

WORLD TELECOMMUNICATION DEVELOPMENT REPORT 1999

Mobile Cellular

Executive summary



October 1999

INTERNATIONAL TELECOMMUNICATION UNION



The global mobile cellular revolution

The global boom in mobile cellular communications has been truly astounding. At the end of 1998 there were more than 300 million subscribers around the world, up from just 11 million in 1990. By the end of this decade there will be more than half a billion mobile users. Mobile cellular already accounts for almost one-third of all telephone connections. It seems highly likely that the number of mobile cellular subscribers will surpass conventional fixed lines during the first decade of the next millennium. Both developed and developing countries are sharing in this revolution: in developed countries, users are flocking to mobile cellular as a complement to existing fixed-lines; in developing nations, mobile cellular is emerging as a substitute for shortages of fixed-lines (Figure 1 and Box 1).

By the end of this decade there will be more than half a billion mobile users

The mobile cellular boom has *revolutionized* the concept of telephony in a number of ways. First and foremost, with mobile, users no longer call a place but a person. Small, portable handsets have liberated users from the cord that tied telephones to a geographic location, enabling users to be reached anytime, anywhere. Beyond this, compared with fixed telephones, mobile cellular typically offers a greater variety of options in terms of features and tariffs.

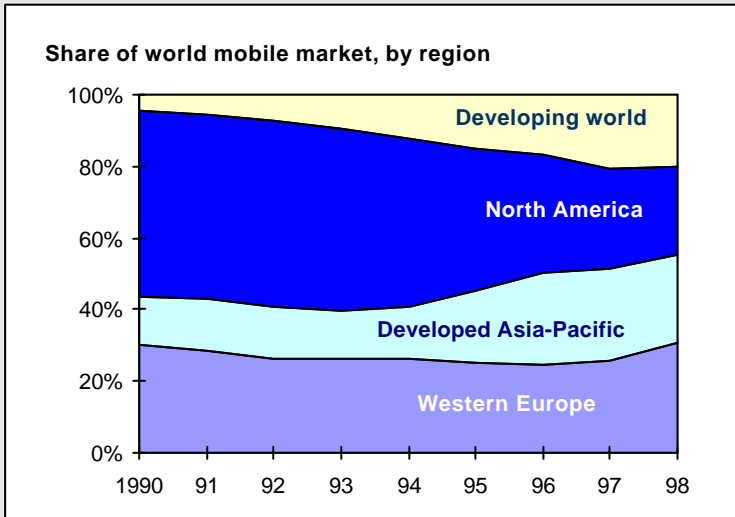
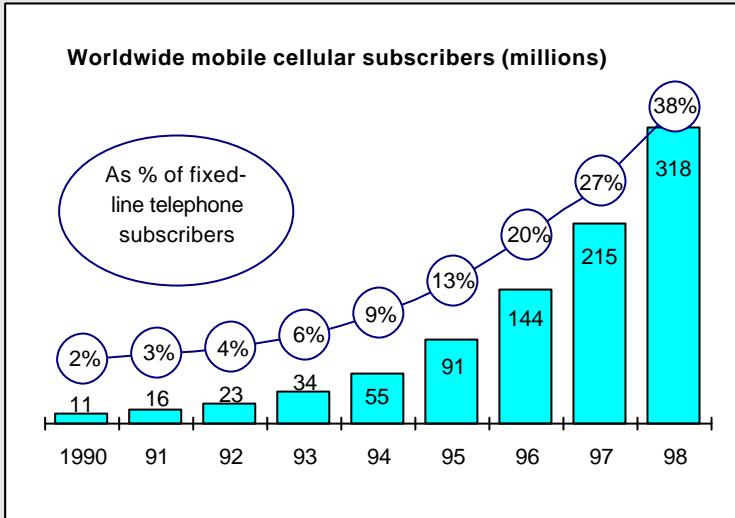
The success of mobile has been a triumph of technology married with marketing

Mobile cellular was the first telecommunication market segment where private ownership and competition were introduced in many countries. Start-up mobile cellular companies are almost always backed by foreign, strategic investors. This combination of competitive markets, private ownership and foreign investment has created an appropriate environment for rapid growth. But the market has been driven, as much as anything, by rampant demand. When mobilephones were first introduced in the early 1980s, they were mainly confined to cars, constrained by weight and power requirements. But as mobilephones became lighter, cheaper and more attractive, they have left the car and entered the briefcase, the handbag and the pocket. A modern portable typically weighs a few hundred grams, is brightly coloured, has a small screen and more features than the average user might use in a lifetime. Mobilephones have as much in common with fashion accessories as plain old telephones. The success of mobile has been a triumph of technology married with marketing.



Figure 1: The mobile cellular boom

Worldwide mobile cellular subscribers, and share by region, 1990-98



Note: World total calculated from sum of country fiscal year data. “Developed Asia-Pacific” in the lower chart refers to Australia, Hongkong SAR, Korea (Rep.), Japan, New Zealand, Singapore and Taiwan-China.

Source: ITU World Telecommunication Indicators Database.



Box 1: A tale of two countries

Cambodia, with a population of 10.3 million, is a poor (1997 GNP per capita: US\$ 300), mainly agriculture-based economy in Southeast Asia. Finland, with a population of 5.1 million, is a wealthy (1997 GNP per capita: US\$ 24'080), industrialized Nordic nation. These two countries could hardly be more different from a cultural, economic or geographic perspective, yet they have one thing in common: they both have more mobile cellular than fixed telephone subscribers.

Mobile cellular came to Cambodia in late 1992. Within a year, mobile subscribers had already surpassed the number of fixed telephones in the country. The main reason was that the fixed network had been extensively damaged during more than two decades of war. It was logical to exploit the advantages of mobile cellular (e.g., there are no wires to lay which is particularly useful in a country like Cambodia endangered by many land mines) in order to provide rapid access to communication facilities. No less than five companies operate mobile cellular services, and all these are backed by strategic foreign investors, an important consideration in a poor nation like Cambodia. A Wireless Local Loop (WLL) system is also in use for fixed service. The spread of mobile communications has happened so quickly that serious questions are being posed about the viability of expanding the fixed network, despite the fact that Cambodia has one of the lowest teledensities in the world. As a result of mobile growth, Cambodia has surpassed 31 other countries in overall telephone penetration over the past six years. Cambodia illustrates the case that leaping straight to wireless is a viable option for rapidly expanding telecommunication access in developing countries with low levels of fixed infrastructure.

