile communication technology.

## **Designing enrolment strategies**

In addition to understanding the stakeholders and designing the messages and services around the technology, the establishing of a stable actor network will require good enrolment strategies. This may involve challenging the stakeholders' current assumptions, and opening existing black boxes in order to promote their replacement with new technology. Lock-in to current technology and ways of doing things will act as an inhibitor to the adoption of new technology. The right economic models involving pricing and linking with the designed services will be required. Enrolment strategies must address attitudes, power and politics. The aim is to promote lock in, in which mobile communications becomes socially acceptable, has a positive social construction placed

on it and becomes socially embedded as the default means of functional interaction among the stakeholders.

## *Conclusion*

The geographic spread of mobile communications depends on the social networks which overlay the geographic landscape. Within these actor networks of people, texts and technology, dynamic interactions occur which establish the technology. The actor network fits the physical landscape and is both affected by and affects the landscape in which it is situated. This actor network evolves into a stable state in which the mobile technology is an established part of the physical and social environment. Its use is then irreversible and it takes on the nature of a black box, whose usage and technical function is routine and unquestioned. The mapping of the social network to the geographical environment is then an important element of understanding how technologies are established within cultures and countries.

The value of the concepts provided by actor network theory may go beyond the ability to describe technology spread, towards providing a prescriptive tool for encouraging technology take-up. An understanding of the actors and their circulation within the networks should enable the development of tailored inscriptions and enrolment strategies that will support the embedding of mobile technology within diverse geographic and social environments. However, it should be recognised that often the inscriptions and enrolment strategies implemented, whether deliberately or accidentally, reflect the culture and values of the operators of the technology who may not be indigenous. Such operators may assume that their cultures, business processes and business practices will seamlessly transfer to the recipient's environment. Often business models for mobile communications adoption and use are based on Western, in particular US, models of business practice where, for example, the formalisation and structuring of business processes is expected. The inscriptions associated with the actor network may be western-derived and not aligned to the local culture and geography.

However, actor network theory has its critics, and its prescriptive use in promoting technology adoption carries with it certain dangers. Furthermore, uncritical use of ANT may fail to take account of power structures and the influence of balances of power on how the network develops and what inscriptions are promoted. Actors with power may use that power to manipulate the networks. That power will involve the power to allow access to the network, the power to decide what inscriptions to apply and the power to control and distribute the resources which will enable the adoption of the technology. The direction in which the actor network moves towards stability may be strongly influenced by those actors who have the power of access, meaning and resources, and can then direct the network towards a state which meets their requirements.

Any attempt to prescriptively engineer a social network in order to promote the adoption of a technology is fraught with risk since it cannot take into account the unexpected behaviour which tends to emerge from any complex network. The prime value of ANT is in its use as a sensitising device, which makes us aware that the spread of mobile

communication networks is not merely a technical exercise in establishing physical infrastructure, but a social exercise in understanding the social dynamics of the technology and the intimate relationship between the technology, the geographical environment and the social environment.

While the challenge for information technologists is to implement successful networks which are sensitive to social, cultural and geographical factors, the challenges for geographers are to understand the relationship of mobile networks to the physical and social networks in the physical landscape and to understand the distinctive properties of mobile communication which are affected by the landscape in which it is placed and which eventually affect the landscape.

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Country	Case	Source	ANT Analysis	Effect
Senegal	Farmers use mobile phones to pick up dynamic data concerning market prices for their produce before setting off to market. An intermediary uses teams of workers to log prices which are recorded on a server. Farmers use the prices to select the best market to go to or to negotiate with middlemen. Farmers pay for the service as part of a deal between the intermediary and the national telephone company. Farmers produce crops for particular markets, depending on demand.	BBC News 5 <sup>th</sup> Oct 2002. <a href="http://news.bbc.co.uk/1/hi/technology/2290540.stm">http://news.bbc.co.uk/1/hi/technology/2290540.stm</a>	Intermediary enrolls farmers by explaining value of technology. Farmers come to treat WAP as black box providing information which increases their income. Services are part of inscription.	Changes in markets, changes in crops, increased wealth.
Japan	50 million people use mobile data services on a daily basis, of which 60 % use i-mode. I-mode is responsible for 85% of the profits of the leading mobile services provider. PDC standard does not exist outside Japan, results in faster data transfer than GSM. Services including easy direction finding and finances appealed to Japanese. 75% of i-mode users are under 25.	BBC News 22 <sup>th</sup> February 2002 <a href="http://news.bbc.co.uk/1/hi/business/1835821.stm">http://news.bbc.co.uk/1/hi/business/1835821.stm</a>	Fixed lines are high cost, greater use of public transport. More aligned actor network creates rapid enrolment and translation of interests.	Development of service industries. Amplification of city-based living.
Kenya	Mobile companies rolled out 600,000 mobile phones in 18 months, compared with 300,000 fixed line phones existing after 40 years of service. Rollout is particularly into the high density rural areas. UN: ICT will help the poor	BBC News 22 <sup>th</sup> January 2002 <a href="http://news.bbc.co.uk/1/hi/business/1778062.stm">http://news.bbc.co.uk/1/hi/business/1778062.stm</a>	Translation of rural needs. Establishing rural networks. Money-making attributes	Farmers may get greater share of price of crops sold in capital city. Shift of economic resource balance from city-bias. Increasing rural

