The Mobile Communications Environment in the European Union: Systems, Regulations, and Consequences in the Past, Present, and Future

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ABSTRACT:

By creating a single market and introducing competition and the de facto global standard, GSM, the European Union (EU) achieved economies of scale and has been the world's leader in the mobile communications sector. A number of interrelated issues surrounding the third-generation (3G) system have recently become visible, however. The first indication is the high 3G spectrum license prices mobile operators had to pay. Although technology promises capabilities far greater than fixed public telephone systems and can be one of the means to achieve the EU's information society framework, there is much uncertainly about the future of the 3G market.

1. Introduction

The development of a new regulatory framework of the European Union (EU) towards liberalization and harmonization in the late 1980s through mid-1990s was a well-planned strategy for a successful EU-wide implementation of the second-generation (2G) digital mobile communications, Global System for Mobile Communications (GSM). Prior to the introduction of GSM, the EU mobile market was fragmented and inefficient due to the existence of a variety of technical standards, telecommunications monopolies, and different national regulatory frameworks. By creating a single market and introducing competition and GSM, the de facto global standard for cellular phones, the EU achieved economies of scale in the mobile sector. As a result, over the past decade, the EU has been the world's leader in mobile communications.

The EU Member States, however, are now facing tough challenges, as mobile technology is in the transition from 2G to the third generation (3G). The first indication is the high prices mobile operators had to pay to secure 3G spectrum licenses. The Commission could not implement an EU-wide license award process, as the Member States wanted to retain the process as a national responsibility. The majority of them chose to use auction as the method for spectrum allocation, resulting in enormous amounts of up-front costs. For instance, the U.K. raised 22.5 billion pounds or 35.1 billion Euro (EUR)[1] (US$32.5 billion) and the German auction made a total of 98.8 billion Deutsche Marks (EUR50.5 billion, or US$46.7 billion) (Benoit & Simonian, 2000). Financial markets reacted negatively to these high costs of 3G licenses. Spectrum licenses alone are extremely expensive, and in addition, building new infrastructure for 3G will likely burden the license holders. This in turn may lead to high mobile service tariffs not many can afford. The market demand for 3G services is uncertain because nobody knows how consumers will use this new technology and how much they will be willing to pay for it. Since the 3G system is a global standard, European operators will have to handle more intense competition not only nationally and within the EU but also globally.

Mobile communications is an integral element of the Information Society, the umbrella framework the EU has been promoting. Equal access to information and communication technologies is an essential condition of this framework. The Information Society is expected to bring a number of benefits, such as increased employment, new business opportunities, higher standards of living, and better services, to businesses and consumers (Commission, 1996a). From the technological viewpoint, the 3G system has the potential to realize the wireless information society. Affordability and people's acceptance of the new service are harder to predict and therefore need to be monitored.

This paper first provides a brief overview of the EU situation in the era of analog mobile communications systems. It then elaborates how the EU as a whole achieved deployment of the standardized digital mobile system and led the rest of the world. And finally it discusses what challenges the Commission, Member States, and mobile communications operators are facing in relation to market entry, competition, and affordability to users.

2. Analog Cellular Mobile Communications Systems (The First Generation)

Most of the EU and European Free Trade Association (EFTA) countries introduced their first analog cellular phone systems in the 1980s, starting Sweden in August 1981 (Paetsch, 1993). There was no European-wide coordination for technical standards and system procurement policies. Among the EU member states, the U.K. and France were the only countries that permitted a second mobile operator to provide cellular phone services within their respective countries in the 1980s. In the other European states, government-owned Post, Telegraph and Telephone organizations (PTTs) monopolized all types of telecommunications services, including mobile communications.

These circumstances led to the proliferation of incompatible cellular phone systems. For example, the Nordic countries and Austria, Belgium, Luxembourg, the Netherlands and Spain deployed Nordic Mobile Telephones

[1] All exchange rates used in this paper are as of 10 February 2001.

(NMT)-450, while the U.K. and Ireland introduced Total Access Communication Systems (TACS). Germany and Portugal had C-450. France and Italy respectively implemented their own standards. In the late 1980s the Nordic countries and some other countries added NMT-900.