Finland is in some ways a curious place to be the world leader in mobilephone penetration. It is not the richest country in the world (for example both Japan and Switzerland have a GNP per capita twice that of Finland while all of its Nordic neighbours have a higher GNP per capita). Furthermore, Finland does not particularly stand out when the factors that are normally believed to drive rapid mobilephone growth are considered. For example, while there is competition, it was essentially a duopoly until 1998. In contrast, Sweden has had three mobile competitors for some time and the United Kingdom four, yet they both lag behind Finland in mobilephone penetration. Also, despite being the headquarters of Nokia, the world's top vendor of mobile telephones, handsets are not subsidized in Finland. Instead, three other factors seemed to have driven the Finnish mobile craze:

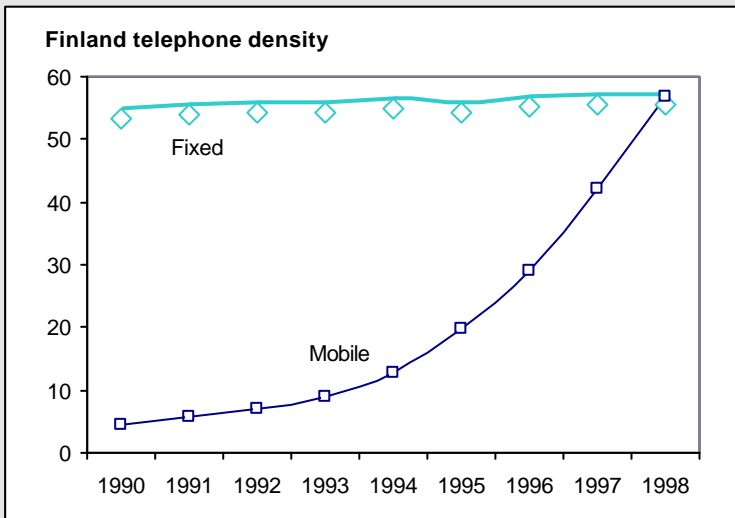
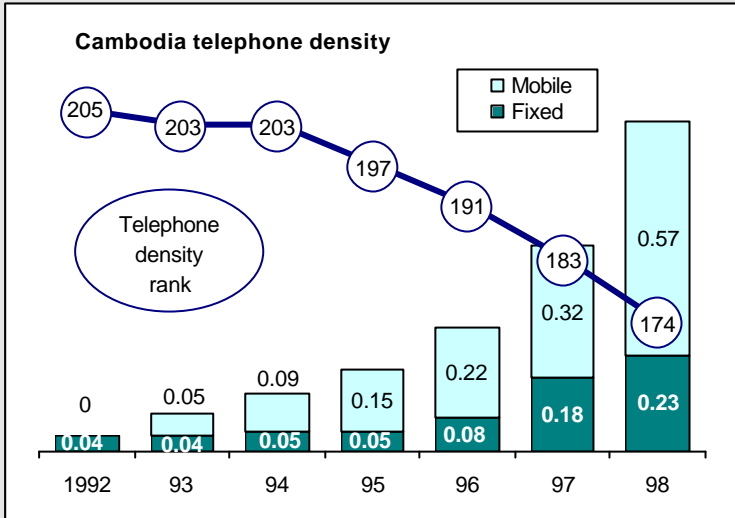
- The early adoption of cellular technology has given Finland a wealth of mobile experience. Finland introduced the analogue Nordic Mobile Telephone (NMT) system in 1982 and was the first country to introduce the digital GSM standard a decade later.
- Second, there were historically many co-operatives providing local telephone service at fairly low rates and with a high penetration. This meant that for mobile cellular to be successful, tariffs would have to be competitive with fixed-line ones. Furthermore, unlike most other countries, the largest operator, Sonera (formerly Telecom Finland), did not have a monopoly for local telephone service, obliging it to look elsewhere for revenue growth.
- Third, there seems to be a Finnish affinity for adopting new technology. In addition to having the highest mobilephone penetration in the world, Finland also leads in Internet host penetration. Finns have also pioneered the use of mobile technology for other applications, such as short message text and data services, chat rooms and even for connecting vending machines.

What Finland illustrates is that mobile cellular penetration may exceed fixed-line penetration even in countries that have already attained a high level of telecommunication development. In the past, a family would have obtained one fixed telephone connection. Today, it is not inconceivable that each member of the family will own their own mobilephone.



Figure 2: Cambodia and Finland: mobile pioneers

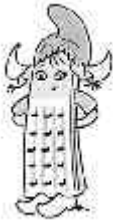
Mobile cellular and fixed-line density in Cambodia and Finland



Note: Telephone density rank in top chart refers to Cambodia's worldwide position and includes fixed telephone and mobile cellular subscribers.

Source: ITU World Telecommunication Indicators Database.





Supplying mobile

Cellular networks have evolved in both functionality and utility, from so-called first-generation analogue networks to today's second-generation digital systems. But thus far there has not been a unique global standard. The existing cellular landscape consists of a mix of analogue and digital systems with different networks often co-existing in the same country (Figure 3).

The ITU, one of whose roles is to define global telecommunication standards, did not issue technical recommendations for first or second-generation mobile systems. The impressive growth of mobile cellular, however, has meant that the ITU has had to become actively involved in developing third-generation (3G) standards.

In order to avoid the higher costs for consumers associated with multiple systems, the ITU goal is to achieve a global standard for 3G through an initiative called IMT-2000, or International Mobile Telecommunications-2000. The concept of a *family* of standards has been adopted. It would bring different types of networks together—macrocell, microcell and picocell terrestrial cellular systems; cordless systems; wireless access systems; and satellite systems—enabling a truly global service soon after the year 2000. There are three distinctive characteristics of IMT-2000:

- seamless global roaming which enables users to move across borders and to make and receive calls while using the same number and handset;
- higher transmission rates offering a minimum speed of 2 Mbit/s for users who are stationary or moving at walking speed, and 348 kbit/s in a moving vehicle; and
- standard service delivery, for instance, via fixed, mobile and satellite networks.

