

Mobile marvels

Poor countries have already benefited hugely from mobile phones. Now get ready for a second round, says Tom Standage.

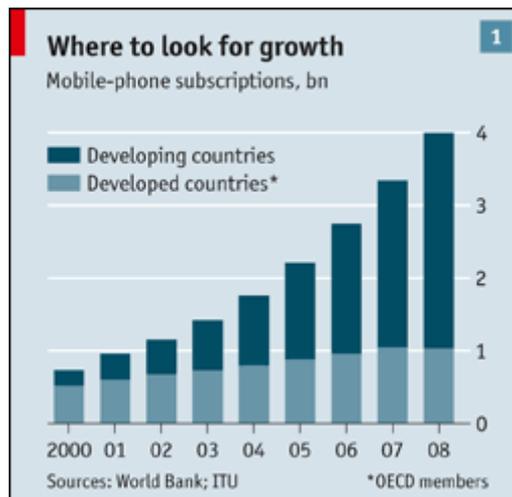


Eyevine

Bouncing a great-grandchild on her knee in her house in Bukaweka, a village in eastern Uganda, Mary Wokhwale gestures at her surroundings. "My mobile phone has been my livelihood," she says. In 2003 Ms Wokhwale was one of the first 15 women in Uganda to become "village phone" operators. Thanks to a microfinance loan, she was able to buy a basic handset and a roof-mounted antenna to ensure a reliable signal. She went into business selling phone calls to other villagers, making a small profit on each call. This enabled her to pay back her loan and buy a second phone. The income from selling phone calls subsequently enabled her to set up a business selling beer, open a music and video shop and help members of her family pay their children's school fees. Business has dropped off somewhat in the past couple of years as mobile phones have fallen in price and many people in her village can afford their own. But Ms Wokhwale's life has been transformed.

Ms Wokhwale prospered because being able to make and receive phone calls is so important to people that even the very poor are prepared to pay for it. In places with bad roads, unreliable postal services, few trains and parlous landlines, mobile phones can substitute for travel, allow quicker and easier access to information on prices, enable traders to reach wider markets, boost entrepreneurship and generally make it easier to do business. A study by the World Resources Institute found that as developing-world incomes rise, household spending on mobile phones grows faster than spending on energy, water or indeed anything else.

The reason why mobile phones are so valuable to people in the poor world is that they are providing access to telecommunications for the very first time, rather than just being portable adjuncts to existing fixed-line phones, as in the rich world. "For you it was incremental—here it's revolutionary," says Isaac Nsereko of MTN, Africa's biggest operator. According to a recent study, adding an extra ten mobile phones per 100 people in a typical developing country boosts growth in GDP per person by 0.8 percentage points.



In 2000 the developing countries accounted for around one-quarter of the world's 700m or so mobile phones. By the beginning of 2009 their share had grown to three-quarters of a total which by then had risen to over 4 billion (see chart 1). That does not mean that 4 billion people now have mobile phones, because many in both rich and poor countries own several handsets or subscriber-identity module (SIM) cards, the tiny chips that identify a subscriber to a mobile network. Carl-Henric Svanberg, the chief executive of Ericsson, the world's largest maker of telecoms-network gear, reckons that the actual number of people with mobile phones is closer to 3.6 billion.

But exact numbers are hard to come by, not least because of the continued rapid growth in the global number of subscribers. In the year to March 2009 an additional 128m signed up in India, 89m in China and 96m across Africa, according to TeleGeography, a telecoms consultancy. Numbers in Indonesia, Vietnam, Brazil and Russia also grew rapidly (see chart 2). China is the world's largest market for mobile telephony, with over 700m subscribers. India is adding the biggest number each month: 15.6m in March alone. And Africa is the region with the fastest rate of subscriber growth. With developed markets now saturated, the developing world's rural poor will account for most of the growth in the coming years. The total will reach 6 billion by 2013, according to the GSMA, an industry group, with half of these new users in China and India alone.



All this is transforming the telecoms industry. Within just a few years its centre of gravity has shifted from the developed to the developing countries. The biggest changes are taking place in the poorest parts of the world, such as rural Uganda.

Not the usual suspects

Three trends in particular are reshaping the telecoms landscape. First, the spread of mobile phones in developing countries has been accompanied by the rise of home-grown mobile operators in China, India, Africa and the Middle East that rival or exceed the industry's Western incumbents in size. These operators have developed new business models and industry structures that enable them to make a profit serving low-spending customers that Western firms would not bother with. Indian operators have led the way, and some aspects of the "Indian model" are now being adopted by operators in other countries, both rich and poor. This model provides new opportunities, especially for Indian operators. The spread of the Indian model could help bring mobile phones within reach of an even larger number of the world's poor.

The second trend is the emergence of China's two leading telecoms-equipment-makers, Huawei and ZTE, which have entered the global stage in the past five years. Initially dismissed as low-cost, low-quality producers, they now have a growing reputation for quality and innovation, prompting a shake-out among the incumbent Western equipment-makers. The most recent victim was Nortel, once Canada's most valuable company, which went bust in January. Having long concentrated on emerging markets, Huawei and ZTE are well placed to expand their market share as subscriber numbers continue to grow and networks are upgraded from second-generation (2G) to third-generation (3G) technology, notably in China and India.

The third trend is the development of new phone-based services, beyond voice calls and basic text messages, which are now becoming feasible because mobile phones are relatively widely available. In rich countries most such services have revolved around trivial things like music downloads and mobile gaming. In poor countries data services such as mobile-phone-based agricultural advice, health care and money transfer could provide enormous economic and developmental benefits. Beyond that, mobile networks and low-cost computing devices are poised to offer the benefits of full internet access to people in the developing world in the coming years.

This special report will examine each of these three trends in turn. Each one is significant in itself but also has consequences for rich as well as poor countries. Together they could start a second wave of mobile-led economic development as powerful as that prompted by the original launch of mobile phones. Their spread in poor countries is not just reshaping the industry—it is changing the world.

Eureka moments

How a luxury item became a tool of global development.



What, no network? – Reuters

How did a device that just a few years ago was regarded as a yuppie plaything become, in the words of Jeffrey Sachs, a development guru at Columbia University's Earth Institute, "the

single most transformative tool for development”? A number of things came together to make mobile phones more accessible to poorer people and trigger the rapid growth of the past few years. The spread of mobile phones in the developed world, together with the emergence of two main technology standards, led to economies of scale in both network equipment and handsets. Lower prices brought mobile phones within reach of the wealthiest people in the developing world. That allowed the first mobile networks in developing countries to be set up, though prices were still high.

The next big step was the introduction of prepaid billing systems, which allow people to load up their phones with calling credit and then talk until the credit runs out. When mobile phones first came in, subscribers everywhere talked first and paid later (a model known as postpaid), so they had to be creditworthy. Prepaid billing saves operators sending out bills and chasing up debts. It helped the spread of mobile phones among teenagers in Europe in the late 1990s because it offered parents a way of preventing their children from running up huge bills. It also dramatically expanded the market for mobile phones in poor countries.

Themba Khumalo of MTN recalls the firm’s launch of mobile services in South Africa in 1994, using the postpaid model. “Mobiles were initially perceived as a niche product, for business people, unaffordable by ordinary people,” he says, so this seemed the obvious method to adopt. But the launch of prepaid services “changed the landscape”, he says, by reducing the cost of owning a mobile phone. Top-up vouchers, in denominations as small as \$0.50, are now routinely sold by agents in small shops and on street corners across the developing world. “Mobile phones could not work in Africa without prepaid because it’s a cash society,” says Mo Ibrahim, the Sudanese businessman who established Celtel, a pan-African mobile group now owned by Zain, based in Kuwait. The prepaid model requires systems to accredit and support thousands of resellers, as well as handling the actual top-ups, says José María Álvarez-Pallete, general manager for Latin America at Telefónica, a Spanish telecoms giant that transferred its prepaid expertise from Spain to its Latin American subsidiaries.