Pan-European roaming was technically impossible. The process of reaching a cross-border roaming agreement between countries with the same standard was slow. In the early 1990s only two roaming areas existed in Europe: One was a Scandinavian-country agreement among Denmark, Finland, Norway, and Sweden, and the other was NMT-450 roaming among Belgium, Luxembourg, and the Netherlands (Paetsch, 1993).

The European mobile market in terms of the size and pricing also showed substantial discrepancies in the late 1980s through early 1990s. The Member States' penetration rates in 1990 ranged from 0.1% in Portugal to 7% in Sweden. Handset prices and service charges significantly varied from country to country. For example, a cell phone cost US$1,110 in Ireland, US$1,140 in Sweden, US$2,190 in France, US$2,530 in Germany, and US$2,780 in Spain. Monthly service charges for 100 2-minute calls during peak hours were US$68 in Iceland, US$100 in Denmark, US$134 in Sweden, US$141 in Spain, $278 in Germany, and US$361 in France (Paetsch, 1993).

This picture drastically changed when the EU strategically changed the environment of its market and introduced GSM to the mobile communications market. The next section discusses how it happened.

3. Digital Systems (the Second Generation): GSM

3.1 The single European market

In parallel with the fragmented activities of the Member States, in the mid-1980s the European Commission initiated a series of discussions concerning liberalization of the telecommunication sector, including mobile communications, in an attempt to change the existing telecommunications regulatory framework to a more harmonized, coordinated, and competitive one. The first strategic action was the Single European Act signed in 1986, according to which the Member States (12 countries at that time) were to form a single European market by the end of 1992 (Paetsch, 1993). This move effectively made the EU, with over 323 million people, the largest market in the world.

The telecommunications sector was one of the critical areas for the EU's economic growth. In June 1987, the European Commission published a Green Paper titled "*Towards a dynamic European economy--the development of the common market for telecommunications services and equipment*." "The objective pursued by the Green Paper was the creation of a telecommunications environment that would provide European consumers with a wide array of communications services, facilitate the rapid diffusion of new technologies, and establish and maintain a coherent development between the EC Member Countries" (Paetsch, 1993, p. 258). The same Green Paper proposed the creation of an independent standardization organization, the European Telecommunications Standard Institute (ETSI) (ETSI, 2000). The ETSI inherited all European telecommunications standardization activities from the European Conference of Postal and Telecommunications Administrations (CEPT) in 1989. The 1987 Green Paper, however, did not include provisions specific to mobile communications.

The European Commission published the first Green Paper on mobile and personal communications in 1994 (Commission, 2001). This Green Paper, "*Towards the personal communications environment: Green paper on a common approach in the field of mobile and personal communications in the European Union,"* recognized that mobile communications was the fastest growing area within the telecommunications sector (Commission, 1994). At the time this Green Paper was written, there were more than eight million cellular phone users in Europe. The Commission forecast that there would be about 40 million users in the EU by the year 2000. Even taking the fact that Austria, Finland, and Sweden were not part of the EU in 1994 into account, this estimate turned out to be far below the actual number of mobile subscribers. In summer 2000, there were about 194 million users in the 15 Member States in total (Commission, 2000). A key element for

this explosive growth in the mobile communications market was GSM.

3.2 GSM deployment

France and Germany began a joint study program for a digital mobile communications system in 1981 (Paetsch, 1993). Digital technology, as opposed to analog, was proposed to increase efficiency of the limited resources (i.e., frequency bands) (Sempere, 1997). In order to prevent technological fragmentation, as was the case with the analog mobile systems, a working group called the Groupe Special Mobile within the CEPT began developing a pan-European standard in 1982. The acronym GSM was initially derived from the name of this standardization group. When the ETSI took over the EU's telecommunications standardization activities, the GSM group became a technical committee of this new organization. The same acronym has been since then interpreted as Global System for Mobile Communications (Eberspacher & Vogel, 1999). GSM was the world's first digital mobile communications system (Sempere, 1997). To ensure a harmonized implementation of GSM networks, the European Council issued Recommendation 87/371/EEC on the coordinated introduction of public pan-European digital mobile communications and Directive 87/372/EEC on the frequency bands reserved for the service (Paetsch, 1993). Thus, the European Commission clearly and intentionally made GSM as a means to create a mass market, elements of which included lower prices and greater penetration than analog systems and non-EU operators' networks. GSM was a prescription to success under the environment the EU had by then created.