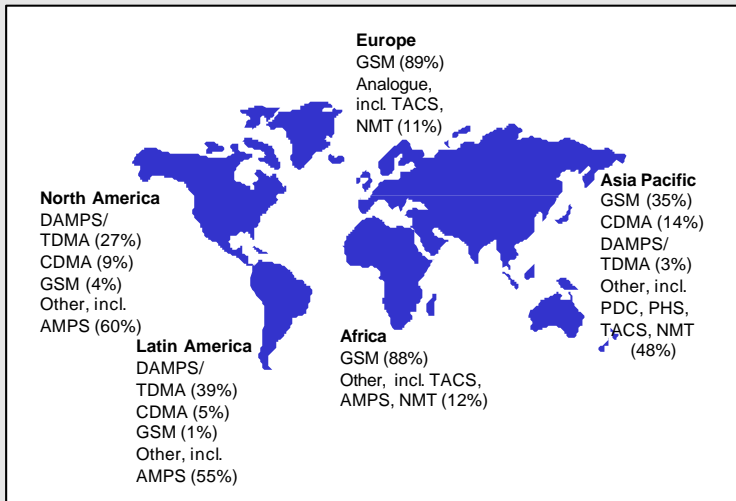
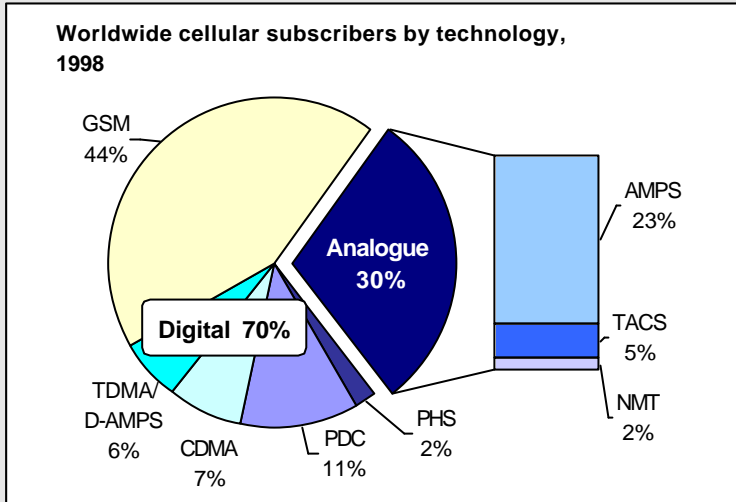
3G services are expected to be launched in Japan in 2001, in Europe in 2002 and in other countries shortly afterwards.

The high cost of building 3G networks may mean that full coverage will not be available for several years, so the first 3G services are likely to be provided in markets with a high concentration of potential users such as large cities and their immediate surroundings. Complete coverage may not be needed straight away, as in low traffic areas existing enhanced services will suffice for most purposes. 3G may develop more slowly in those countries that already have well-established second generation networks. But the benefits of 3G in enabling true mobile multimedia services should be very attractive, especially where spectrum is constrained or there is a large Internet user base. Operators will seek first to amortise their investment in existing networks and build up new capacity step-by-step. Therefore, 3G will be an evolutionary rather than a revolutionary process.

In order to avoid the higher costs for consumers associated with multiple systems, the ITU goal is to achieve a global standard for 3G through an initiative called IMT-2000, or International Mobile Telecommunications-2000

Figure 3: Alphabet soup

Distribution of mobile cellular subscribers by technology and by region, 1998



Note: Analogue systems include: AMPS (Advanced Mobile Phone System), NMT (Nordic Mobile Telephony), TACS (Total Access Communications System). Digital systems include: CDMA (Code Division Multiple Access), GSM (Global System for Mobile), PDC (Personal Digital Cellular), PHS (Personal Handyphone System), TDMA (Time Division Multiple Access).

Source: ITU adapted from Ericsson, GSM MoU, CDMA Development Group.



Box 2: Nokia: From wood pulp to connecting people

The history of Nokia dates back to 1865 with the establishment of a wood pulp mill on the river Nokia in Southern Finland. Nokia evolved into a conglomerate, active in paper, chemicals and rubber. Mobile communications research dates back to the 1960s with the company developing its first telecommunication products in the late 1970s. The transformation of the company from a raw-material producer to an electronics manufacturer took place in the 1980s. In the beginning of 1990s, its paper and chemical activities were divested and the company focused on telecommunications. The strategy paid off with Nokia emerging as the world's top vendor of mobile handsets in 1998.

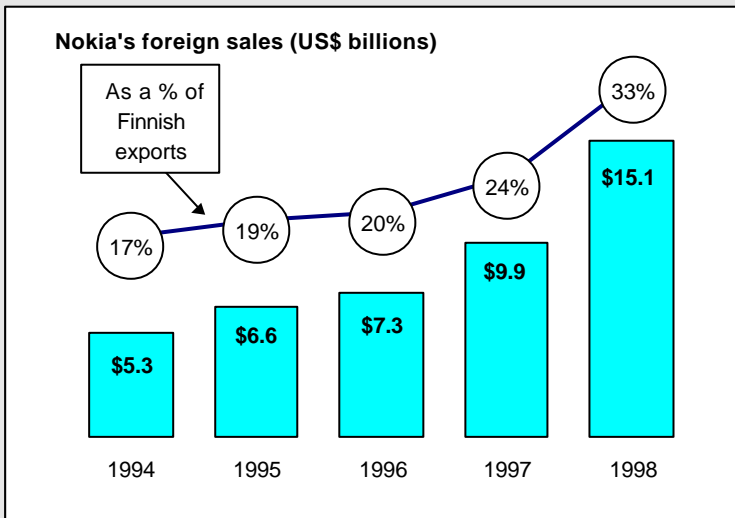
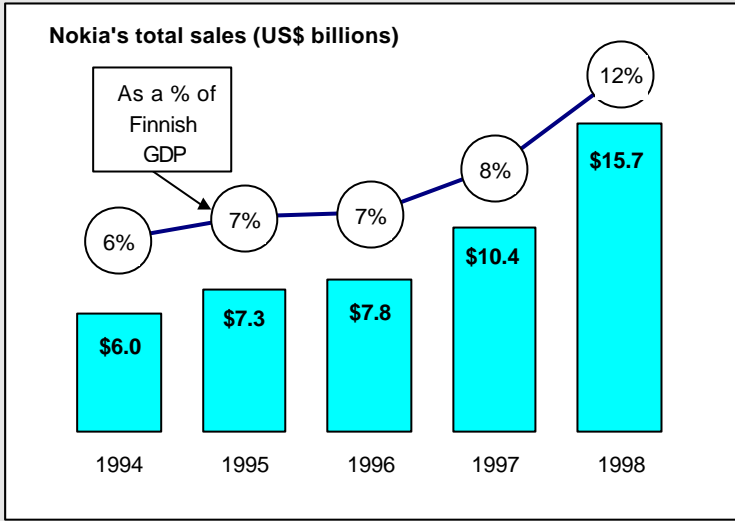
Nokia's strength has been design innovations, giving it a couple of years lead over competitors. Another advantage has been clever market segmentation through the introduction of lifestyle models fulfilling the needs of different users. Sleek models and a range of coloured handset coverings are examples. Nokia has also benefited from its geographical location. The Nordic region was among the first to establish a cellular standard (the Nordic Mobile Telephone system, NMT) creating a market for regional equipment manufacturers. Even though NMT never became a dominant standard globally, it provided Nokia with experience in producing mobilephones. The fact that Finland was the first country to introduce a digital GSM network also helped Nokia gain a head start in that technology. With the world's highest density of mobilephone users and the highest penetration of Internet host computers, Finland has been called the model for the information society—thus an excellent test market for Nokia. Contact with end users in the highly evolved consumer markets in the Nordic region has allowed Nokia (and Sweden's Ericsson) to receive feedback directly and respond quickly by offering cellular phones with user-friendly features and attractive designs.

