



November 16, 2001

No. 20

conomics

Internet revolution and new economy

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3G - chance for take-off in mobile business

- The internet and mobile telephony are set to merge increasingly thanks to UMTS (Universal Mobile Telecommunications System). It became clear early on that UMTS, also known as 3G (third-generation mobile phone systems), would be a **key technology** for profitable markets of the future.
- The telecommunications business is international, and dominated by companies that operate internationally. All contenders pursue **global strategies** – in which the German market plays a central role owing to its sheer size and its geographical location.
- Now that the German authorities have permitted closer cooperation in setting up networks, the costs will probably be **up to 40% lower** than the earlier estimates of roughly EUR 6 bn per network. The amortisation period for the telecoms investment will be correspondingly shorter than the originally estimated 15 years.
- It is expected there will be **shortages** of fully functional handsets, highly specialised personnel and special electronic components for the networks.
- **UMTS** technology offers some major **advantages** that can be demonstrated under laboratory conditions but which it will not be possible to use fully in the mass market in the medium term. In the transition from the second to the third generation of mobile phones, **GPRS** (General Packet Radio Services) will help to familiarise customers with the new types of service.
- There is a need for services that emphasise the specific advantages of mobile phones and complement conventional wired services. The more advanced versions of **SMS** (Short Message Service), **location-based services** and **mobile electronic payment systems** hold great potential. However, personalised offers of information will probably generate less turnover than simple voice services until 2010.
- While the new technology opens up an enormous spectrum of possibilities, product developers must never lose sight of the consumer. A service will only be a financial success if customers are entirely satisfied with the **combination of content and technology**. Business models stand a particular chance of success if network operator, content providers and manufacturers of terminals coordinate the steps they take. It is not certain that UMTS will be a success in m-business, but there is a strong chance.

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This paper benefited from the results of a workshop held jointly by DBS/TEC and Deutsche Bank Research.

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3G - chance for take-off in mobile business

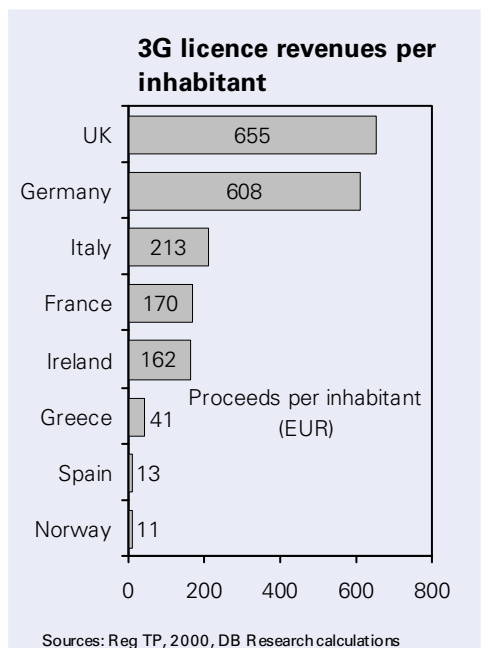
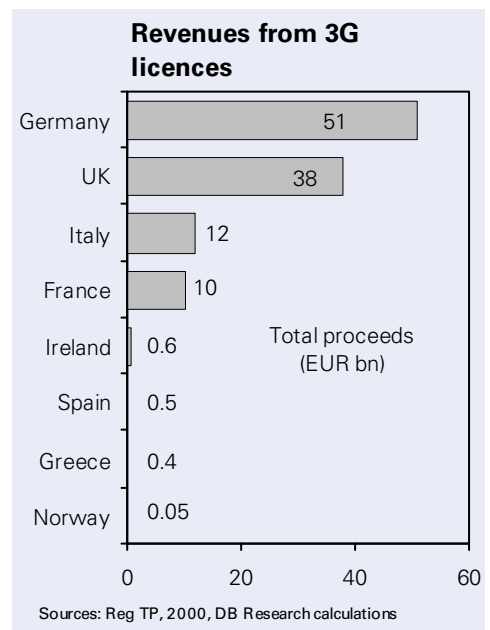
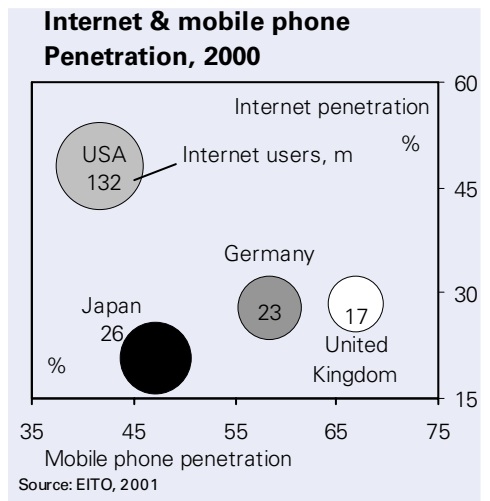
The internet and mobile telephony have developed incredible momentum in the recent past. In 2000 the number of internet users in Germany jumped by about 70% to 24 million, while the number of mobile phone customers soared by a staggering 105% to 48 million. Third-generation (3G) technology – UMTS/IMT-2000 (Universal Mobile Telecommunications System/International Mobile Telephone Standard 2000) – will enable the internet and mobile telephony to merge increasingly. UMTS appears to be a key technology for profitable markets of the future. The enormous response to the auctions of 3G licences thus came as no surprise. Germany's auction in summer 2000 brought the country's finance minister an additional EUR 51 bn in revenues – and whetted financial appetites throughout the government apparatus. In Western Europe as a whole 3G licences have generated some EUR 140 bn for state coffers. With proceeds of roughly EUR 600 per inhabitant, Germany was slightly behind the United Kingdom (approx. EUR 650) but far ahead of the remainder of Europe.