Starting with Vodafone of the U.K. and Radiolinja of Finland in December 1991, 13 networks in eight countries began offering GSM by the end of 1992 (Commission, 1994). By early 1994, GSM accounted for over 10% of the installed cellular telephony base in the EU. GSM was also accepted fairly quickly in regions outside Europe. Several commercial GSM services began in Asia Pacific and Middle East at the end of 1993 (Eberspacher & Vogel, 1999). In the 1994 Green Paper on mobile and personal communications, the European Commission already declared that "GSM is now the major European mobile system and has become a world-wide success" (p. 77). Europe emerged as a leader of harmonized mobile communications.

The EU had by that time the optimal environment fostering competition and interconnection between mobile operators' networks. Most Member States issued licenses to more than one mobile operator, according to the liberalization trend set in the 1987 Green Paper (Commission, 1994). This was done before the January 1998 date set for EU-wide telecommunications liberalization. The early introduction of competition to the mobile communications sector was possible probably because the mobile communications service was not a basic service (i.e., voice telephony). While the fixed public telephone service was the major source of incomes for the telecommunications monopolies (PTTs) in all countries, with the exception of the U.K. where competition began in 1984, the cellular phone service was not. The cell phone was not the first telephone people would get, and also, only a small number of people were using the service. It appears that the competitive environment contributed to the growth of the mobile sector in the late 1990s, as the European Commission hoped. The 1994 Green Paper states that "An open, competitive market has stimulated the growth and development of mobile services promoting a rapid take up of better and cheaper services, in particular, in relation to GSM" (p. 137).

GSM's success is probably attributed to a combination of several factors, including:

a) The European Commission steered its regulatory framework towards fair competition in a building-block fashion over time,
b) European mobile operators played a key role in technological developments, and
c) The GSM standard was specified by the CEPT/ETSI and implemented in Europe ahead of any other areas in the world (Bekkers & Smits, 1999).

By summer 1997, there were 200 GSM networks in 109 countries, accounting for 44 million subscribers (Eberspacher & Vogel, 1999). The growth of the GSM customer base has never slowed down since the introduction of the standard, and rather it accelerated. In

October 2000, 397 million mobile users were estimated to be using GSM and its variants (see next section) worldwide, of which 255 million were in Europe (GSM Association, 2000a). GSM and its variants accounted for 68.5% of the world's digital mobile communications market and 60.6% of the entire mobile communications market. More than 400 mobile operators in 162 countries/areas offer GSM (GSM Association, 2001a). While two other largest markets, namely the U.S. and Japan, implemented different standards, GSM has become the de facto global standard for mobile communications.

Furthermore, through cross-border roaming, GSM made it possible for mobile operators to substantially extend service areas beyond their home territories. EU mobile subscribers can take advantage of roaming services not only within the EU but also outside Europe. In fact, geographical coverage of GSM roaming is extensive. For example, U.K.'s Vodafone has roaming agreements with over 250 operators in 111 countries, Germany's Mannesmann has agreements with 130 operators in 80 countries, France Telecom has agreements with over 120 operators in 82 countries, Finland's Sonera has agreed with 180 operators in 91 countries, and Portugal's Optimus has agreed with 160 operators in 79 countries (GSM Association, 2001b).

3.3 Other systems in today's mobile communications market in the EU

Digital mobile communications systems are also called the second-generation (2G) systems, while analog systems are the first generation (1G). It should be noted that GSM is not the only 2G standard developed and used in the EU. GSM operates at the 900MHz band. The U.K. requested the ETSI in 1900 to develop a variant of GSM for the 1800MHz band in order for the country to further open up its mobile market. At that time BT Cellnet and Vodafone dominated the market. The ETSI modified the GSM radio interface to create Digital Communications Systems (DCS)-1800 (Bekkers & Smits, 1999). This resulted in the addition of two operators, One2One and Orange, to the U.K. mobile communications sector in 1993 and 1994 respectively, and many other operators throughout the EU between 1995 and 1999. The advancement of technology has made it possible for users of these different systems to talk to each other. Today there are a number of dual-band handset models available in the marketplace (Vital Business Communications, 2001).