To some, Nokia has become better known than Finland, and actually Finland depends a lot on Nokia. The company's net sales are equivalent to almost 12 per cent of the country's GDP while its foreign sales equate to a third of Finland's exports. While 50 per cent of the workforce are Finns, only 4 per cent of the company's sales are domestic. If Nokia's growth continues at the same pace, its revenues will exceed the budget of Finland some time early next decade.

In 1998, Nokia's workforce increased by almost 30 per cent, sales rose 51 per cent and operating profits increased 75 per cent. Managing rapid growth has been one of the greatest challenges for the company. Behind the success are many factors, including competent management and a distinctive corporate culture. Hierarchies are discouraged, and key managers are rotated from one business unit to another at frequent intervals in order to prevent complacency. New strategies and policies are discussed by teams that include employees from different parts and ranks within the company.

Nokia became the winner in second-generation cellular phones. But its next challenge is only beginning. With third-generation mobile technology expecting to result in a fusion of wireless and multimedia, Nokia envisages transforming itself from a cellular phone firm into a software company. According to its President: "This company is not about producing basic consumer products. We are looking for software solutions in wireless communication."

Figure 4: Finland's growth engine
Nokia's total sales and foreign sales



Source: ITU, adapted from Nokia, Statistics Finland.





Regulating mobile

Regulation of mobile cellular services has tended to be minimal. For instance, fewer than half the countries replying to an ITU questionnaire in 1999 stated that their mobile operators had universal service/access obligations or that their mobile tariffs were regulated. The relative lack of cellular regulation is partly due to the belief that fixed networks have been *too* regulated, stifling innovation and network growth. Since mobile has developed at a time when this belief has become commonly accepted, regulation has been limited. A related factor is that mobile cellular has typically been defined as a value-added-service, falling outside the regulatory scope of basic voice telephony. In developing countries, the lack of regulatory skills and in some cases, the absence of an independent regulator, have narrowed the latitude for encouraging mobile operators to enlarge overall accessibility to communications. The question that begs asking is whether mobile cellular has grown so fast because of limited regulation or whether it would grow even more rapidly with greater regulation.

Fewer than one per cent of mobile subscribers are in countries that do not permit competition

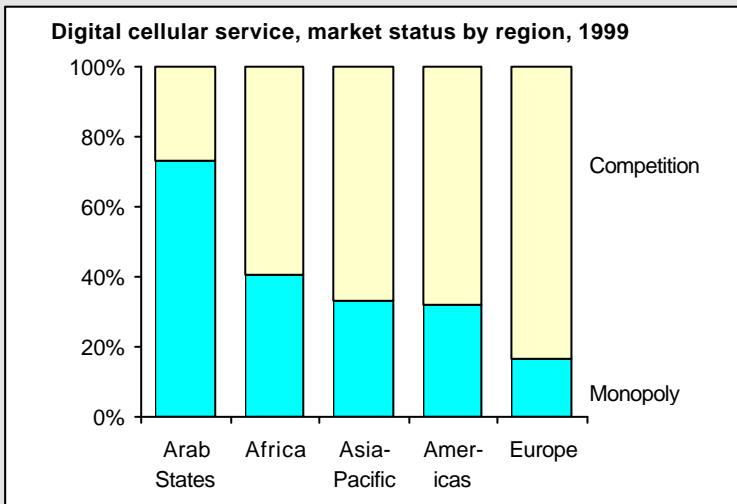
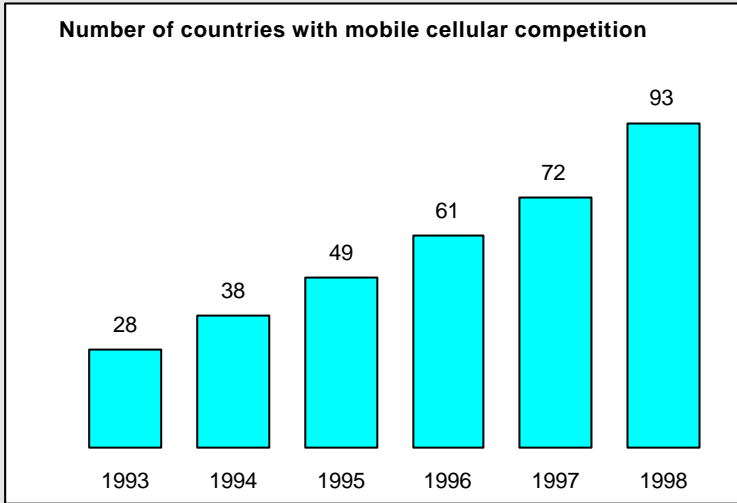
There is a need for some minimal degree of mobile regulation, if for no other reason than to ensure services can operate without frequency interference. One way this has traditionally been done is by limiting the number of operators. Frequency constraints, coupled with the high level of initial investment required (either because of significant licence fees, network construction expenditures or both) suggest that there are high barriers to entry and that the mobile cellular industry could never be a textbook example of a perfectly competitive market. As a result, there may be some areas where competition will not work as intended. For instance market distortions could arise, particularly in pricing, unless there is some form of regulatory oversight.

Although a slight majority of countries do not allow mobile cellular competition, their number is shrinking (see Figure 3.) Furthermore, the number of subscribers under monopoly environments is minuscule, accounting for only one per cent of the world total.

But where competition does exist, how many operators should be allowed? Is there a significant difference between two network providers as opposed to three or more? In the case of the United Kingdom, the growth rate in the number of cellular subscribers accelerated when the number of operators licensed was expanded from two to four in the early 1990s. Nevertheless, that country's regulator

Figure 5: How many countries allow mobile competition?

Number of countries with mobile cellular competition 1993-98, and market structure by region, 1999



Note: Upper chart based on situation in 206 countries; lower chart on situation in 187 of the ITU Member States. The existence of competition is determined by the actual rather than theoretical status. In the lower chart, “monopoly” implies only one operator; “Competition” implies two or more operators.

Source: ITU.



has been puzzled why, with four mobile operators, prices are still higher than in Nordic countries which have fewer operators. Conversely, is the fact that Hongkong SAR has a higher penetration than Singapore a result of introducing competition much earlier?