From luxury to commodity

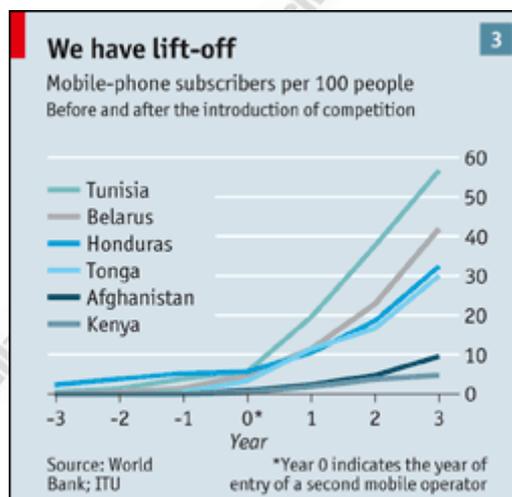
Once the switch to prepaid was made, the biggest barrier to broader mobile access became the cost of a handset, which was still an expensive item in the late 1990s. But the price of a basic model steadily fell, from around \$250 in 1997 to around \$20 today. As handset-makers became aware of the scale of the opportunity in the developing world, they turned their minds to producing low-cost models. And for those who still could not afford their own handsets, help was at hand in the form of microfinance. Popularised by Grameen Bank in Bangladesh, this involves making small loans, mainly to the rural poor. In a typical example, a woman borrows money to buy a cow and then repays the loan from the profits she makes on selling its milk. That way she gets an income, and her neighbours are able to buy milk.

Iqbal Qadir, a Bangladeshi who moved to America and became an investment banker, looked at this model and had an epiphany: “A cellphone could be a cow.” In 1997 the resulting effort to combine microfinance and mobile phones brought forth a Bangladeshi mobile operator called GrameenPhone, a joint venture between Grameen Bank and Telenor, a Norwegian telecoms firm. GrameenPhone pioneered the idea of the “telephone lady”, extending loans to women in rural villages to enable them to buy a mobile handset, an antenna and a large battery so they could sell calls to other villagers. Taking a small cut on each call, they were able to pay off the loan and thereafter to use the proceeds to pay for health care and education for their families and to develop other businesses. This “village phone” model quickly extended mobile coverage to thousands of villages in Bangladesh.

Although telephone ladies now make up only a small proportion of GrameenPhone's customers—around 220,000 out of a total of 8.5m—they account for as much as one-third of all calls because their phones are used by many people. The Grameen Foundation, a not-for-profit organisation set up by Muhammad Yunus, the founder of Grameen Bank, has since replicated the village-phone model in Cameroon, Indonesia, Rwanda and Uganda, and it has been widely copied elsewhere. In Afghanistan telephone ladies take an average of eight months to pay off the microloan required to buy their equipment and then earn \$50-100 a month, says Karim Khoja, chief executive of Roshan, the country's largest operator.

The village-phone model is a good way to introduce people to the advantages of telecommunications and provide access to start with, but it may soon have had its day. With prices continuing to fall, the vast majority of mobile users in the developing world now have their own handsets. Mr Khumalo says MTN recently placed an order with a Chinese manufacturer to supply handsets at \$13 each. Still, demand for shared phones has not dried up completely. Calling from a village phone costs less than buying a top-up, so even people with their own handsets may sometimes make calls from shared phones if they have run out of credit, notes Eric Cantor of the Grameen Foundation's Uganda office. And Mr Khumalo points out that some of MTN's village-phone operators now make more money selling airtime than phone calls.

Prepaid billing and affordable handsets on their own are not enough to ensure a rapid adoption of mobile phones, however. Another vital factor has been the liberalisation of telecoms markets and the issuing of licences to rival operators. As those operators compete for customers and try to recoup the cost of building their networks, calling charges fall and mobile adoption increases.



There is clear evidence that liberalisation drives adoption (see chart 3). The most vivid illustration comes from a comparison between two African countries: Ethiopia and Somalia. Ethiopia is one of the few remaining countries where mobile telecoms remains a government-run monopoly. By the end of 2008 the country had a "mobile teledensity" of 3.5% (ie, 3.5 mobile phones per 100 people), compared with 40% for Africa as a whole. By contrast, in war-torn Somalia, a similarly poor country with no functioning government and a completely unregulated telecoms market, more than a dozen operators have sprung up to meet demand, and mobile teledensity is 7.9%. Even warlords want their phones to work, notes Mr Ibrahim, so they leave networks alone: Celtel launched its networks in Sierra Leone and the Democratic Republic of Congo during civil wars, and both prospered.

Calling for growth

Does the spread of mobile phones promote economic development? At first the evidence was anecdotal. There were stories about farmers and fishermen phoning around to see where they would get the best price for their produce, for example. Mobile phones also unlock entrepreneurship: porters, carpenters and other self-employed workers can advertise their services on lamp-posts and noticeboards and ask potential clients to get in touch with them. Mr Quadir likes to tell the story of a barber in Bangladesh who could not afford the rent for a shop, so he bought a mobile phone and a motorbike instead, scheduling appointments by phone and going to his clients' homes. This was more convenient for them and he was able to serve a larger area and charge higher fees.

Globally such micro-entrepreneurs account for 50-60% of all businesses, and in Africa nearly 90%, says Jussi Impio, the head of Nokia's African research arm, based in Nairobi. Mobile phones make micro-entrepreneurs vastly more productive: a plumber no longer has to return to his shop to pick up messages from clients, for example. Mr Impio says he recently met an entrepreneur with a roadside kiosk who sold underwear and ice cream, "an interesting combination". He had conducted a detailed study of his company's fortunes and found that his income had increased by 70% in the six months after he started using a mobile phone in 2006, because basic activities such as stock handling and negotiating prices with suppliers become much more efficient with a mobile phone.

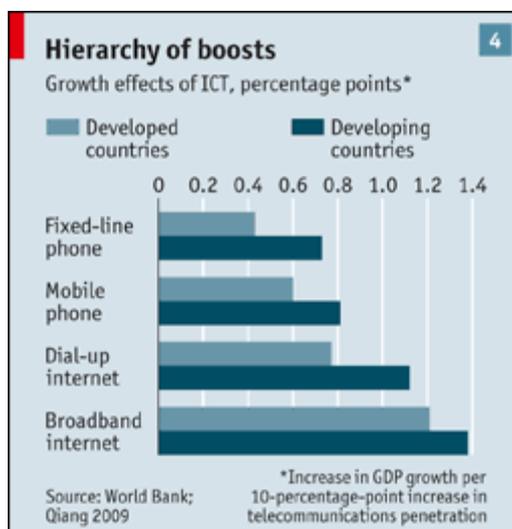
It is also clear that mobile phones create new jobs, stimulate investment and provide tax revenues for governments. Roshan is Afghanistan's largest private company, largest investor and largest taxpayer, and with its network of 25,000 agents who sell top-up vouchers it is one of the country's largest indirect employers. Roshan's success in Afghanistan attracted MTN and Etisalat, two big foreign operators, who provided further investment and created more jobs. By generating taxes, creating jobs that are not related to opium production and promoting prosperity, says Mr Khoja, the telecoms industry provides "a bubble of hope for Afghanistan".

In the past few years the anecdotal evidence has been backed up by studies that measure the economic impact of mobile phones directly. One example is the analysis of fish prices on the coast of Kerala, in southern India, carried out in 2007 by Robert Jensen, an economist at Harvard University. By examining historical price data as mobile-phone coverage was extended down the coast between 1997 and 2001, Mr Jensen was able to show that access to mobile phones made markets much more efficient. Fishermen could call several markets while still at sea before deciding where to sell instead of taking their catch back to their home market and throwing it away if there were no buyers for it. This eliminated waste, dramatically reduced the variation in prices along the coast, brought down consumer prices by 4% and increased fishermen's profits by 8%. Mobile phones paid for themselves within two months. Mr Jensen concluded that "information makes markets work, and markets improve welfare."

Similarly, Jenny Aker of the University of California at Berkeley carried out an analysis of grain markets in Niger, published in 2008, to see how the phasing-in of mobile-phone coverage between 2001 and 2006 affected grain prices. She found that it reduced price variations between one market and another by a minimum of 6.4%, and often more in remote and hard-to-reach markets. As a result, prices for consumers were lower and profits for traders higher. During a spike in food prices in 2005 grain was 4.5% cheaper in markets with mobile coverage.