At present there are doubts that the telecommunications sector is heading for rosy times. This study investigates the opportunities and risks the sector faces with UMTS technology. It examines whether the new network technology can get m-commerce really well on its way. For this we have to look at the technological and regulatory aspects, as well as the economic issues involved.

Maximum data rates only under lab conditions

The UMTS network is based on radio cells – of different sizes and capacities – allocated to certain transmitters and receivers and to specific radio frequencies. The network architecture is strictly hierarchical. All cells are linked by radio or – especially over long distances – by fibre optic cabling. At the top of the hierarchy is the macro cell covering a certain area. It has the lowest maximum transmission speed (144 kbit/s), followed by the micro cells (maximum speed 384 kbit/s; maximum range 1 km), and finally the pico cells (2Mbit/s; 30 m), which cover individual locations or buildings. UMTS technology has some major advantages that can be demonstrated under laboratory conditions but which it will not be possible to use fully in the mass market in the medium term. For example, the performance of a UMTS cell declines sharply as use increases, i.e. the speed falls if numerous users within one cell call up large data packets simultaneously. In a pico cell the maximum number of users who can simultaneously obtain the optimum rate of 2 Mbit/s is only two. If there are five, the speed falls to 144 kbit/s, with nine users it drops to 64 kbit/s (which is the maximum ISDN speed) and with seventy to 9.6 kbit/s (maximum GSM rate).

The data rate depends not only on the load, but also on the way the system is used. If the user is moving faster than 10 km/h, he or she will be switched from the pico level to the micro level; if they move faster than 120 km/h, they will be allocated to the macro level. The promised maximum speed of 2 Mbit/s is in fact only attained if there is just a sole user, moving slowly if at all. But despite these limitations, the 3G technology will still greatly increase the average speed in mobile telephony.



Government successful at auctions

There was intense public debate in Germany over how the scarce UMTS frequencies should best be assigned. It was felt that, ideally, there should be as few government constraints as possible and no lengthy political decision-making processes. Instead, an economically sound procedure should allow the various market participants to assess for themselves the implications of the technical, regulatory and economic issues. There were doubts before the auction, for example, that a paired frequency spectrum would be sufficient for the operation of a network. This appears to be a purely technical question, but it also involves economic considerations. An auction has the advantage that participants work out for themselves, on the basis of their own business model, the economic consequences of obtaining the necessary technological capacity, adjusting their expectations for future payment flows accordingly. They can then decide how much they are willing to pay and how to go about bidding. Ideally, the licence is awarded to the participant whose business model has the greatest profit potential. This, however, assumes that the participants are informed of the real opportunities and risks, and are not simply acting on strategic considerations.

After being successful with the auctions for ERMES (European Radio Messaging Services) and GSM (Global System for Mobile Communications), the German authorities decided on a simultaneous multiple-round auction for the 3G licences as well. Participants were able to choose between a package consisting of two blocks of paired spectrum („small licence”) and a package with two blocks of paired spectrum and one block of unpaired spectrum („large licence”). This meant that, depending on the strategy of the individual bidders, between four and six companies could obtain UMTS licences.

3G auction – look back in anger?