In addition to GSM and DCS, the analog (1G) markets still exist. Eight mobile operators in seven EU countries operate analog networks today, although most of them will be phased out within the next few years (Commission, 2000). The number of analog phone users, however, accounts for only a few percent of the entire mobile users (Information Society Technologies Programme [IST], 2000).

3.4. Licensing of 1G and 2G

At the global level, the radio communications sector of the International Telecommunications Union (ITU), ITU-R, is the permanent organization ensuring efficient use of the radio frequency spectrum for all radio communications services (ITU, 2000). Radio spectrum is coordinated at its World Radiocommunications Conferences (WRC). In Europe, the European Radiocommunications Committee (ERC), one of the three committees of the CEPT, develops radio communications policies and coordinates frequency management, radio regulations, and spectrum engineering in conjunction with other organizations such as the ETSI (ERO, 2000). Neither the ITU-R nor the ERC allocates spectrum to mobile operators in individual countries. The basic idea of licensing is that a National Regulatory Agency (NRA) awards an applicant a license for the use of a certain frequency band in that country.

There are several types of methods to allocate radio frequencies (Commission, 2000):

1) **First-come-first-served method**: Spectrum is allocated to applicants in the order the applications are received until it is filled. The NRA usually sets criteria on recipients and usage of the bandwidth.

2) **Extension of the existing license**: There are a few scenarios: Renewal when the term is up, extension of a GSM license to DCS services, and extension of an analog license to GSM or DCS services.

3) **Beauty contest**: The NRA sets qualification criteria for market entry. Licenses are awarded to the most qualified applicants.

4) **Auction**: Applicants bid for licenses. Those applicants who bided the largest amount of money receive licenses for the pre-defined number of frequency bands.

5) **Beauty contest and auction combined**: The NRA may select qualified applicants out of all applicants in the first step and then use an auction in the second step. Alternatively, licenses may be awarded to the applicants who have offered the best combination of qualification, implementation plan, and economic criteria.

The only 2G spectrum licenses auctioned in the EU were for six GSM and DCS licenses (all in 1998) in the Netherlands, two DCS licenses (in 1999) in Germany, and another two DCS licenses (one in 1997 and the other in 1999) in Austria (Commission, 2000). All others--nearly 90 licenses--were granted either through beauty contests or extension of existing licenses or given on a first-come-first-served basis. The duration of 1G/2G licenses in the EU is typically 10 to 25 years. As discussed later, many Member States changed their 3G licensing methods to auction. Some auctions generated controversial outcomes, which are the sources of concern for the future.

3.5. Current state of the mobile market

It is useful to look at the state of the mobile market from the statistical viewpoint, as they indicate the rate of diffusion and can be used to predict future directions. In summer 2000, there were 194 million mobile subscribers in the 15 EU Member States, and the EU average penetration rate was 55% of the population (Commission, 2000). The penetration rates ranged from 39% in Belgium to 70% in Finland, while five countries dominated the market in terms of the subscriber numbers: Germany 36.2 million; Italy 36.2 million; U.K., 31.8 million; France, 25.1 million; and Spain, 20.8 million. The EU average penetration growth rate from 1999 to 2000 was 63%.

It should be noted that in general countries that had lower penetration rates in 1999 grew more than countries with higher rates. For example, Greece, Germany, and Spain grew by 111%, 101%, and 93% respectively from their respective 1999 penetration rates of 23%, 22%, and 27%. On the other hand, Finland, Sweden, and Denmark, whose 1999 penetration rates were 62%, 52%, and 45% respectively, grew by 13%, 26%, and 36% respectively. Judging from these trends and the fact that the EU average penetration rate has reached 55%, the market seems to be near a saturation point; therefore, growth in 2001 and beyond may slow down in some countries, particularly the ones with higher-than-average penetration rates.