Such microeconomic studies provide support for macroeconomic analyses that suggest a link between mobile phones and economic growth. In a much-cited study in 2005, for example, Leonard Waverman of the London Business School found that an extra ten mobile phones per

100 people in a typical developing country added 0.6 percentage points of growth in GDP per person. Critics say that it is difficult to tell whether mobile phones are promoting growth, or whether growth promotes the spread of mobile phones as more people become able to afford them. But detailed analyses of micro market data, such as Mr Jensen's study, demonstrate that phones really do make people better off. As Grameen Bank's Mr Yunus, who won the 2006 Nobel peace prize, once put it: "When you get a mobile phone it is almost like having a card to get out of poverty in a couple of years."



The most recent macroeconomic study, carried out by Christine Zhen-Wei Qiang, an economist at the World Bank, examined the effect of fixed-line and mobile phones, as well as dial-up and broadband internet access, on GDP per person for 120 developed and developing countries. She found that an increase of ten percentage points in mobile-phone adoption in a developing country increased growth in GDP per person by 0.8 percentage points, consistent with Mr Waverman's earlier result. According to Ms Zhen-Wei Qiang's research, mobile phones were more effective at promoting growth than fixed-line phones, but less effective than internet access or broadband (see chart 4). Since mobile phones have the greatest penetration, however, "the aggregate impact is highest for mobile," she says. She also found that all telecoms technologies promoted growth more effectively in developing countries than in developed ones. This is because telecoms services help make markets more efficient, reduce transaction costs and increase productivity—all areas in which developing countries have further to go than developed ones.

Wireless freedom

But the benefits of mobile phones are not just economic; there are political and social advantages too. FrontlineSMS, a system that allows groups to communicate via text messages, is being used to report human-rights violations and co-ordinate aid and conservation projects, among many other things. Ushahidi (Swahili for "testimony"), a website set up in response to the post-election violence in Kenya in 2008, allows mobile phones to be used for crisis and disaster management. In India's election this year voters were able to use their handsets to call up information about candidates, such as their educational background and any criminal charges they might be facing.

Mobile phones have been used for election monitoring in countries including Nigeria, Kenya and Sierra Leone. Reporting vote totals by phone from polling stations to local radio stations makes it harder to fiddle the results later. And text messaging has been used to co-ordinate political protests in many countries. "Mobile phones play a really wonderful role in enabling civil society," says Mr Ibrahim, who has set up a foundation to improve transparency and

governance in Africa. "As well as empowering people economically and socially, they are a wonderful political tool."

Mr Impio cites the popularity of call-in radio shows in Kenya as another example of how mobile phones can make politics more transparent. "People have phones, and when politics is being discussed they can call anonymously and say things journalists cannot discuss," he says. "Newspapers have started to quote them, and journalists say it has given them more freedom to discuss corruption."

Mobile phones can also be used to root out corruption in more direct ways. For example, Zubair Bhatti, a Pakistani bureaucrat, asked all clerks in the Jhang district who handled land transfers to submit a daily list of transactions, giving the amount paid and the mobile-phone numbers of the buyer and the seller. He explained that he would be calling buyers and sellers at random to find out whether they had been asked to pay any extra bribes or commissions. When charges were subsequently brought against a clerk who had asked for a bribe, the others realised that Mr Bhatti meant business, and buyers and sellers reported a sudden improvement in service. Mr Bhatti extended the scheme to other areas, such as cracking down on vets who demanded bribes from farmers, and has proposed that the Jhang model, as it is now known, be adopted in other districts. "It could easily be institutionalised with a call centre," he says. "It could have big vote-getting influence."

Again, these are just a few anecdotal examples, but they illustrate the myriad unseen ways in which mobile phones are improving people's lives across the world, and in the developing world in particular. New data services that provide agricultural advice and price information, improve the provision of health care and allow quick and easy money transfers hold out the promise of extending the benefits of mobile phones still further.

Ericsson's Mr Svanberg draws an analogy with the internet: only when it had been widely adopted in the rich world were websites such as Facebook and YouTube able to take off. Similarly, he says, once poor countries have established comprehensive mobile coverage, and a reasonable proportion of the population owns a handset, they have a platform from which new services, such as farming advice and mobile money, can be launched. This second wave of mobile-driven benefits, however, will reach its full potential only if access can be extended even further. That, in turn, will require mobile operators in developing countries to find new ways to cut the cost of ownership even more.

The mother of invention

Network operators in the poor world are cutting costs and increasing access in innovative ways.



Dialling low-cost innovation – Alamy

Providing mobile services in a developing country is very different from doing the same thing in the developed world. For a start, there may not be a reliable electrical grid, or indeed any grid at all, to power the network's base stations, which may therefore need to run on diesel for some or all of the time. That in turn means they must be regularly resupplied with fuel, which can be tricky in remote areas. Then there is the challenge of running the network profitably. In Europe mobile subscribers typically spend about \$36 a month, a figure known in the industry as the average revenue per user (ARPU). In America that figure is \$51 and in Japan \$57. But in China it is only around \$10, in India less than \$7 (see table 5) and in some African countries even lower. As mobile phones get cheaper and more poor people can afford them, ARPUs across the developing world are falling.

It all adds up			
Average revenue per mobile-phone user per month 2008, \$			
Japan	56.9	Nigeria	12.7
France	54.2	China	10.1
United States	50.7	Kenya	9.8
Britain	37.3	India	6.5
Germany	30.5	Indonesia	4.8
Brazil	14.6	Bangladesh	3.7

Source: TeleGeography

Operators in poor countries have responded by finding new ways to reduce the cost of operating mobile networks and serving customers. The country that has gone furthest down this road is India, so the result is sometimes known as the "Indian model", even though some of its features originated elsewhere, and some low-cost innovations developed elsewhere have not caught on in India. Despite an ARPU of only \$6.50 and call charges of \$0.02 per minute, Indian operators have operating margins of around 40%, comparable with leading Western operators, according to a study by Capgemini, a consultancy. "On low-cost, innovative models, this is where the centre of gravity is," says Prashant Gokarn, head of strategy at Reliance Communications, India's second-biggest operator. Given India's size, its combination of poverty and rapid growth and its reputation as a centre of technology and outsourcing, it is hardly surprising that it has emerged as the crucible of business-model innovation.

Indian model

Outsourcing is at the heart of the Indian model, which was pioneered and is now embodied by Bharti Airtel, India's biggest mobile operator. All of Bharti's information-technology (IT) operations are outsourced to IBM; the running of its mobile network is handled by Ericsson and Nokia Siemens Networks (NSN); and customer care is outsourced to IBM and a group of Indian firms. This passes much of the risk of coping with a rapidly growing subscriber base to other parties and leaves Bharti to concentrate on marketing and strategy. Unusually, it is not just the operation of Bharti's network that is outsourced but the construction as well, under a scheme known as "managed capacity" that is now used by several Indian operators.

When moving into a new area, Bharti requests a certain amount of calling capacity and pays for it three months later at an agreed price per unit of capacity, says Kunal Bajaj of BDA, a telecoms consultancy. That leaves it up to the vendor to handle the business of designing networks, putting up base stations and so on, giving it an incentive to build the network as frugally as possible. Margaret Rice-Jones of Aircom, a network-planning consultancy, says this cut costs by ensuring that operators do not pay for more capacity than they really need. "The

old model was a bit like letting your supermarket plan your shopping list," she says. The vendors, for their part, gain economies of scale because they build, run and support networks for several Indian operators. Ericsson's Mr Svanberg says his firm can run a network with 25% fewer staff than an operator would need. Bharti's operating expenses are around 15% lower than they would be if it were to build and run its network itself, and its IT costs are around 30% lower, according to Capgemini.

Arguably, the Indian model should be called the Ericsson model, says Mr Svanberg, because his firm developed it and first deployed it on a small scale in New Zealand. But, says Mr Bajaj, "Bharti decided to do its entire network like this, and to experiment at that scale is totally different." There were growing pains to start with as Bharti and its outsourced suppliers searched for the right balance of cost- and risk-sharing. Expanding into rural areas is especially tricky because the capacity needed is initially very low, so Bharti typically agrees to buy a minimum amount.

Equipment vendors make most of their profits when capacity is increased. "You make the land grab in the early phases, and what you're securing is margins and revenues for the future," says Ms Rice-Jones. The outsourced-network model is now gaining popularity with other operators in India. Even if they do not go as far as Bharti, they are more likely than operators elsewhere to outsource network design, tuning and management, says Mr Svanberg.