Perhaps the safest course for regulators is to licence the maximum possible number of operators and let the market decide who the winners and losers will be

These questions suggest that there is no simple answer to how many mobile operators should be allowed. Perhaps the safest course for regulators is to licence the maximum possible number of operators and let the market decide who the winners and losers will be. In any case, the upper limit is partly dictated by frequency limitations, although this problem can be alleviated if market mechanisms are used for spectrum allocation, for instance by providing an incentive for owners of earlier, analogue licences to migrate their user base towards digital systems.

Extending access to telecommunications is a commonly expressed desire of many countries. Yet most governments and regulators only have fixed telephony in mind when contemplating this issue and designing policies for achieving it. This is unfortunate since mobile cellular could do much to alleviate demand for telecommunications. Universal service and access requirements for mobile cellular revolve around three areas:

1. achieving widespread coverage;
2. ensuring that mobile operators contribute to universal service/access funds and can draw upon those funds;
3. mandating the installation of a certain number of public payphones.

The level of prices is also relevant since 100 per cent coverage is not of much use if most people cannot afford to use the service. The availability of a pre-paid service is also important since potential users are not excluded for reasons of credit unworthiness.

Promoting widespread coverage is the starting point for ensuring that mobile cellular contributes to universal access. While a small-island state such as Singapore can boast of 100 per cent population coverage, and most mobile networks in developed countries cover at least 95 per cent of the population, many developing nations are not so fortunate.



Take South Africa for example, home to one of the world's largest digital mobile networks. It has the best mobile coverage on the continent at 80 per cent of the population, but that still leaves some nine million people without service. Coverage in many other developing countries is far less and typically limited to major towns. Network roll-out targets including coverage requirements should be specified in licences. The award of national licences should be tied to achieving a high level of population coverage. Regulators might also want to provide mobile operators with expanded scope in return for enhancing coverage. For example, cellular licences might be made more lucrative by allowing operators to provide international service. Another consideration is that mobile coverage will be limited to areas where the fixed network exists unless cellular operators are allowed to provide their own backbones linking remote areas to urban ones. Tie-ups between cellular operators and global mobile satellite systems could also help to expand coverage in areas without terrestrial infrastructure.



Box 3: The end of cellular monopolies in Western Europe

December 1998 was a landmark in the evolution of the mobile cellular industry in Western Europe. Switzerland became the last country in the region to adopt mobile cellular competition when the first new market entrant, diAx, commenced commercial service on 24 December 1998. The lack of competition had expressed itself most visibly through high tariffs, with Swiss mobile cellular prices among the steepest in the world. Tariff options were limited with no bundling of free minutes or handset price subsidies. DiAx introduced the concept of including free minutes with its tariffs. With a special promotion (that has proved to be ongoing), diAx effectively doubled the number of minutes that could be purchased for the same price. As a result, diAx's tariff for 100 minutes of use is half that of Swisscom's and among the lowest in Europe. Orange entered the market as a third competitor in June 1999; in response both Swisscom and diAx lowered their prices. Swisscom, which had only changed its mobile prices once between 1995 and July 1998, has made three reductions in less than a year (including the introduction of lower rates for mobile-to-mobile calls).

Despite historically high tariffs, Switzerland has achieved a fairly high mobile penetration rate (around a quarter of the population at the end of 1998, ranking it 19th in the world) although this is much lower than would be predicted by its relative wealth. With lower tariffs as a result of competition, demand will rise (diAx gained 300'000 subscribers in the space of just six months), and the Swiss penetration rate could eventually reach the level of the Nordic countries.



Mobile access

The idea that mobile cellular can dramatically extend access to communications, particularly in developing countries, seems like a contradiction. *First*, almost four-fifths of mobile cellular subscribers are in developed countries. The four largest emerging economy networks (China, Brazil, Republic of Korea and Turkey) account for another 12 per cent leaving just 9 per cent of mobile cellular subscribers in the more than 100 remaining developing nations. In many developing countries, mobile has only recently been introduced and some still do not have service (see Figure 6). *Second*, mobile is typically perceived as a service for the wealthy, priced beyond the reach of the average citizen.

There are a number of reasons why mobile can be a more attractive solution than fixed-lines for improving access to telecommunications in developing countries

But this is changing. Developing countries are now experiencing the highest levels of mobile growth. While the perception that cellular is expensive may have been true in its early years, that has now changed and mobile is entering a new, mass market phase. The “expensive” tag that mobile acquired was partly a result of the technical constraints imposed on analogue systems when spectrum was scarce, competition was limited and handsets expensive. Growth rates have subsequently risen and mobile has become relatively abundant with considerable capacity available now on second-generation digital systems. Over a thousand companies have been licensed around the world to provide mobile service thanks to the widespread introduction of competition. Handset prices have dropped tremendously due to growing market sizes, which permit economies of scale, technological enhancements and, in some cases, cross-subsidization of handset prices. As a result, more residential users are connecting to mobile networks and the amount they pay is falling.

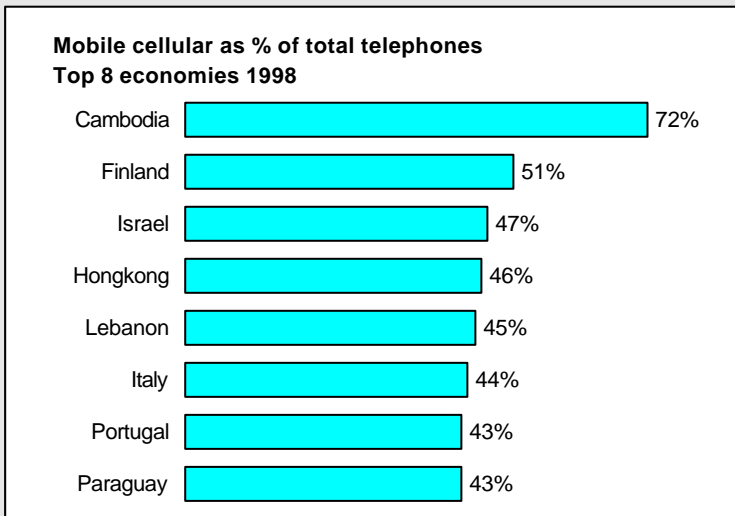
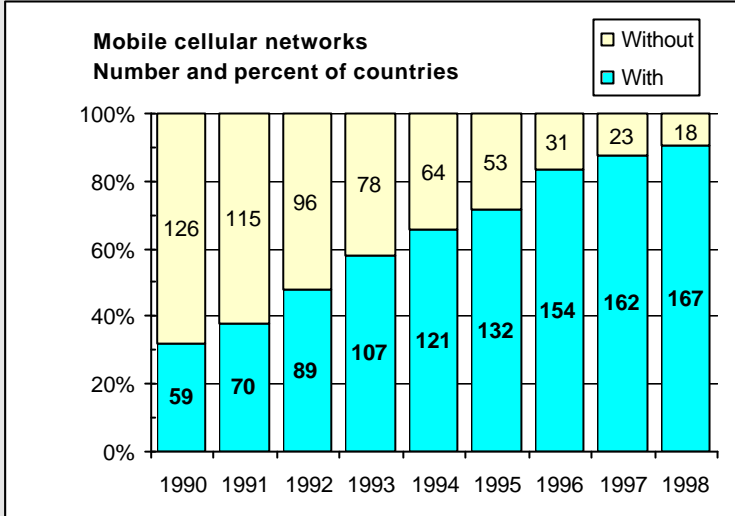
There are a number of reasons why mobile can be a more attractive than fixed-lines for improving access to telecommunications in developing countries:

- Mobile networks can be installed more rapidly than fixed-line networks;
- Mobile networks are increasingly available with pre-paid cards so that users are not automatically disqualified from using the service because of a lack of creditworthiness;



Figure 6: Going mobile

Countries with and without cellular service and top 8 economies by mobile cellular as a percentage of total telephone subscribers, 1998



Note: In the upper chart, *countries* refer to the 185 members of the United Nations.

Source: ITU World Telecommunication Indicators Database.



- Mobile networks are generally provided by private companies which often tap the financial resources and technical expertise of strategic foreign partners;
- Users in developing countries are just as attracted to the functionality features of mobile as those in developed countries; and,
- Mobile networks are generally cheaper to install than fixed networks.

The day is approaching when cheap pre-paid mobile handsets may be packaged for one-time use then thrown away like disposable cameras

In the past few years, the availability of pre-paid schemes has transformed the prospects for mobile, especially in developing countries. The concept of paying for telephone service in advance is so appealing that it is surprising it took so long to develop. Pre-payment is good for operators who make their money up front, reducing their credit risk. The cost of acquiring a pre-paid subscriber is also much lower. It is also attractive for users who want to control their costs, desire anonymity or would not qualify for a post-paid service.

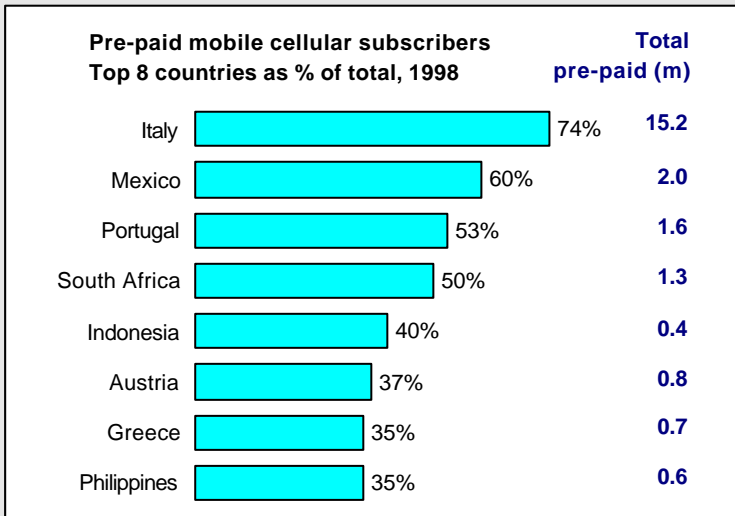
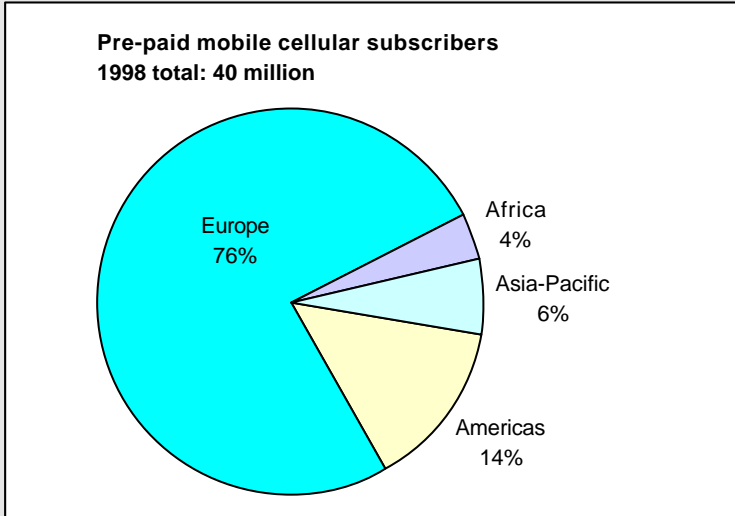
The magic of mobile pre-paid is that it is turning telephone service into a *mass market commodity*. Subsidized handsets are bundled with pre-paid cards, slickly packaged, and bought from supermarket shelves like washing powder, soft drinks or breakfast cereal. The day is approaching when cheap pre-paid mobile handsets may be packaged for one-time use then thrown away like disposable cameras. The widespread availability of pre-paid mobile cellular in retail outlets means that a commodity that has traditionally been in short supply—telephone service—is now available on demand. If this model can be copied by developing countries, then one of the major barriers to achieving widespread access to telecommunications—insufficient supply—is eliminated.

The challenge for developing countries is to emulate the mass market success mobile is enjoying in developed countries. The availability of second-generation mobile systems, combined with the high level of demand for pre-paid access, gives them the opportunity to make a technological and commercial jump. This may require a change in the mindset of many developing country governments and mobile operators to get away from the perception that mobile is not for the masses. Enlightened policies can create the necessary environment to ensure the widespread availability of mobile cellular in every nation.



Figure 7: Pre-paid leaders

Distribution of pre-paid mobile cellular subscribers by region, 1998 and Top 8 countries by share of pre-paid subscribers, 1998



Source: ITU World Telecommunication Indicators Database.





Pricing mobile

Mobile service is rarely cheaper than fixed-line telephony. Even in countries where the service is relatively mature, the price of using a mobilephone to make a particular call is generally more expensive than using a fixed-line telephone. However, higher prices appear to have done little to detract from the popularity of mobile service. Indeed, many users make calls on their mobilephone even when they are at home or in the office and could easily make the same call, more cheaply, on a fixed-line telephone. The secret of the attractiveness of mobile pricing can be summed up in one word: *options*.

For most countries, their first experience of telecommunications competition came with the introduction of a mobile operator, either in direct competition with the mobile subsidiary of an incumbent operator, or in indirect competition with its fixed-line operations. With competition comes the need for a service provider to differentiate itself from its rivals, to segment the market, to target specific niches and to offer different price options and discounts to customers.