For assessment of competition, the number of license holders in each country may be thought as one of the indicators. Currently, two to five network operators are authorized to provide 1G and 2G mobile services in each Member State, and the total mobile network operators in the EU is 54.

Reduction of tariffs is a critical consequence of competition and this is one of the major objectives of the European Commission as well as the Member States, as affordable pricing is likely stimulate the market further. As discussed above, analog services and handsets in the early 1990s were much more expensive than today's levels. Today, consumers have many service options including packaged services and pay-as-you-go services. Although handset prices range widely, many models are priced less than US$100. The U.K's Oftel found that during the year of 1999 prices of mobile services--an index consisting of one-time connection charges and monthly basic and usage charges--fell by 17% in the country (Oftel, 2000). Another study of Oftel's shows that between 1990 and 1999 prices of mobile services provided by four U.K. mobile network operators were reduced by about two thirds (Oftel, 1999). A recent study of mobile tariffs for all EU countries show that in summer 2000 average monthly bills, based on the packaged tariffs, was EUR28 for the residential profile and

EUR89 for the business profile (Commission, 2000).

Thus, the EU has made a significant progress in its mobile communications market since it introduced GSM in early 1990s. In terms of its market size, penetration rates, pricing, and competitive environment, the EU is indeed the world's leader in this sector. Can the EU maintain the position in mobile communications in the next decade? A number of interrelated issues surrounding the next-generation mobile communications system have recently become visible, which are discussed below.

4. The Third Generation (3G): Universal Mobile Telecommunications System (UMTS)

4.1 Emerging global standard

The 3G mobile communications system, also known as International Mobile Telecommunications (IMT)-2000, is a set of global standards the ITU has defined. 3G services will start in Europe in 2002. While the development of 2G systems was prompted mainly by a scarcity of radio spectrum, motives for 3G systems involve additional functions including transmission of large data files, audio, and video (multimedia) (Bekkers & Smits, 1999). 3G phones, with the transmission speed at 144 kbps up to 2Mpbs, 200 times faster than current standards, will have capabilities far greater than fixed public telephone systems. 3G systems will be totally integrated with fixed telephone, satellite, and other wireless networks to form a single, ubiquitous telecommunications system. Also, 3G systems are designed to be backwardly compatible with all the existing 1G and 2G systems. Thus, 3G effectively realizes digital convergence.

The European version of IMT-2000 is Universal Mobile Telecommunications Systems (UMTS). In the mid-1990s, within only a few years after GSM took off, the concept of UMTS was conceived in Europe as a completely new standard superseding all the existing 2G systems. The 1994 Green Paper proposed that the transition from 2G to 3G must be smooth and that the potential of EU initiatives towards UMTS should be maximized by, for example, developing "coordinated licensing and award procedures between Member States and/or at Community level" (p. 213). ETSI and UMTS Forum, a non-profit organization consisting of experts in mobile technology and regulation, have led European developments of 3G (UMTS Forum, 2001).

At the global level, a number of organizations are working together for a coordinated implementation of 3G systems, including the ITU, the Third Generation Partnership Projects (3GPPs), other working groups and the Operators Harmonization Group (OHG) (Huber, Weiler, & Brand, 2000; "3G mobile," 2000). Unlike the case with GSM, the ITU is the central point for global coordination for 3G. The ITU has approved a broad set of guidelines for interfaces of 3G phones but did not define rigid specifications (Frenzel, 2000). Several versions of the IMT-2000 family have been proposed. After a collaboration process between Europe and Japan, they both adopted a standard called W-CDMA (Wide-band Code Division Multiple Access). Despite some minor differences, the European and Japanese versions are effectively identical. The U.S. is proposing a different standard, cdma2000, although it is also a variant of IMT-2000 ("3G mobile," 2000). Other countries are adopting somewhat different standards. Thus, IMT-2000 seems a loose set of acceptable standards.