A second plank of the Indian model is infrastructure-sharing, in which several operators share the metal towers on which network antennae are mounted and which house their associated equipment, generators and so forth. In 2007 three Indian operators, Bharti, Vodafone Essar and Idea Cellular, pooled 100,000 of their towers in a single company, Indus Towers. Not all the operators use all the towers (the average is about 1.5 operators per tower), but the arrangement saves the three companies having to find new sites and build their own towers. Indus Towers will also lease tower capacity to other operators.

Similarly, Reliance Communications has spun off its towers into a separate unit that will offer tower capacity to other operators. This turns an operator's assets into a source of new revenue, says Mr Gokarn, and allows the mobile operator to concentrate on serving customers. Tower-sharing happens in other countries too, including Britain and America, says Greg Jacobsen of Capgemini; and some countries, including China and Bangladesh, have made sharing compulsory. What is unusual about India is the extent of voluntary, market-led sharing as a way to reduce costs.

Other components of the Indian model include "lifetime" prepaid schemes, in which customers pay a one-off fee and can then receive incoming calls indefinitely, even if they do not make outgoing calls; widespread use of paperless top-ups, to reduce the costs of distributing top-up vouchers; and automatically turning off some equipment at night, when traffic volumes fall, to reduce energy usage.

The search for new cost savings continues. Reliance is experimenting with a "micro-call-centre" model, in which large call centres in urban areas are replaced by a smaller number of centres in more rural areas. This means agents can be paid less and are more likely to be able to answer queries. Turnover is high, so the trick, says Mr Gokarn, is to reduce the cost of training new agents. Indian operators are also keen adopters of "green" base-station technologies, such as air cooling, solar and wind power, and hybrid diesel-electric generators, which reduce energy consumption and hence operating costs. "Green technology has become a hot topic in India because it's cheaper," says Mr Bajaj.

African operators, which face many of the same difficulties as those in India, have devised some cost-lowering innovations of their own, such as dynamic tariffing, pioneered by MTN. This involves adjusting the cost of calls every hour, in each network cell, depending on the level of usage. Customers can check the discount they are getting on their handsets. At 4am it can be as high as 99%. This generates calls when the network would otherwise be little used, says Themba Khumalo of MTN Uganda. In addition to the peak hour from 8am, he says, there is now a new peak hour from 1am as people take advantage of cheaper calls. Customers in developing countries are far more price-sensitive than people in the rich world, notes Stephan Beckert of TeleGeography, so they are prepared to stay up late to save money. Vodacom has introduced a similar scheme. In Tanzania, says Ms Rice-Jones, it found that call volumes increase by 20-30% in areas where dynamic tariffing is switched on.

Another African innovation is "borderless roaming", introduced by Celtel (now Zain) in late 2006. This allows customers in Kenya, Tanzania and Uganda to move between these countries without paying roaming charges to make or receive calls. They can also top up their calling credit in any of these countries. The scheme has been extended to other African countries where Celtel operates, and rival operators such as MTN have introduced similar offers. Borderless roaming is possible because many operators have direct fibre-optic connections between their networks in different countries, allowing them to act, in effect, like a single network.

Alessio Ascari, of McKinsey, a consultancy, argues that Africa, rather than India, "is the new battlefield and the new laboratory for development" in telecoms. The difficulties operators face are even greater than in India, given the huge diversity and political instability in many countries, as well as widespread poverty and fierce competition. Africa is also interesting because local operators and regional champions are competing with Middle Eastern operators, such as Zain and Etisalat, and those from Europe, such as Vodafone and Orange. All of them, Mr Ascari points out, "bring different strengths to the market".

The wealth of innovation in India and Africa demonstrates that the Western operators are not always best at running networks. "Each of us is learning different pieces of the puzzle from the others," says Mr Álvarez-Pallete of Spain's Telefónica. His company is transferring expertise, and indeed managers, between its operations in Europe and Latin America. Much the same is done at Vodafone, which has separate divisions for the developed and the developing world. Vittorio Colao, its chief executive, says his company is applying its European expertise in customer-profiling and segmentation in India, for example, as customer loyalty becomes more important. But there is also a flow of expertise in the opposite direction, in particular in network operations. "There are a lot of operational ideas from a cash-constrained, poor and very entrepreneurial environment that you can immediately bring back to the developed world," he notes.

Perhaps the most striking example is the agreement struck between Vodafone and Telefónica in March 2009 to share towers and other network infrastructure in four European countries. Network-sharing is not new, says Mr Colao, "but the confidence to do it at scale, and with a fierce competitor, came from India. Once you see how it works in that kind of environment, you become much more confident that you can do it in Barcelona or Venice." The savings are much bigger in Europe because the cost of leasing tower sites is higher, which adds to the attraction of the deal. An agreement reached in July by Sprint, an American operator, to outsource the day-to-day running of its network to Ericsson can also be seen as an example of the spread of the Indian model, argues Capgemini's Mr Jacobsen. Ericsson is betting that it will be able to sign similar deals with other American operators in order to gain economies of scale.

Vodafone has outsourced more of its IT, again inspired by the Indian example, and it is using the Indian "managed capacity" model at one of its rapidly growing subsidiaries in Turkey. But according to Mr Colao this model, which he likens to leasing rather than buying a car, does not work everywhere. "In markets where you are not sure about speed and shape of growth, the model makes sense," he says. But in mature markets where demand is easier to predict it can be better for operators to build new capacity themselves. Vodafone is also taking a leaf out of the Indian marketing book, moving its marketing chief from India, Harit Nagpal, into a global marketing role. (Google "Zoo zoo" to see Vodafone's popular series of Indian television advertisements.)

The challenge now is to apply all these cost-saving lessons to connecting the world's remaining 3 billion people and achieving universal mobile coverage. Within India, even the most remote areas are now judged to be on the verge of commercial viability, judging by the results of two auctions held in 2007. In each case bidders had to say how much government subsidy they would require to expand into rural areas, with the contract going to the lowest bidder.

In the first auction, for the right to build shared towers in 8,000 rural locations, the average subsidy requested was 35%, much less than expected. In the second auction, for the right to offer mobile services, many operators submitted zero bids or even negative ones—in effect offering to pay for the right to set up in rural areas. "The subsidies required are not as big as everyone thought, because the companies believe there's a business case in being present in rural areas first," says Mr Bajaj. In part this reflects the cut-throat competition in the Indian market. But it also shows that mandated tower-sharing can make the economics far more attractive for operators in rural areas, which could be a valuable lesson for other countries. A second round of rural expansion, with another 12,000 shared towers, has been announced.

In China tower-sharing is mandatory, which has helped reduce the cost of expanding into rural areas. But since the three mobile operators are state-owned, the extension of coverage is coordinated from the centre. China Mobile, the largest operator, has signed an agreement with the agriculture ministry to cover 98% of rural areas by 2012, in part to compensate for its relative weakness in third-generation (3G) networks, where it is being forced to adopt the home-grown and relatively immature Chinese standard. And just as India, renowned for its technology-services industry, has pioneered clever business models and outsourcing to get prices down and extend access, China has used its own particular strength as a low-cost manufacturer.

Rural access elsewhere in the developing world is also likely to improve. One hopeful sign is the merger being negotiated between Bharti and MTN, which should accelerate the transfer of low-cost operating expertise between India and Africa. Greater scale will also increase the combined firm's clout with suppliers. The deal is driven by Bharti's and MTN's desire for long-term growth potential outside their existing markets, rather than by hopes of cost savings, says Mr Bajaj. But it could promote greater use of network outsourcing in Africa, and new techniques such as dynamic tariffing in India.

Spreading the word

This is unlikely to be the end of Indian operators' international ambitions, which could spread the Indian model to other parts of the world. So far moves into Africa by Middle Eastern operators have not been conspicuously successful. Nick Jotischky of Informa Telecoms & Media, a consultancy, notes that Middle Eastern operators often lack the Indian operators' experience with low-cost business models. Zain, for example, was said to be looking for a buyer for its operations in sub-Saharan Africa, many of which are making losses, to concentrate on wealthier customers in North Africa and the Middle East. But in recent weeks it

has been negotiating to sell a 46% stake to a consortium of Indian and Malaysian buyers. Reliance, India's number two, held merger talks with MTN last year.

In recent years Indian firms have made a series of bold foreign acquisitions in industries such as steel and cars. If its telecoms giants follow suit, their low-cost model could give them a clear competitive advantage—and help bring mobile phones within reach of even more people.