The secret of the attractiveness of mobile pricing can be summed up in one word: options

There is a degree of correlation between those countries which have higher prices and those with a lower rate of mobile penetration than would be expected given their level of wealth. As shown in Figure 8, of the economies in Western Europe, those with high tariff levels tend to have a lower level of mobile density than might be predicted given the relative wealth of their citizens. On the other hand, countries with cheaper prices, such as Finland or Norway tend to have higher mobile densities.

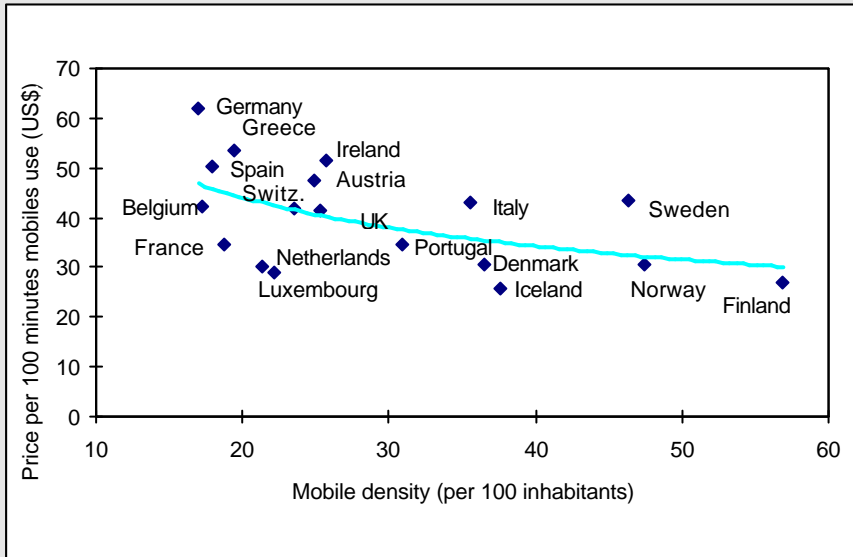
Are mobile prices getting cheaper? Certainly the popular perception is that the tariff plans being offered today are much cheaper than they were a few years ago, and the functionality offered on digital mobilephones is certainly higher than on analogue ones.

The average price of mobile service in the OECD Member States in 1989 was around 56 US cents per minute. Ten years later this had fallen to just over 40 US cents per minute, a rate of decline of 3.7 per cent per year. But this is still, on average, almost four times higher than the cost of fixed-line service in the same countries. In the 1980s mobile prices were high because supply was limited; in the early 1990s



Figure 8: Mobile density and prices

Relationship between mobile density per 100 inhabitants, 1998, and price of 100 minutes of monthly service, 1999, Western Europe



Note: The price is based on a basket of use including monthly subscription charge plus 50 minutes of peak-rate and 50 minutes off-peak use.

Source: ITU World Telecommunication Indicators Database.

prices could still be sustained because the high level of demand meant that suppliers did not need to cut prices in order to attract more customers. Only in the late 1990s has price cutting become an issue, thanks to the licensing of additional companies and the proliferation of pre-paid schemes targeted at marginal users.

For mobile operators, a critical indicator is average revenue per user (ARPU). For most of them, ARPU is declining over time. This is partly the result of price-cutting in competitive markets, but it also reflects an expansion in the user base; newer subscribers tend to be lower-spending than longer established ones. The decline in ARPU is partially offset by declining costs per subscriber. Economies of scale are a significant element. As the total number of subscribers increases, the



marginal operating cost per subscriber of functions such as transmission, switching, acquisition of cell sites and billing, will fall. On the other hand, the costs of acquiring and retaining customers tends to rise, due to increased advertising expenditures and use of customer loyalty schemes.

Other cost elements, which have tended to rise over time, are non-operational costs. These include items such as licence payments, spectrum fees and taxes. As governments have realized the revenue-earning potential of mobile communications, they have tended to increase the financial burdens on the sector, especially in the form of licence fees. These are inevitably passed on to the consumer.

Probably the most significant cost that a mobile operator faces are interconnection fees. In markets where the fixed-line network is well-established, the majority of calls to mobiles will originate on the fixed-line network and, equally, the majority of calls from mobiles will go to the fixed-line network. Thus the interconnect arrangements between mobile and fixed-line can make or break the business plan of a new mobile operator. They also determine the degree of mark-up passed on to consumers.

For the moment, the price of ownership and usage of mobilephones is considerably higher than for the fixed-line network. But looking ahead, it is likely that the gap will narrow over time:

- At present, a high percentage of calls originating on mobile networks terminate on fixed-line networks. As the user base of mobile subscribers grows, a higher percentage of calls will remain on the mobile network, thereby obviating the need for an interconnect payment.
- Most mobile operators are relatively recent in origin, and their digital networks are generally less than five years old and still growing rapidly. Consequently, the investment has not yet been amortized. Over time, as the market matures, the capital requirements for mobile operators should be reduced and their asset base will grow. This should also serve to reduce their cost base.

At present, in a buoyant market, mobile operators do not have to try too hard to gain new customers. As the level of penetration increases, and market saturation approaches, price-cutting should become more prevalent.

The interconnect arrangements between mobile and fixed-line can make or break the business plan of a new mobile operator



Table 1: Money-making machines*Top 10 mobile cellular operators, ranked by equity-based global subscribers, 1998*

<i>Rank</i>	<i>Mobile operator (headquarters)</i>	<i>Subscribers (000s)¹</i>	<i>Revenue (US\$ m)</i>	<i>Pre-tax profit (US\$ m)</i>	<i>Profit / revenue</i>
1	NTT DoCoMo (Japan)	23'897	26'163	2'939	11.2%
2	TIM (Italy)	14'299	7'169	2'564	35.8%
3	AirTouch (USA) ²	14'072	5'181	1'041	20.1%
4	Vodafone (UK) ²	10'445	5'417	1'508	27.8%
5	BAM (USA)	8'600	3'798	343	9.0%
6	BellSouth (USA) ³	8'235	4'725	524	11.1%
7	AT&T (USA) ⁴	7'198	5'406	118	2.2%
8	SBC (USA)	6'851	4'184	490	11.7%
9	China Telecom (Hongkong SAR) ⁵	6'531	3'182	1'134	35.6%
10	Omnitel (Italy)	6'190	2'792	505	18.1%
Top 10		106'318	68'016	11'167	16.4%

Note: ¹ Consolidated worldwide subscribers (equity-based). ² AirTouch and Vodafone merged in July 1999. ³ Revenue and profit refer to domestic wireless and international operations.

⁴ Profit refers to EBIT (Earnings before interest and taxes). ⁵ Subsidiary of China Telecom and holding company for three operators on the mainland.