Although no country has released commercial versions of 3G services yet, and European mobile operators will not start offering 3G until 2002 or later, analysts have been speculating about its market size. One estimate predicts that the 3G market will grow to 9.2 billion dollars worldwide in 2005 ("ITU Gives," 2000). Another predicts 480 million subscribers to 3G services by 2006 and over one billion by 2010 (McCartney, 2001). With such high stakes, mobile operators feel that they will not have a future without a 3G license (Roberts, 2000). As mentioned above, the Commission hoped that Member State would have more coordinated licensing procedures. However, disparities between countries in this area are evident.

4.2 3G licensing

As of 1 March 2001, nine out of 15 Member States have completed their 3G licensing processes. Five out of those nine countries used auction as the method of granting spectrum. The first auction took place in the U.K. in March through April 2000. Thirteen bidders applied. By the time the country's

Radiocommunications Agency awarded five applicants with 3G spectrum licenses, it raised 22.5 billion pounds (US$ 32.5 billion), while the total reserve price for the five licenses was 500 million pounds (US$ 722 million) (Radiocommunications Agency [RA], 2000a, 2000b). Thus, the U.K. government gained 45 times more than the minimum price it originally set. Four out of the five winners are the existing 1G/2G operators. This was the first 3G auction in the world and the first auction ever that has taken place for spectrum allocation in the U.K. The UK has been awarding 1G and 2G mobile licenses through beauty contests or extending 1G licenses to cover DCS services (Commission, 2000). Stephen Byers, Secretary of State for Trade & Industry, said on the day he announced the winners, "UK consumers will be among the first in the world to reap the benefits of this exciting new technology. The outcome of this auction is good news for business, the consumer, the economy, and the taxpayer" (RA, 2000c). Some people, as discussed below, were not convinced, however.

Finland and Spain had completed their beauty contests prior to the U.K. auction. Finland did not charge any spectrum fees to the four winners, while Spain received a modest fee of EUR500 million (US$467 million) from the four licensees ("3G - Country," 2000). Sweden also decided against the auction method, and set the spectrum price at 100,000 Swedish Kronor (EUR11,174, or US$10,339) per license. After the U.K. auction, governments in other countries realized the potential for raising a substantial amount of money by selling 3G spectrum. Some EU countries followed the U.K.'s model. The Netherlands' auction in July 2000, however, raised EUR2.7 billion (US$2.5 billion) in total, significantly less than the Dutch government's goal of EUR9 billion ("The price is right," 2000).

Then the following month, another huge auction in Germany, after 14 days and 173 rounds of bidding, made a total of 98.8 billion Deutsche Marks (EUR50.5 billion, or US$46.7 billion) (Benoit & Simonian, 2000). Four incumbents and two new entrants were awarded licenses. As was the case with the U.K., the German officials were pleasantly surprised with the higher-than-expected amount the auction raised. The German finance minister, Hans Eichel, stated that the money would be used to reduce the national debt. Although the total amount of the German auction was much higher than that of the U.K.'s, the per-head price was not, due to the fact that Germany has the largest population in Europe. German's price per head of population was EUR615 (US$569), while the U.K. figure per head was EUR630 (US$583). However, these numbers can be misleading because not everybody will subscribe to the service and it will take several years for a mobile operator to implement 3G infrastructure covering only large cities in the respective country (GSM Association, 2000b).

The other auctions had mixed results. It took only two days for Austria to complete its auction process, raising EUR706 million (US$653 million). The Italian auction, also lasted only two days of bidding, raised EUR12.2 billion (US$11.3 billion) from five licensees ("3G - Country," 2000). Belgium, Ireland, Denmark, Portugal, and Luxembourg have not completed their 3G licensing process.

The immediate reaction to these high license costs was the reduction of the value of European telecommunication companies' stocks and bonds. Stocks fell by a fifth between January and August 2000 ("Killer applications," 2000). Bond prices also fell sharply. Investors are concerned about the tremendous amount of money telecommunications companies are spending for 3G spectrum licenses. The proceeds of licensing in the EU are estimated to total EUR150 billion (US$139 billion) (Da Silva, 2000). In addition to these spectrum fees, 3G mobile operators will have to invest heavily in building new infrastructure. An estimate total cost for EU's 3G infrastructure is more than EUR200 billion (US$185 billion). It is not surprising that the financial markets have grown skeptical about 3G operators' ability to recover their investment.