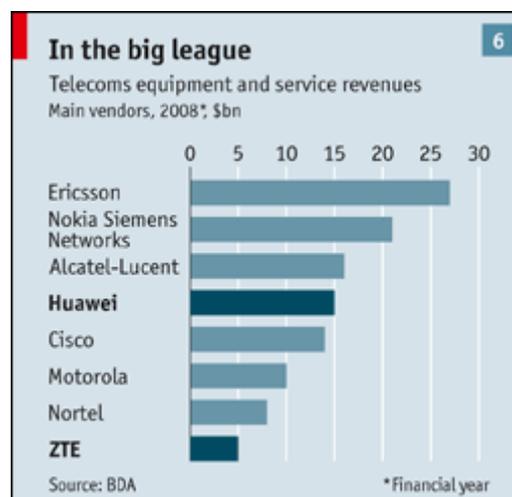
Up, up and Huawei

China has made huge strides in network equipment.



Now gearing up in handsets – Imaginechina

In the 1960s, when Japan emerged as a manufacturing exporter, it soon became a byword for low cost and low quality. Much fun was made of unreliable Japanese watches and cheap Japanese cars. But quality improved and Japan became a powerful force in electronics, carmaking and other industries. Today Toyota is held up as a model of efficient manufacturing, and Japanese firms lead the world in clean technology, carmaking and consumer electronics. China hopes to make a similar transition. For now, foreigners think that its home-grown electronics and cars are cheap and shoddy, as Japan's were thought to be 40 years ago. But quality is steadily improving and China is being taken increasingly seriously as an innovator. The firm that embodies this new, high-tech China is Huawei, the country's largest telecoms-equipment company.



Founded in 1988, Huawei has risen astonishingly fast. Last year it was the world's fourth-largest maker of network equipment, ranked by sales (see chart 6), and this year it is

expected to move into third place, according to BDA, a consultancy. It is already ranked a close second in optical networking and third in mobile-network gear. Only slightly behind is ZTE, China's second-largest maker of telecoms equipment, founded in 1985. Last year it was in eighth place, and it is moving up the field—not least because Nortel, the number seven, went bankrupt in January. Both Chinese firms specialise in network infrastructure, but they also make handsets. In a fiercely competitive market, ZTE became the world's sixth-largest handset-maker last year. Its goal is to be the number three in handsets within five years.

The two Chinese firms' global market share is still relatively small, but their impact on telecoms has been colossal. Together they have driven down costs and brought about consolidation across the industry. Having offered discounts of as much as 50%, they were in large part responsible for the mergers in 2006 between Alcatel and Lucent and the network-equipment arms of Nokia and Siemens, and the collapse in January 2009 of Nortel and the sale of many of its assets to Ericsson.

Huawei and ZTE are now winning the lion's share of equipment contracts for China's three third-generation (3G) mobile networks, spending on which will total \$59 billion between 2009 and 2011, according to the Ministry of Industry and Information Technology. This will further increase their market share, to the disappointment of Western vendors that had hoped to benefit from China's adoption of 3G, one of the biggest telecoms projects in history. "The vendor community is struggling, but Huawei and ZTE are still growing, largely on the back of the emerging markets," says Informa's Mr Jotischky.

The Chinese are coming

Huawei and ZTE are not just strong at home; both firms also ventured abroad in the 1990s, selling fixed-line equipment in Asia and Africa. Western vendors' interest in those regions was limited and their prices were too high, says Zhu Xiaodong, ZTE's technology chief in Europe. Next, the Chinese firms began selling wireless equipment in the Middle East, South-East Asia, Africa and Latin America. Mr Zhu, who led the team that designed ZTE's first mobile base-station based on the GSM standard, says Chinese companies had two advantages in the wireless-equipment market: much cheaper labour and, by that time, settled standards. Nokia and Ericsson, the pioneers of the GSM standard, took years to develop the technology; ZTE built its first base-station in six months.

Huawei was the first of the two firms to move into Europe, the home market of Ericsson, the world's largest telecoms-equipment supplier. At first only smaller operators, and the eastern European subsidiaries of bigger ones, bought its equipment, but now it supplies several leading European operators, including Vodafone, Telefónica, T-Mobile and BT. In America Huawei is selling 3G network gear to Cox Communications, and its equipment is being tested by AT&T.

Customers needed time to get to know Huawei, says Edward Zhou, its marketing chief in Europe, but now "we are accepted as a provider of innovative solutions and high quality." A few years ago Huawei had only a small booth at Mobile World Congress, the industry's biggest annual trade show, notes Mike Thelander of Signals Research, a consultancy. This year it had a whole building to itself, which had been Ericsson's sole prerogative. "It's impressive what they've done in a short period of time," says Ericsson's Mr Svanberg.

Perceptions of the Chinese vendors within the industry shifted suddenly between 2004 and 2006, says Vodafone's Mr Colao, who spent that period working outside the industry as head of an Italian media group. "When I left, I think I had heard of Huawei twice, but I would not have been able to remember their name," he says. "When I came back in 2006 they were a supplier to Vodafone, and they are now one of the main ones." Having got started by offering

low prices, he notes, the Chinese firms have since gained scale and a reputation for innovation.

Huawei and ZTE led the way in something called "remote radio-head" technology. In a mobile base-station the radio circuitry usually sits in a cabinet and is connected by a cable to an antenna on the tower overhead. Replacing this cable with an optical fibre, and moving the radio circuitry into the antenna itself, eliminates power losses in the antenna cable, cutting energy consumption by around one-third and reducing the size of the equipment.

More recently, says Weiran Zhuang of BDA, the Chinese vendors have shown that they can innovate by launching reconfigurable base-stations, the functions of which are defined in software rather than hardware. That means the base-station can be quickly rejigged to support different mobile-network technologies, or even several such technologies at the same time. Most mobile operators are now running 2G and 3G networks alongside each other, using separate sets of equipment, so the prospect of being able to replace them with a single system is enticing. América Móvil, the largest mobile operator in Latin America, found that deploying Huawei's reconfigurable SingleRAN hardware reduced the power consumption of its base-stations by 50% and the volume of equipment needed by 70%. ZTE makes a similar system which reduces power consumption by 40% and has already been deployed by CSL, an operator in Hong Kong. Both systems can also be upgraded to LTE, the emerging 4G standard. This has particular appeal for Chinese operators, which are still upgrading from 2G to 3G as 4G already looms on the horizon.

A few years ago Huawei used to boast of its cost advantage in research and development, mostly because its Chinese engineers commanded much lower salaries than its rivals' staff. But as foreign firms have shifted more of their own R&D to China, and Huawei has expanded outside China, it is now keen to present itself primarily as an innovator rather than a low-cost provider. "It is a misperception to say that Huawei is a low-cost company," says Mr Zhou. The firm now has over 100 offices abroad and maintains research centres in Europe, America and India as well as China. In January Huawei topped the World Intellectual Property Organisation's 2008 rankings for international patent applications, a sign that the company is outward-looking and determined to defend its intellectual property abroad.

A TD-S diversion

Even the Chinese government has been surprised by the speed at which Huawei has established itself as an international force. Since the late 1990s the government has been pursuing an elaborate industrial policy designed to boost the prospects for Chinese equipment-makers at home and abroad. But the plan has fallen so far behind schedule, and Huawei and ZTE have done so well on their own in international markets, that the entire scheme has become almost irrelevant.

The plan involved the development and promotion of a Chinese 3G technology called TD-SCDMA, or TD-S. A decade ago, as operators in America, Europe and Japan prepared to build the first 3G networks, there was a fierce argument over the merits of two rival 3G technologies: one called W-CDMA, backed by European operators and vendors, and one called CDMA2000, backed by American firms. It was clear that W-CDMA would predominate in Europe and CDMA2000 in America, but both camps had their eye on foreign markets. Chinese officials decided that China should also enter this competition and develop its own 3G standard. By mandating its adoption in China they could provide enough scale to get the technology established. TD-S could then be offered to operators abroad, particularly those in Asia whose customers might wish to roam in and out of China. Chinese equipment-makers would enjoy a boost to their sales and would not have to pay licensing fees to foreign vendors.