Source: ITU Public Telecommunication Operators Database, PTO annual reports.

A mobile future



Mobile has emerged as a mini-industry in its own right with 1998 service revenues of around US\$ 155 billion (see Figure 9). At current trends, the value of mobile revenue will overtake total fixed-line revenue worldwide (international and domestic) in about the year 2004. Indeed, revenues from fixed-line telephone service have been in decline globally since around 1996. Were it not for revenues from mobile, the telecommunications sector would be shrinking rather than growing.

As the world enters a new millennium, it is no longer a question of if mobile cellular subscribers will overtake fixed telephone lines, but when

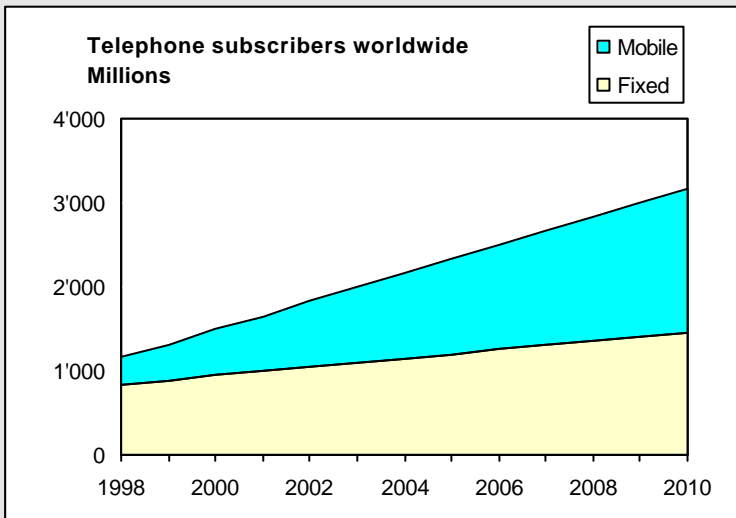
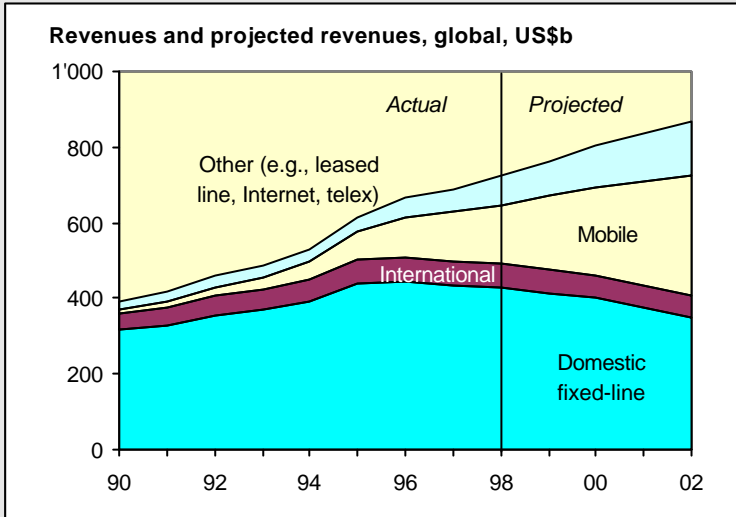
As the world enters a new millennium, it is no longer a question of *if* mobile cellular subscribers will overtake fixed telephone lines, but *when*. In poor countries, mobile is being used to rapidly install badly needed telecommunications infrastructure. In rich countries, the functionality of mobile appeals to users long tied to their fixed telephones. The number of new mobile subscribers has surpassed new fixed ones every year since 1996. In 1998 there were almost twice as many new mobile subscribers as fixed ones. Sometime, around the middle of the next decade, the number of mobile telephone subscribers will exceed fixed-lines. The crossover point could occur much sooner if mobile prices—which are currently considerably above costs—come down. Growth will be further boosted if the new IMT-2000 global mobile standard—to be introduced commercially in some countries in just a few years time—takes off. The success of mobile is something to ponder. It will have taken the mobile industry a little over two decades to reach one billion subscribers; fixed networks have already taken more than 130 years to reach the same number.

The growth of the mobile sector is sometimes overshadowed by the success of the Internet. While the growth prospects for the Internet should not be underestimated, the fact is that the mobile market is much bigger. The long-term future for the mobile sector is likely to be closely tied to that of the Internet. Third-generation (3G) mobile systems will enable Internet access at high speeds. In economies where mobile systems are well-advanced, such as Finland, non-voice services such as short message service (SMS) already account for a significant contribution to total revenue. These services, which are limited in message length, will soon seem as primitive as the telegraph seems today. The demand for mobile access to data services, especially the Internet, is potentially huge and 3G will create a virtually new industry. The future is bright, the future is mobile.



Figure 9: Thank goodness for mobile

Actual and projected revenues, in billions of US dollars, from fixed-line telephony services (domestic and international), from mobile services and from other services, 1990-2002, and projected fixed and mobile subscribers, 1998-2010



Source: ITU World Telecommunication Indicators Database, 1990-98, and ITU projections, after 1998.



Table 2: Mobile makers

Top mobile equipment manufacturers ranked by 1998 estimated mobile equipment sales (both terminals and infrastructure)

Rank	Manufacturer (headquarters)	Mobile equipment revenue				Foreign sales 1998 ²
		US\$ billion 1998	Change (1997-98)	% of total sales ¹	% of telecom sales	
1	Motorola (USA)	17.9	0%	61%	61%	59%
2	Nokia (Finland)	14.7	59%	94%	94%	94%
3	Ericsson (Sweden)	14.5	5%	64%	64%	95%
4	Lucent (USA) ³	4.3	-6%	14%	16%	26%
5	Nortel (Canada) ⁴	3.7	8%	21%	22%	36%
6	NEC (Japan) ⁵	3.7	-3%	9%	29%	5%
7	Qualcomm (USA) ³	3.3	60%	100%	100%	34%
8	Matsushita (Japan) ^{5,6}	3.1	16%	5%	17%	51%
9	Siemens (Germany) ³	3.0	10%	4%	18%	69%
10	Alcatel (France)	2.7	30%	11%	13%	83%
	Top 10	71.0	14%	23%	39%	54%

Note: ¹ Mobile equipment revenue as a percent of companies total reported revenue. ² As a percent of total sales. ³ Financial year ending 30 September. ⁴ Foreign sales include United States. ⁵ Financial year ending 31 March 1999. ⁶ Parent company of Panasonic.

Source: ITU estimates, company reports.

*For a comprehensive listing of fixed and mobile cellular penetration by country, see the ITU Indicators webpage:
<http://www.itu.int/ti/industryoverview/index.htm>*

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Mobile Cellular

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