Apart from the four already established operators of the GSM networks, two newcomers also acquired German 3G licences – without any regulatory intervention being necessary. For, unlike in the UK, places were not reserved in Germany for newcomers. In addition, the German auction procedure led to (roughly) equal prices for licences with equal frequency spectrums – which was not necessarily to be expected (see table p. 4). It was not long before the telecommunications companies criticised the high price. But the regulatory authority is satisfied with the results in every aspect, and thinks they provide a good basis for healthy competition in the German telecommunications sector. When discussing the details of the 3G licence auction, it should not be forgotten that the relative scarcity of frequencies is artificial: it is determined by policy decisions. Auctions are only a means of distributing resources that are currently in short supply. They are geared to conditions in the short term, and cannot rectify policy errors. A frequency policy with a long-term horizon must seek to ensure that sufficient spectrum is available for highly productive applications. One reason why mobile telephony is currently restricted to a relatively narrow frequency band is that parts of the remaining spectrum are blocked by other applications. UMTS frequencies are hence at present particularly scarce and valuable.

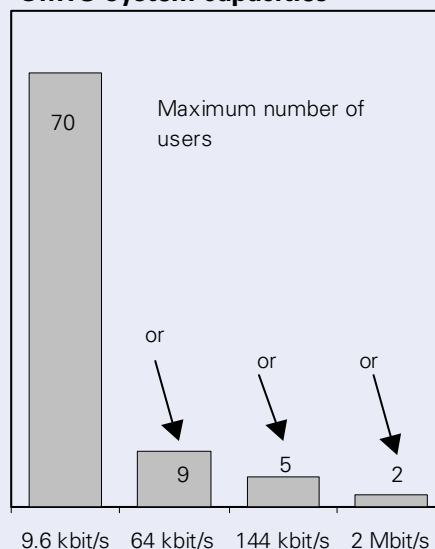
The shortage cannot be overcome at the national level. Frequencies and standards enabling mobile phones to be used internationally must be harmonised globally. International initiatives are needed if the progress in mobile communications is not to falter. On the road to the

Technology & data rate

		Mbit/s
GSM	Global System for Mobile Communication	0.0096
HSCSD	High Speed Circuit Switched Data	0.0288
GPRS	General Packet Radio Service	0.064
UMTS	Universal Mobile Telecommunication System	
	UMTS macro cell (>1km / unlimited)*	0.144
	UMTS micro cell (1km / 120 km/h)*	0.384
	UMTS pico cell (30 m / 10 km/h)*	2
Analogue		0.056
ISDN		0.064
ADSL		8

*Range/maximum speed of receiver

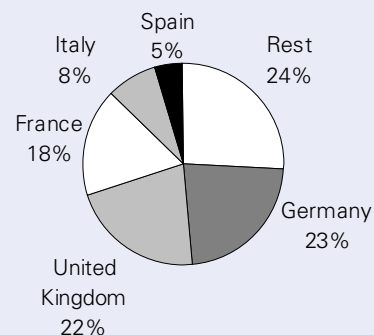
UMTS system capacities



Source: UMTS Forum, 2000

Telecoms market, W. Europe, 2000

Total: EUR 248 bn



Source: EITO, 2001

globally coordinated introduction of a 3G standard, the World Radio Communications Conference 2000 produced good results. It was a big success for the Europeans that Japan, which predominately uses a 2G standard, PDC (Personal Digital Cellular), and the USA, which has CDMA (Code Division Multiple Access) and USDC (US Digital Cellular System), agreed to the IMT-2000 standard. This should speed up the spread of UMTS world-wide and make global mobile communication more attractive.

International companies

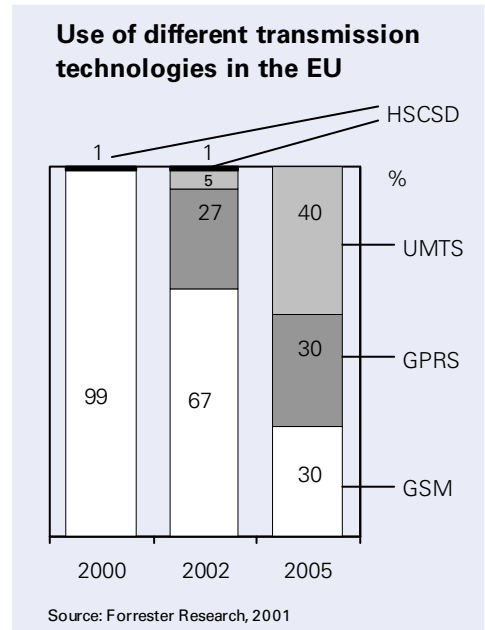
The telecommunications business is international, and is dominated by companies that operate internationally. The major players want to offer their services in as many important markets as possible in order to exploit economies of scale. When the German frequencies were auctioned, it was by no means a case of weak newcomers up against powerful, established telecommunications companies. All the bidders – incumbents and newcomers alike – pursue international strategies in which the German market, because of its sheer size and its geographical location in Europe, plays a central role. This key position at least partly justifies the high price paid for the German licences.