But TD-S took much longer to develop than expected. The government delayed issuing China's 3G licences because it wanted to ensure that TD-S would be used for at least one of the country's 3G networks. After years of uncertainty it reorganised China's various mobile and fixed-line operators into three giant groups in 2008, in preparation for the introduction of 3G. But by this time Huawei and ZTE were doing well in foreign markets without any help from TD-S, and the global telecoms industry was already looking towards 4G networks, based on the LTE standard. Huawei is at the forefront of LTE development: the world's first LTE mobile connection was made using the company's equipment in June this year. But TD-S has had so much political capital invested in it that the Chinese government could not give up on it. So when at last it awarded 3G licences in January this year it required China Mobile, the world's largest operator by subscriber numbers, to use TD-S to build its 3G network.

Because of its size, China Mobile is arguably the only operator on Earth that could establish a new technological standard on its own, but even this giant seems unable to make a success of TD-S. In a recent filing with financial regulators the company admitted that "we have encountered and may continue to encounter challenges in the deployment of our 3G services" and that "we may not be able to effectively and economically deliver our 3G services based on this technology." The main problem is the lack of TD-S handsets: existing models must be completely redesigned to work with TD-S networks. China Mobile had hoped to have 10m TD-S subscribers by the end of 2009, but by the end of June it had signed up only 959,000. Of these, says Mr Zhuang, only half are using TD-S handsets. The other half are using the TD-S network to provide a mobile-broadband connection for laptops, which seems a more promising market until more TD-S handsets become available. The prospect that TD-S will be adopted outside China, never bright, has now faded altogether.

Although China Mobile, Huawei and ZTE continue to talk up TD-S, they have already devised a face-saving exit strategy: to promote a new variety of LTE, called TD-LTE, which with enough hand-waving can claim to be derived in some respects from TD-S. "The reality is that they are two completely different, incompatible technologies, but it's a nice way to get away from TD-S, by claiming it's an upgrade or an evolution," says Mr Thelander. China Mobile now requires all suppliers of 3G equipment to support smooth evolution to LTE, says Mr Jotischky.

Vodafone and Verizon Wireless are taking part in efforts to make TD-LTE work smoothly with the mainstream LTE standard. (Vodafone owns a small stake in China Mobile and would like a single global 4G standard to make roaming easier and increase economies of scale.) If TD-LTE can then be rolled into the main LTE standard, so that LTE handsets work well on Chinese TD-LTE networks, China Mobile will escape being hobbled by an inferior home-grown technology motivated by political aims. In the meantime it must push ahead with TD-S as best it can.

Both Huawei and ZTE, along with other Chinese equipment-makers such as Datang, received government funds to support the development of TD-S. But "by the time the TD-S cake was baked—and it never really tasted that good—Huawei and ZTE had racked up impressive and unexpected gains," says Duncan Clark of BDA. Huawei, which did the minimum necessary to support TD-S, has emerged as the strongest, whereas Datang has been far less successful abroad. So it is difficult to argue that the TD-S project has helped make Chinese firms more internationally competitive.

One source of concern about Huawei is its opaque ownership. The company is privately held, and Mr Zhou insists that it is entirely employee-owned. But its military culture, and the fact that its founder, Ren Zhengfei, is a former army officer, have led to persistent rumours that it has close ties with the army. Moreover, its ownership structure may be complicated by its history of joint ventures, says Mr Clark.

The big two Chinese vendors are relatively weak in services compared with their Western rivals, though both are pushing ahead as fast as they can. Being able to offer services in conjunction with network equipment is becoming more important as operators, in India and elsewhere, outsource their network operation to reduce costs. As network gear becomes commoditised, services offer higher margins and long contracts, notes Mr Thelander. Like many people in the industry, he believes that only Ericsson and Huawei are sure to be around in a decade's time. A senior executive at one large mobile operator says he sometimes awards contracts to non-Chinese vendors, even if their prices are a little higher, in order to maintain choice and competition in the market.

As Huawei goes up against Ericsson in network equipment, ZTE hopes to move up in handsets. At the moment many of its handsets are sold by mobile operators (including Vodafone and T-Mobile) under their own brands, customised to the operators' specifications. ZTE says it is willing to work with operators, but is also preparing to push its own brand more vigorously, particularly in western Europe. To succeed, it will need to produce some desirable, high-specification handsets. So far, says Mr Thelander, "I haven't seen anything that's wowed me." But then only a few years ago the Chinese vendors' network equipment was seen as not very exciting.

Beyond voice

New uses for mobile phones could launch another wave of development.



I'm not selling for that – Reuters

In A field just outside the village of Bumwambu in eastern Uganda, surrounded by banana trees and cassava, with chickens running between the mud-brick houses, Frederick Makawa is thinking about tomatoes. It is late June and the rainy season is coming to an end. Tomatoes are a valuable cash crop during the coming dry season and Mr Makawa wants to plant his seedlings as soon as possible. But Uganda's traditional growing seasons are shifting, so he is worried about droughts or flash floods that could destroy his crop. Michael Gizamba, a local village-phone operator, offers to help using Farmer's Friend, an agricultural-information service. He sends a text message to ask for a seasonal weather forecast for the region. Before long a reply arrives to say that normal, moderate rainfall is expected during July. Mr Makawa decides to plant his tomatoes.

A few miles away in the village of Musita, Michael Malime, another village-phone operator, explains how his customers have been using the same service to get farming tips. Rice farmers who had trouble with aphids texted for advice and received a message telling them how to make a pesticide using soap and paraffin. A farmer with blighted tomato plants learned how to control the problem by spraying the plants with a milk-based mixture.

The Farmer's Friend service accepts text-message queries such as "rice aphids", "tomato blight" or "how to plant bananas" and dispenses relevant advice from a database compiled by local partners. More complicated questions ("my chicken's eyes are bulging") are relayed to human experts, who either call back within 15 minutes or, with particularly difficult problems, promise to provide an answer within four days. These answers are then used to improve the database.

Farmer's Friend is one of a range of phone-based services launched in June by MTN, Google and the Grameen Foundation's "Application Laboratory", or AppLab. As well as disseminating advice in agriculture, provided by the Busoga Rural Open Source and Development Initiative, the new services also provide health and market information. The Clinic Finder service points people to nearby clinics, and the Health Tips service explains the symptoms of common diseases.

Lastly there is Google Trader, a text-based system that matches buyers and sellers of agricultural produce and commodities. Sellers send a message to say where they are and what they have to offer, which will be available to potential buyers within 30km for seven days. Mr Makawa says his father used the service to look for a buyer for some pigs, which he sold to pay school fees. These services cost 110 shillings (\$0.05) a time, the same as a standard text message, except for Google Trader, which costs double that. In their first five weeks the services received a total of more than 1m queries.

A web of sorts

"There is a big shift from holding a phone to your ear to holding it in your hand," says David Edelstein of the Grameen Foundation. "It opens the door to information services. It's not the web, but it's a web of services that can be offered on mobile devices." As with the Village Phone project, Grameen is trying to establish a model that can be scaled up and replicated in other countries. Offering agricultural and health information is more difficult than offering a phone service, however, because such information must be localised and must take cultural differences into account. The answer is to work closely with local partners, says Mr Edelstein. Grameen is also experimenting with the idea of "community knowledge workers"—local people who can help others get access to mobile services, reading, translating and explaining text messages where necessary, just as village-phone operators provide access to basic communications.

Trading up

Grameen's collaboration with MTN and Google in Uganda is just one of dozens of services across the developing world that offer agricultural, market and health information via mobile phones. In India, for example, farmers can sign up for Reuters Market Lite, a text-based service that is available in parts of India. Its 125,000 users pay 200 rupees (\$4.20) for a three-month subscription, which provides them with local weather and price information four or five times a day. Many farmers say that their profits have gone up as a result.

Tata Consultancy Services, an Indian operator, offers a service called mKrishi which is similar to Farmer's Friend, allowing farmers to send queries and receive personalised advice. "The rural population is willing to pay substantial subscription fees to get this information multiple

times a day," says Kunal Bajaj of BDA. There have been lots of pilot schemes in the past, he says, but commercial offerings are now beginning to gain ground.