	work their way out of poverty.		attached to mobile communications.	wealth and development.
China	Mobile usage has soared in cities such as Shanghai. Manufacturers set up roadside stalls. Mobile mania is driven by richer urban Chinese.	BBC News 10 <sup>th</sup> September 2002 <a href="http://news.bbc.co.uk/1/hi/business/2239692.stm">http://news.bbc.co.uk/1/hi/business/2239692.stm</a>	Meaning attached to owning a mobile phone as being fashionable.	Expanding communications infrastructure. Possible effect on social mobility.
Gabon	Government workers issued with mobiles because of inadequacy of landline, but misuse, primary for personal calls, causes ban on their use.	BBC News 19th July 2002 <a href="http://news.bbc.co.uk/1/world/africa/2139527.stm">http://news.bbc.co.uk/1/world/africa/2139527.stm</a>	Conflicting interests emerged with Actor network. Non-alignment destroyed stability of network.	Inhibition of public sector communication improvements.
Russia	Mobile usage limited primarily to Moscow (31%) and St Petersburg (21%). Usage outside the cities in 10 times lower.	BBC News 26 <sup>th</sup> April 2002 <a href="http://news.bbc.co.uk/1/hi/business/1950215.stm">http://news.bbc.co.uk/1/hi/business/1950215.stm</a>	Access to resources, power structure and isolated social groupings may inhibit expansion of actor network outside certain geographical areas.	Mobile usage amplifies city/rural divide.
Nigeria	Mobile companies provide 600,000 mobiles in less than one year, substantially greater than all the landlines in the country. Traders can talk in Lagos without having to get through worst traffic jams in world to meet.	BBC News 1st April 2002 <a href="http://news.bbc.co.uk/1/hi/business/1905744.stm">http://news.bbc.co.uk/1/hi/business/1905744.stm</a>	Growth of technology from alignment of interests with actor network.	Economy growth through less impeded business activity
United Kingdom	Half of children own a mobile. Most popular use is	BBC News 29 <sup>th</sup> January	Social inscriptions	Changes in social networks.

	text messaging.	2001 <a href="http://news.bbc.co.uk/1/hi/business/1142033.stm">http://news.bbc.co.uk/1/hi/business/1142033.stm</a>	concerning importance of technology in social interaction support enrolment.	Possible disruption or dilution of local communities.
Finland	Finns sent over a billion text message in 2000. Various services are available, including ticket reservation, mobile games, and checking up on second hand cars.	BBC News 18th December 2000 <a href="http://news.bbc.co.uk/1/hi/sci/tech/1076179.stm">http://news.bbc.co.uk/1/hi/sci/tech/1076179.stm</a>	Service inscriptions and cultural affinity for technology.	Possible service industry expansion through changing business models.

**Table 1: Actor-Network Theory Analysis of Country-based Mobile Communication Expansion.**

## **Grameen Telecom**

In Bangladesh, 97% of households and virtually all households outside cities have no telephones. Rural villages may spend two days travelling to a city to make an important telephone call. The poor performance of the national telecommunications operator which still controls the national fixed network has reduced access to fixed line telephones. Waiting times for a fixed line can be up to ten years and installation costs prohibitive for an unreliable service. In the cities, this low level of fixed line infrastructure and availability has led to the rise of mobile to mobile services. However, the cost of such telecommunication services is beyond rural villagers.

In 1995 Grameen Telecom (GTC) was set up with the express purpose of providing a nationwide telecommunication business to serve rural villages in order to promote sustainable rural development. An entrepreneur persuaded Grameen Bank, a successful micro lending institution, to set up GTC as wholly owned subsidiary. GTC owns 35% of GrameenPhone Ltd (GP) which bid for a cell phone licence when the Bangladeshi government decided to auction licences to private firms. GP was awarded a licence for GSM 900 cellular mobile phones in 1996 and set up a mobile phone service in 1997. Bangladesh's dense population and compact geography enables efficient coverage with wireless infrastructure. GP also leased a fibre optic transmission network, running along Bangladesh railways. This enables GPs rural telephone service to stretch though most of Bangladesh's rural countryside.

GTC runs the village phone scheme through unit offices, of which 13 currently exist. Unit officers scout for technically feasible village locations, given technical information by GP on network coverage. Local creditworthy Grameen Bank customers are then encouraged to become Village phone operators. Selection is based on a good past repayment record, having some existing business interest in the village and literacy within the family. These entrepreneurs, usually woman, are given unsecured loans to purchase mobile phones to operate a business of leasing phones to customers by the phone call from their shop or home. GTC provides the phone subscription, connection, hardware and training. The money lent by Grameen bank is repaid through revenues collected from users charge per minute. Aggregating the buying power of the entire village provides revenue to support the infrastructure and operating costs of the telephone operator. Low rates, combined with a system of peer support and regular meetings to collect revenue results in a 90-95% repayment rate on loans. GTC Unit Offices run weekly meetings and track trends in phone use in order to help operators who are having difficulty marketing their service or collecting revenue. The office provides training and trouble-shooting services.

Village phones offer significant benefits for both operators and users. The status of the female phone operators within villages improves and the phone location may serve as a social focus for women as well. The phone provides a link to government and police and a vital link if natural disasters occur such as flooding or tornados. The phone enables access to market information concerning prices for rural goods, enabling villagers to

negotiate better prices for their produce. The most important use of the phone is in contacting relatives working in cities or overseas and facilitating remittances from relatives.

Sources: Cohen,(2001), Grameen Telecom (2003)