It remains to be seen whether the high German licence fees can be passed on to mobile-phone customers. The amount that companies are willing to pay for licences is determined by their earnings expectations. According to traditional economic theory, sunk costs have no influence on market prices under perfect competitive conditions. The fixed amounts paid for the rights are sunk costs, i.e. when the competition mechanism functions they do not affect pricing, but they certainly do affect the company’s results and may, in some cases, drive a company into bankruptcy.

Limited scope for interpretation

The telecommunications companies need capital not only to pay for the licences, but also to set up the networks. Conditions in the equity markets at present make it more difficult to raise financing, however, and this increases the pressure to generate income from the 3G technology as quickly as possible. The initial euphoria at the telecommunications companies fizzled out rapidly. Anxious to get UMTS technology on its way in Germany despite the difficult situation facing the entire information and communications sector, the regulatory authority investigated the scope for interpreting the legal agreements in ways that would permit alliances, in order to help reduce the telecommunication companies’ costs. But the scope is limited for competitive reasons. It is essential that the regulatory authority insist on the terms stipulated beforehand if the entire auction procedure is not to become legally contestable. No company – whether it has a 3G licence or not – should gain the impression that it has been disadvantaged by later changes to the rules. Legal disputes would hold up the introduction of the new technology.

In mid-2001 the regulatory authority decided to permit closer forms of cooperation, e.g. mobile phone companies can now share the use of broadband cables (backbone) between transmitters. Even though the same transmission, reception and routing equipment is used, the logistics of the competing networks must be kept separate. Cooperation between network operators is to be kept to the necessary minimum. Now that legal obstacles to cooperation have been overcome, it is in technology that the bottleneck lies. Despite the efforts



UMTS auction in Germany

Licencee	Frequencies	EUR bn
E-Plus Hutchison	2 + 1	8.43
Group 3G	2 + 1	8.47
Vodafone	2 + 1	8.48
MobilCom	2 + 1	8.43
T-Mobil	2 + 1	8.54
VIAG Interkom	2	8.45
Total:		50.81

Source: RegTP, 2000

Regulatory authority investigated the scope for interpreting the legal agreements

of the infrastructure manufacturers there is still no technology that makes it possible to operate several mobile networks completely separately via the same radio installations. In order to work together, the network operators will first have to reach agreement on compatible technology. The fact that they cooperate with different infrastructure manufacturers makes this even more complicated.

Thanks to their increased scope for cooperation, the licencees expect that investment in antennas, energy supply, radio stations, network controllers, cable and radio connections, previously estimated at up to EUR 6 bn per network, will be between 10% and 40% lower. The amortisation period will be correspondingly shorter than the original estimate of up to 15 years.

Original rules still apply

Despite the new possibilities for cooperation, the regulatory authority demands that network coverage must still comply with the levels as originally scheduled for different phases. Each licencee must potentially cover one-quarter of the German population with a UMTS network of its own by end-2003 and one-half of the population by end-2005.

Germany is a relatively densely populated country. About one-third of the population lives in 80 cities and approximately another two-fifths in the nearly 1,500 towns with 10,000 to 100,000 inhabitants. Owing to the uneven distribution of the population across the country, only 15,000 base stations covering less than one-tenth of the geographic area will be needed in order to reach one-half of the inhabitants by 2005. The costs rise exponentially if the remainder, who are spread over 13,000 towns and villages, are also to have access to UMTS technology. The number of cell towers required would then rise by over 30,000. It seems likely that the smaller telecommunications companies will only set up networks in the more densely populated areas, and rely on agreements to share other companies' networks in thinly populated rural areas.

There are already 60,000 GSM base stations at 40,000 locations, but these cannot be fully incorporated into UMTS networks. The number of new base stations needed will be greatly reduced, though, by the closer cooperation between network operators. However, there are also political factors which could delay the launch of 3G services. In view of the public debate over health risks, it is possible that the legal limits for electrosmog might be tightened. If the Swiss limits – one-tenth of the German figures – were adopted, this would raise investment costs by about EUR 3 bn per network. There will also be difficulties relating to the key resources required in building up the networks. Since about 75 networks are to go into operation in Europe by 2003, i.e. roughly simultaneously, there are going to be shortages of highly specialised personnel and of special electronic components.