Nokia, the world's largest handset-maker, launched its own information service, Nokia Life Tools, in India in June. In addition to education and entertainment, it provides agricultural information, such as prices, weather data and farming tips, that can be called up from special menus on some Nokia handsets. The basic service costs 30 rupees a month, and a premium service which provides detailed local crop prices in ten states is available at twice that price. "It is in its early stages, but it has resonated extremely well with its target audience," says Olli-Pekka Kallasvuo, Nokia's chief executive.

Services to help farmers have been most widely adopted in China, where China Mobile offers a service called Nong Xin Tong in conjunction with the agriculture ministry, as part of its push into rural areas. It has already signed up 50m users and is aiming for 100m within three years. The service provides news, weather information and details of farming-related government policies.

China Mobile also runs a website, 12582.com, that sends farmers information about planting techniques, pest management and market prices. The service, which costs two yuan (\$0.30) a month, sends out 13m text messages a day and has over 40m users. There are dozens of other examples across the developing world. TradeNet, launched in Ghana in 2005, now links buyers and sellers of agricultural products in nine African countries; CellBazaar provides a text-based classified-ads service in Bangladesh.

Mobile phones are also being used in health care. One-way text alerts, sent to everyone in a particular area, can be used to raise awareness of HIV; sending daily text messages to patients can help them remember to take their drugs for tuberculosis or HIV. Mobile phones can be used to gather health information in the field faster and more accurately than paper records and help with the management of drug stocks. Camera-phones are used to send pictures to remote specialists for diagnosis.

Bright Simons, a Ghanaian social entrepreneur, has devised a phone-based system called mPedigree to tackle the problem of counterfeit drugs. Some 10-25% of all drugs sold are fakes, according to the World Health Organisation, and in some countries the proportion can be as high as 80%. Under Mr Simons' scheme, which is being implemented in Nigeria and Ghana, a scratch-off panel on the packaging reveals a code which can be texted to a special number to verify that the drugs are genuine. Most mobile-health projects are still at the trial stage, but a report compiled in 2008 by the UN Foundation and the Vodafone Foundation documented around 50 such projects across the developing world. Studies are now under way to quantify their benefits.

These new services have become feasible because mobile phones are increasingly ubiquitous. "We are now in a new phase where we are seeing the network effects of so many people using mobile phones," says Mr Simons. His system can, for example, safely assume that the pharmacist in any given village will have a mobile phone. These text-based services, though they fall short of full internet access, have the potential to unlock a range of social and economic benefits to users of even the most basic mobile phones. "There's a lot of talk about what you can do with more sophisticated devices, but it's much more compelling when you focus on the devices that people have in their hands today," says Mr Edelstein.

Money talks

Quantifying the benefits of agricultural and health services is hard, and such services are still in their early days in much of the world. The mobile service that is delivering the most obvious

economic benefits is money transfer, otherwise known as mobile banking (though for technical and regulatory reasons it is not, strictly speaking, banking). It has grown out of the widespread custom of using prepaid calling credit as an informal currency.

Suppose you want to send money from the city back to your family in the country. You could travel to the village and deliver the cash in person, but that takes time and money. Or you could ask an intermediary, such as a bus driver, to deliver the money, but that can be risky. More simply, you could buy a top-up voucher for the amount you want to transfer (say, \$10) and then call the village-phone operator or shopkeeper in your family's village and read out the code on the voucher. The credit will be applied to the phone of the shopkeeper, who will hand cash to your family, minus a commission of 10-20%. In some countries, where airtime can be transferred directly from one phone to another by text message, the process is even simpler: load credit onto your phone, then send it to someone on the spot who in return gives cash to your intended recipient.

These methods became so widespread that some companies decided to set up mobile-payment systems that allow real money, rather than just airtime, to be transferred from one user to another by phone. Once you have signed up, you pay money into the system by handing cash to an agent (usually a mobile operator's airtime vendor), who credits the money to your mobile-money account. You can withdraw money by visiting another agent, who checks that you have sufficient funds before debiting your account and handing over the cash. You can also send money to other people, who will be sent a text message containing a special code that can be taken to an agent to withdraw cash. This allows cash to be sent from one place to another quickly and easily.

Some mobile-money schemes also allow international remittances; others issue participants with debit cards linked to their mobile-money accounts. Since there are many more mobile phones and sellers of mobile airtime than there are cash machines and bank branches, mobile money is well placed to bring financial services within reach of billions of "unbanked" people across the developing world.



Banking for the unbanked - Getty Images

The biggest successes in this field so far have been Gcash and Smart Money in the Philippines, Wizzit in South Africa, Celpay in Zambia and, above all, M-PESA in Kenya, which has become the most widely adopted mobile-money scheme in the world. Launched in 2007 by Safaricom, Kenya's largest mobile operator, it now has nearly 7m users—not bad for a country of 38m people, 18.3m of whom have mobile phones. M-PESA's early adopters were young, male urban migrants who used it to send money home to their families in the country. But it has since become wildly popular and is used to pay for everything from school fees to taxis (drivers like

it because it means they are carrying less cash around). Roughly \$2m is transferred through the system each day, with an average amount of \$20. "In markets in Kenya, stallholders are happy to take M-PESA payments. It's pretty dramatic," says Bob Christen, head of the "Financial Services for the Poor" initiative at the Bill & Melinda Gates Foundation.

Making it easier, quicker and cheaper to transfer money has enormous social and economic benefits. Commissions are lower, and recipients no longer have to pay for transport to towns to make withdrawals. They can also take out funds more easily and frequently. In rural households that have adopted mobile money, incomes have increased by 5-30%, according to Olga Morawczynski, an ethnographer at the University of Edinburgh who has studied M-PESA in detail. It also saves men working in the city having to take time off to deliver the money to their families. The only drawback, say their wives, is that some men now visit home less frequently.

A safe place for savings

M-PESA is also used as a form of savings account, even though it does not pay interest. Having even a small cushion of savings to fall back on allows people to deal with the unexpected, such as suddenly having to pay for medical treatment. "An awful lot of people climb out of poverty every year, but a lot drop back in because they have no savings, no buffer, so when something bad happens they have to sell assets and lose a lot of ground," says Mr Christen. Poor people tend to save by buying livestock, which can get sick or die, or buying gold, which can be stolen, or investing in community-based schemes that may be fraudulent, says Timothy Lyman of the Consultative Group to Assist the Poor (CGAP). Mobile banking offers a more reliable alternative, he says, and could have economic benefits comparable to those of mobile phones.

Given all these benefits, why has mobile banking taken off in Kenya and a few other places but not elsewhere? M-PESA did not do well in neighbouring Tanzania, for example. There were special factors that made M-PESA more likely to work in Kenya: the unusually high cost of sending money by other methods; the unusually large market share (80%) of Safaricom, the main mobile operator (an affiliate of Vodafone); the regulator's decision to allow the scheme to proceed, even without formal regulatory approval; and, most intriguingly, the post-election violence in the country in early 2008. M-PESA was used to transfer money to people trapped in Nairobi's slums at the time, and some people regarded M-PESA as a safer place to store their money than the banks, which were entangled in ethnic disputes. All this makes Ms Morawczynski think that Kenya's success in mobile banking may not be matched elsewhere. "But I hope somebody can prove me wrong," she says.

There are signs that her wish may soon come true. Banks and regulators, which have been sceptical towards mobile money in many countries, are coming around to the idea, in large part because of M-PESA's success. "Many of the issues that seemed to be significant stumbling blocks last year seem less significant now, or at least more manageable," says Mr Lyman. There has, he says, been a "change in the comfort level" about non-banks (ie, operators) providing financial services. "A year ago most banks were scared—they were seeing the mobile guys taking their lunch away," says Dare Okoudjou, head of mobile money at MTN. But now, he says, some banks have realised that teaming up with a mobile operator to launch a mobile-money service will allow them to reach many more customers. After all, mobile operators have far more powerful brands and much greater reach than banks.

Regulators, meanwhile, are reassured by the banks' involvement. Mobile-money schemes generally limit balances and transfers (typically to around \$100), which helps allay fears about money-laundering. And when customers sign up, they have to produce some form of

identification. That makes the process more formal than for buying a SIM, but less rigorous than for opening a bank account. "We can find a balance between those two," says Mr Okoudjou.

MTN's launch of a mobile-money service in Uganda in March 2009, in partnership with Stanbic Bank, provides further cause for optimism. MTN backed up its launch with a huge marketing campaign based around the simple idea of sending money home, as Safaricom had previously done in Kenya. After three months 60% of the population had heard of the service—a level of awareness that M-PESA took a year to achieve, according to MTN. After four months the service had signed up 82,000 users. Of the \$5.1m transferred in that period, half was in the fourth month, indicating a rapid take-off. MTN plans to increase the number of outlets that can handle mobile money to 5,000 by early 2010.

Banking for the unbanked

MTN's apparent success in Uganda seems to suggest that Kenya may not be a one-off after all. After fine-tuning its technology and procedures in Uganda, MTN plans to introduce the service in 20 other African and Middle Eastern countries; it has already launched in Ghana. Meanwhile Zain, which operates in several African markets, has started its own mobile-money service, called Zap. According to CGAP, there will be over 120 mobile-money schemes in developing countries by the end of 2009, more than double the number in 2008. By 2012, it predicts, some 1.7 billion people will have a mobile phone but no bank account, and 20% of them will be using mobile money.

Operators do not expect to make much money from mobile banking, says Mr Okoudjou, but it can help keep customers from defecting to rivals and cut costs by allowing people to top up their airtime directly on their phones, as well as providing wider social and economic benefits that reflect well on operators. Most importantly, he says, mobile banking can help the industry repeat the huge impact made when mobile phones were first introduced. "This is a second wave that can unleash the potential of mobile phones again," he says. "So we need to do this, and we need to do it properly, and we need to do it all over."

Finishing the job

Mobile-phone access will soon be universal. The next task is to do the same for the internet.

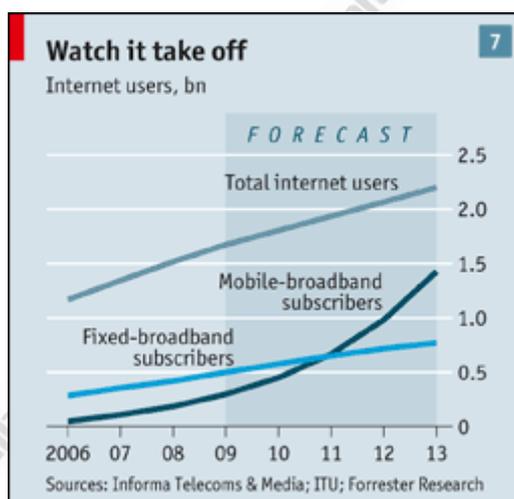


The way forward – Panos

How long will it be before everyone on Earth has a mobile phone? "It looks highly likely that global mobile cellular teledensity will surpass 100% within the next decade, and probably earlier," says Hamadoun Touré, secretary-general of the International Telecommunication Union, a body set up in 1865 to regulate international telecoms. Mobile teledensity (the number of phones per 100 people) went above 100% in western Europe in 2007, and many developing countries have since followed suit. South Africa passed the 100% mark in January, and Ghana reached 98% in the same month. Kenya and Tanzania are expected to get to 100% by 2013.

Even 100% teledensity does not mean that everyone has a phone, because many people have several handsets or SIMs. But nor is everyone a potential customer: the under-fives, for instance, still usually manage without. But at current rates of growth it seems likely that within five years, and certainly within ten, everyone in the world who wants a mobile phone will probably have one. 3G networks capable of broadband speeds will be widespread even in developing countries, and even faster 4G networks will be spreading rapidly in some places. Then what?

The next task, says Mr Touré, is to ensure that everyone who wants to can use mobile technology to access the internet. Like many in the industry, he predicts that this will be done using low-cost laptops, or netbooks, connecting to the internet via mobile networks. "Mobile broadband will become a global phenomenon—it will be the dominant form of broadband," says Informa's Mr Jotischky. He thinks there could be 1.4 billion mobile-broadband subscribers by 2014.



Meanwhile, with the falling price and size of laptops and the advancing potential of mobile phones, the two seem to be converging in a new range of devices that combine the power and versatility of a computer with the portability of a phone. Already, netbooks can cost as little as \$200, making them cheap enough to be given away with long-term mobile-broadband contracts in some countries, just as mobile handsets already are for some users. Mobile phones, it seems, are the advance guard for mobile-broadband networks that will extend internet access to the whole of mankind.

The combination of mobile broadband and cheap netbooks will resolve a long-running argument within the technology industry about the relative merits of computers and mobile phones as tools to promote development. Leading the computer camp is Nicholas Negroponte of the Massachusetts Institute of Technology, the man behind the \$100 laptop. He and his followers argue that bringing down the cost of laptops, and persuading governments in developing countries to buy and distribute millions of them, could have enormous educational benefits.

Critics of his scheme argue that it makes more sense to spend \$100 on a schoolhouse, or textbooks, or teacher training, than on a laptop. And advocates of mobile phones, including Iqbal Qadir, who has sparred with Mr Negroponte on the subject, point out that mobile phones provide immediate economic benefits, which enables them to spread in a self-sustaining, bottom-up way, without the need for massive government funding. Mr Negroponte responds that mobile phones are not much use for education; Mr Qadir replies that thanks to economic development driven by mobile phones, parents can afford to educate their children. The argument, having rumbled on for years, has now ended in compromise.

On the face of it, those in the mobile camp seem to have won. Mobile phones are now seen as a vital tool of development, whereas Mr Negroponte's laptop project has failed to meet its ambitious goals. But although his engineers have so far only managed to get the cost of their elegant laptop down to about \$150, they have shown what is possible with a low-cost design, and helped create today's vibrant netbook market. If netbooks do indeed become the preferred devices to access the internet in the developing world, Mr Negroponte will have had the last laugh. But if those netbooks turn out to be, in effect, large mobile phones with keyboards that access the internet via mobile networks, as also seems likely, Mr Qadir and his camp can claim to have won the day. Technological progress in devices and networks seems to have rendered the debate moot: the important thing is that internet access will be on its way to becoming as widespread as mobile phones.

Obstacles remain even to universal mobile access, and beyond that to universal internet access. One problem is a lack of backbone links, particularly to Africa. But a series of new cables is in the works to improve Africa's connectivity with the rest of the world, increasing capacity and reducing the cost of internet access. The first of these, the SEACOM cable, eastern Africa's first modern submarine cable, was completed in July.

As international links improve and network equipment becomes cheaper and more effective, it will not be difficult to provide a low-cost mobile-broadband service, says Vodafone's Mr Colao. The main challenge will be to reduce the price of access devices. "We need to come up with a mobile-data device that costs \$60-80 maximum," he says. "Netbooks are very good, but we need an emerging-market netbook that costs one-third of the price." With phones, he observes, "we got real penetration when we got below \$35. Netbooks must be below \$100 in price to get real traction." This will require advances in neighbouring industries, such as chipmaking and manufacturing, rather than telecoms, he points out.

The rise of the village netbook

In the meantime, notes the Grameen Foundation's Mr Cantor, the internet equivalent of the village-phone model could provide a stepping stone to wider internet access in the poorest areas, just as village phones did for telephony. The Grameen Foundation has already experimented by giving netbooks to a few village-phone operators in Uganda so that they can sell internet access as well as telephony. Despite the relatively slow connection provided by Uganda's 2G mobile networks, demand for the service proved to be stronger than expected, and revenues were double the level required to make the service self-sustaining.

Christine Zhen-Wei Qiang of the World Bank notes that internet-kiosk operators in India are charging small fees for access to government services online. This makes such services easier to get at, prevents officials from extorting bribes and provides an income for the kiosk operator, "so there is a revenue-generating model," she says. It might make sense to offer microfinance loans to entrepreneurs to buy netbooks and provide information services. Many of the methods used to make mobile phones more widely available seem likely to be applied to extending internet access in the future.

As Ms Qiang's research shows, access to the internet can provide an even bigger boost to economic growth than access to mobile phones. But to make the most of the internet, users have to have a certain level of education and literacy. Its effect on development may be greater in the long term, but is unlikely to be as sudden and dramatic as that of the spread of mobile phones in the first decade of this century.

In the grand scheme of telecoms history, mobile phones have made a bigger difference to the lives of more people, more quickly, than any previous technology. They have spread the fastest and proved the easiest and cheapest to adopt. It is now clear that the long process of connecting everyone on Earth to a global telecommunications network, which began with the invention of the telegraph in 1791, is on the verge of being completed. Mobile phones will have done more than anything else to advance the democratisation of telecoms, and all the advantages that come with it.

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