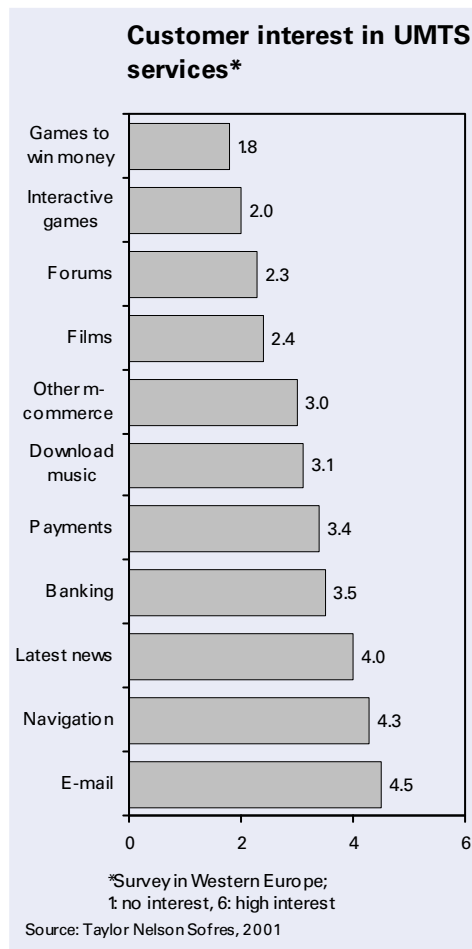
The financial success of UMTS systems does not depend solely on setting up the networks, it also hinges on customer acceptance. The demand side of mobile phone use thus needs to be scrutinised closely.

WAP flop dampens 3G enthusiasm

It is questionable whether users of first-generation WAP (Wireless Application Protocol) will be as enthusiastic about the next step with UMTS. The WAP system, which has so far been based on GSM technology, makes internet content available on a mobile phone. However, animations based on today's WAP applications are only rudimentary compared with those that use i-mode, which is highly

Amortisation period shorter than originally estimated

Network coverage must still comply with levels originally scheduled



popular in Japan. Apart from the fact that connections are relatively slow, unstable and expensive, the quality so far belies the optimistic announcements of the telecoms companies when WAP technology was introduced. Many customers who are basically enthusiastic about mobile services are now correspondingly cautious. Demand for new types of service will probably pick up only gradually.

Providers of UMTS-based services highlight the fact that customers do not pay according to the time they spend online, as with GSM technology, but only for the volume of data they obtain. It then becomes financially attractive to leave the phone "always on". This will not be enough to entice new groups of buyers, but it is still a first step towards a much wider, customised service spectrum. Demand will probably be slow to increase, as users will only gradually take advantage of the possibilities offered by the new technology. The fact that penetration rates for the internet and mobile phones are high, and people are accustomed to handling electronic media, will help. In the transition from GSM to UMTS, HSCSD (High Speed Circuit Switched Data) and especially GPRS (General Packet Radio Services) will be two important building blocks. Unlike HSCSD, GPRS is to be used in the mass market, where it is to help familiarise customers with new types of service and new uses before the 3G technology is introduced. GPRS is based on GSM technology and splits data into small packets. These packets are sent whenever there is a small gap in network traffic. With GPRS, the existing network can be used more efficiently but capacity is not increased, as data rates in GPRS are not high. Costs are based on the quantity of data transferred, as will be the case later with UMTS. Internet access should in most cases be cheaper than with GSM. On the other hand, capacity-intensive applications such as internet radio or video streaming are not practicable with GPRS either, owing to the fragmented transmission. Only UMTS will offer satisfactory solutions for complex applications in heavily utilised networks.

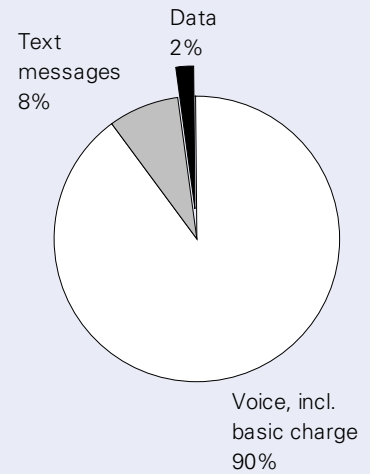
Mobile internet – often misunderstood

There are still some hurdles to be overcome before UMTS systems can start as planned by 2003. Much more energy is required, for example, to transfer large quantities of data and present them in a colour display than for simple voice telephony. Power supply is still a major technical problem. For this reason, WIK (Wissenschaftliches Institut für Kommunikationsforschung) draws attention to conservative forecasts according to which only one-fifth of terminals will be fully UMTS-enabled even in 2006.

Contrary to what the phrase "mobile internet" suggests, it is not the intention, even with 3G technology, to reproduce the entire "stationary internet" on mobile phones. Mobile use focuses more on rapid information than on browsing. In the provision of conventional internet content, mobile phones will in future still not be able to compete with wired connections. All mobile internet access requires complex, high-cost handset. Mobile phones have only limited computer power, small memory capacity, limited power storage and small displays. On top of that, a mobile connection is inevitably less stable than broadband access via a PC.

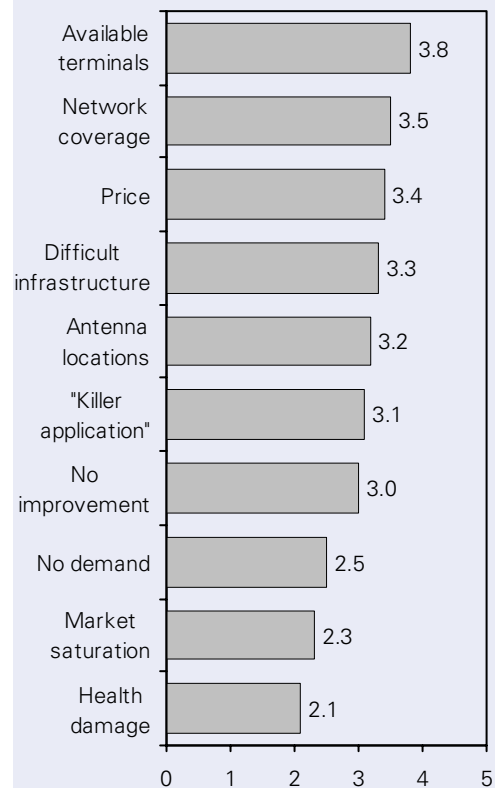
In view of these disadvantages compared with the stationary network, companies need to establish services that emphasise the specific advantages of mobile phones (the ability to reach the user practically anywhere, or to pinpoint the location of a specific phone) and effectively complement the conventional wired services. Business models based

Breakdown of turnover in German mobile phone services, 2000



Source: Forrester Research, 2001

Factors that will hamper 3G business*



*Survey among experts; scale from 0 (little effect) to 5 (particularly strong effect)

Source: c-quantial, 2001

on cooperation between infrastructure manufacturer, network operator and content provider appear to be among the most promising. The jointly generated earnings will have to be distributed in a way that secures the existence of all the partner companies. Here, European network operators can learn from the Japanese i-mode model.

Hope for SMS, payment systems, LBS

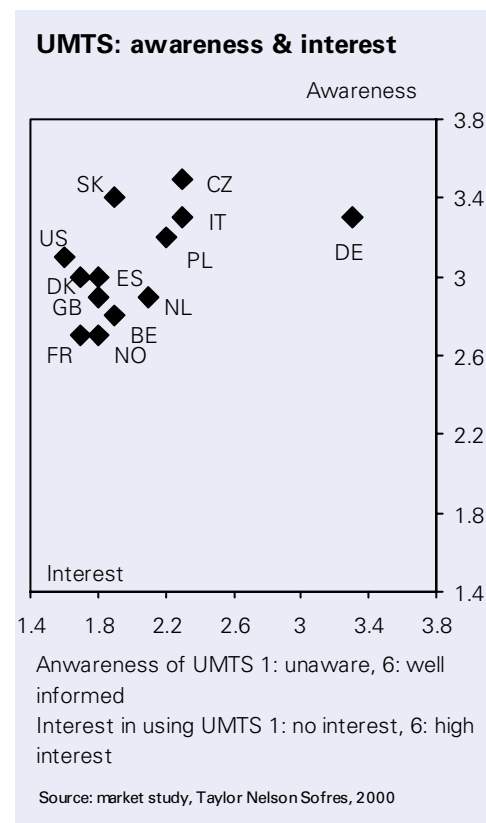
In surveys, consumers mostly put the rapid exchange of brief messages and navigation assistance at the top of the list of things they want to be able to do with UMTS-enabled mobile phones. Interactive games, online forums and video clips are among the least wanted services. We see great potential mainly in the three areas of communication – especially **e-mail** or SMS (Short Message Service) and its more advanced version MMS (Multimedia Messaging Service) – location-based services (LBS) and electronic payment systems. In 2000, roughly 250 bn SMS (text) messages were sent world-wide. 18 billion were sent in Germany alone, which is equivalent to more than one per day for every mobile phone in the country. Since an SMS message is limited to 160 simple characters, providers hope to add to their success by enlarging capacity. EMS is a first step in the evolution from SMS to MMS. In addition to plain text, an EMS can contain simple formatting, graphics and sound. An MMS – like HTML mails – transmits more sophisticated graphic, sound and video animations as well as formatted text.

Mobile phones offer all the attributes of an electronic purse, and since people carry their mobile phone around with them just like a wallet in any case, mobiles will probably be used more for **payment transactions** in future. In the long term this will probably erode the popularity of credit cards. Internet payments by credit card generally offer a lower level of security since only the existence of the card number is checked, not usually the cardholder's identity. By contrast, users of mobile payment systems have to identify themselves to the collecting office by entering a password or PIN from the right terminal. The seller does not gain access to the customer's personal data. Anonymity and transparency increase the acceptance of mobile payment systems. The growing confidence in these systems should boost m-commerce as a whole over the medium term.

The 3G technology makes **location-based services** more attractive. The automatic analysis of the user's position combined with information about his or her demand behaviour gives access to selected, relevant local information. Apart from GPS (Global Positioning System), which is very precise but still relatively expensive, there are favourably priced systems which determine the position of the mobile phone via the active UMTS radio cell. In densely populated areas these are accurate to within a few metres. But in sparsely populated areas with less cell coverage they can be up to 30 km off target. Location-based services therefore tend to be of little practical use outside urban areas. Despite these constraints, LBS should have good medium-term potential not only among commercial customers but also for personal use. Owing to the technical limitations of the GSM networks, WAP services have operated almost exclusively as pull services, where information is requested by the customer. From the business point of view, however, push services are much more attractive. In this case, location-based information (e.g. about restaurants or hotels) is provided automatically as soon as the user – who is always connected thanks to UMTS – enters the range of a new cell. However, such personalised offers of entertainment and information will probably only begin to generate

In 2000, roughly 250 billion SMS

Mobile phones offer all the attributes of an electronic purse



more turnover than simple voice services and value-added voice applications (simple voice transmission, voice-controlled computer operation, reading of e-mails) from 2010. The success of applications to locate specific individuals (e.g. friend finder or child watch) seems doubtful owing to fears of invasion of privacy.

M-commerce in its infancy

Japan is far in the lead in m-commerce. Thanks to i-mode, 3.5 million purchases were made there by mobile phone in 2000, five times as many as in the USA. Sales were worth EUR 500 m. In the USA they came to less than EUR 200 m, in Germany below EUR 100 m. In the same year, German retail sales totalled some EUR 500 bn. It is clear from this that m-commerce is still in its infancy as regards actual turnover. Many companies still regard offering mobile services as a form of marketing back-up rather than as part of their core business.

Nonetheless, UMTS offers the technological platform to enliven mobile business world-wide in the medium term. Much work is still needed in many countries, though, to inform people about the wider range of mobile phone applications. In a survey, Germany came out on top as regards awareness of UMTS and interest in using the technology. American, French and Danish respondents felt themselves to be relatively poorly informed, while the Norwegians, French and British showed least interest in using wireless internet technology. The results underscore the potential of the German telecommunications market, and partially explain the prices for the German licences. The situation in the United Kingdom is more problematic. There, the lack of interest shown by users so far is a damper on hopes of rising m-commerce sales, and hence also on the earnings prospects of the telecoms companies.

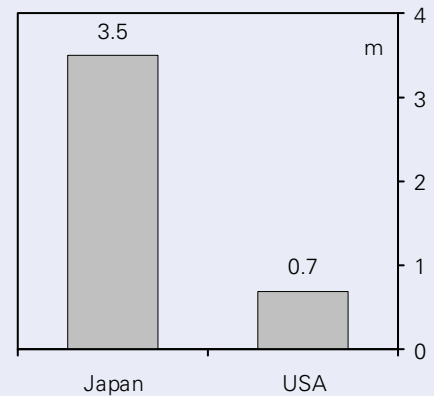
In a survey, 65% of the persons polled said they had little interest in mobile internet access. Although it was assumed in the question that the internet could be surfed just as quickly on a mobile phone as on a computer, only a small minority said they would use the new option regularly. In a consumer poll in the USA, fear of credit-card crime and high access costs for m-commerce were frequently cited as restricting factors.

Willingness to pay for internet services appears to increase if content becomes more attractive, access technology improves and online costs fall. This applies particularly to online banking, software downloads, database searches and e-mail services. The amounts people say they are willing to pay tend to be low, however. In one survey, 85% did not want to spend more than EUR 50 per month on online content; roughly one-fifth did not even want to pay more than EUR 5. But the introduction of services does not depend solely on the price level; price transparency is also a decisive factor. A simple pricing system is important in relations between content provider and customer, as well as between network operator and content provider. Acceptance of services increases if the customer knows just how much he or she has to pay. Roughly half of those polled in a study conducted in Germany preferred to be charged on a pay-per-view basis while slightly over one-quarter preferred a fixed charge.

Success with UMTS: focus on the customer!

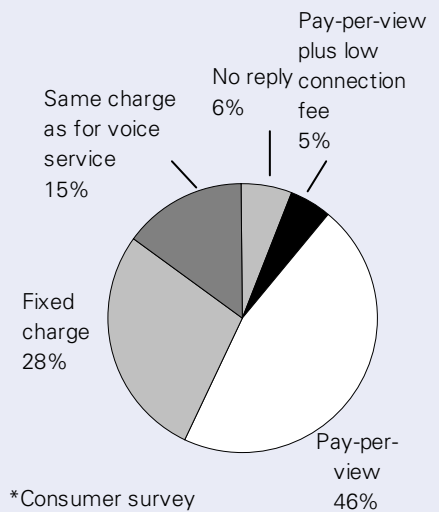
Even though the rules for establishing UMTS networks have been simplified in Germany, for example, all companies involved in telecommunications will still have to work hard to make their business

Number of m-commerce transactions, 2000



Source: Jupiter MMXI, 2001

Payment system favoured in Germany*

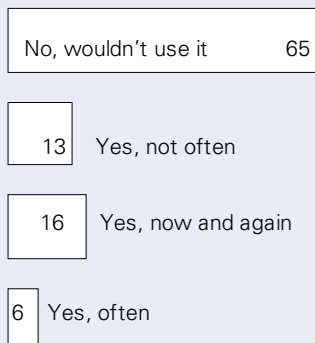


*Consumer survey

Source: Forrester Research, 2000

Use of mobile phones

In future it is to be possible to surf the internet on a mobile phone as quickly as on a PC. Can you imagine making use of this when on the move?



Percentage of those asked

Source: forsa, 2001

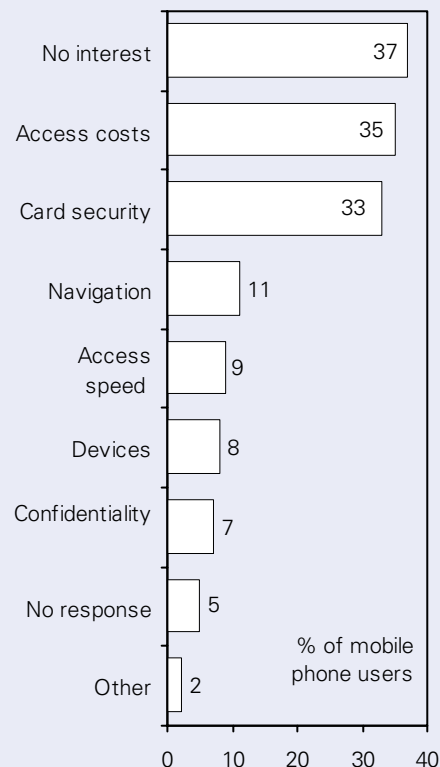
model a success. All companies in the value chain – from the infrastructure manufacturer, through the network operator, to the content provider – will have to get to grips with the technical, regulatory and economic issues if they are to set up attractive, new m-commerce offerings. It seems essential in many cases that the companies cooperate very closely in the interest of making the services pay. There must be a good fit between the form of cooperation between content provider and network operator, the transparent payment system, the necessary security, and the target group for the service. Earnings from promising business models will have to be distributed in a way that secures the existence of all the companies participating in the value chain. Thanks to UMTS it will be possible to give the customer simple and convenient access to a specially selected range of information. While the new technology opens up an enormous spectrum of possibilities, product developers must not lose sight of the consumer. The success of an innovation is decided by the market alone. Consumers have shown relatively little interest so far and will probably only really warm to a service if they are entirely satisfied with the combination of content and technology.

Volume-based pricing, which is a major improvement on GSM technology, will already be introduced with GPRS. The 3G technology will then bring much higher data rates as well. Since the 3G licences in Germany are held by two newcomers and four established operators of GSM networks, and since only the four incumbents can operate GPRS, we believe that the telecoms companies will ultimately push UMTS more strongly than GPRS. The compelling motive for the telecoms companies is to amortise the costs sunk in the licences.

But the success of the new network technology will probably come less quickly than the telecommunications companies had originally hoped. It will be important, first, to arouse the customer's interest and to establish partnership structures within the value chain.

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Factors restricting m-commerce in the USA*



*) Consumer survey, more than one reply possible

Source: Jupiter MMXL, 2001

EMU Watch

ISSN 1430-7391
(in German: "EWU-Monitor")

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Printed by: HST Offsetdruck GmbH, Dieburg.