The French contest is pending as of March 2001 because it received only two final offers by the application deadline. The country will hold a second contest for the two remaining licenses. One of the problems with the French 3G licensing is that although the country chose a beauty contest over an auction to allocate spectrum, the entrance fee was set high--32.5

billion French Francs (EUR5.0 billion, or US$4.6 billion) per license. The timing of the contest, January 2001, was bad. After spending so much money for 3G licenses elsewhere and seeing their stock/bond values weakening, most of the initial applicants withdrew from the contest. They felt that the license fee did not reflect economic reality ("Only fakirs," 2001). Despite the industry criticism, French industry minister, Christian Pierret, has refused to cut the entrance fee (Owen, 2001).

"Market theory predicts that auctions will allocate spectrum to those that value it the most and thus will make the most cost efficient use of the spectrum. However, this does not necessarily mean that the spectrum will be used efficiently from the end user's perspective" (UMTS Forum, 1998, p. 3). Auctions also result in different costs to operators for the same service, as bidding prices are different. Whatever the way mobile operators utilize the spectrum, the financial burden of high up-front license fees remains unchanged. Operators may be forced to set tariffs high, which may slow the rate of adoption. Thus, how NRAs proceed with spectrum licensing has an impact on market growth.

4.3 Possible consequences Member States' discretion

Telecommunications operators are making the biggest gamble in business history ("The wireless gamble," 2000). Profit margin of their existing businesses--fixed-line and mobile services--is narrowing because of keen competition ("Killer applications," 2000). There will be no 3G revenues until 2002 at the earliest, when services start. In addition, there is much uncertainly about the future of the 3G market. It is not clear whether demand for the new services will be significant. How many users would be willing to pay more, perhaps significantly more than their current GSM bills, to send or receive multimedia content on their cell phones? Even experts do not have a firm idea as to exactly how people will use the technology (Landers, 2001). Before 3G infrastructure is put in place, as an interim step, many mobile network operators are introducing 2.5G, typically the standard called General Packet Radio Service (GPRS), which is an upgrade version of GSM with always-on data connections at higher transmission speeds than GSM ("Two stumbling", 2000). Many consumers may be satisfied with GSM and GPRS in the foreseeable future.

Further, it will be harder to acquire new mobile subscribers in coming years. As described in the penetration section, several EU countries are reaching a saturation level. Many adults, particularly in older generations, who do not use the mobile phone at present, will probably never use it. A Deutsche Telekom spokesperson recently commented that the mobile market would continue to grow but not as rapidly as in recent years (Perera, 2001).

Most countries granted more licenses than the current number of 1G/2G licenses, which may mean more intense competition in their home countries in the future. Further, mobile operators will have to compete outside the EU. Japan will release the world's first 3G services in May 2001. The Japanese mobile operators obtained new spectrum licenses free of charge ("The wireless gamble," 2000). The U.S. will be another formidable competitor in a few years. In the 2G market, Japan and the U.S. have not been considered the EU's rivals because their mobile standards are different from the de facto standard of GSM. The EU has been the leader in the mobile communications sector, taking advantage of economies of scale. However, in the next-generation mobile communication market, all operators worldwide will be using the new global standard, IMT-2000. European, Japanese, and American telecommunications companies have been heavily investing in one another. Competition will be truly at the global level.

All of these factors are warning signs to European mobile operators. Some say that spectrum costs are reasonable because the terms of these spectrum licenses are long--typically over 20 years--so operators should have enough time and opportunities to make profits to recover their investment (Manchester, 2000). It may be so, but probably not for the next several years.

This is exactly what the Commission was worried about. It has been contemplating a common licensing process for years. The idea was suggested, for example, in the 1994 Green Paper, concerning both the GSM and UMTS licensing procedures. Commission officials admitted that in 1998 their proposed regulation

on the EU-wide 3G licensing process did not pass because the Member States wanted to keep the licensing process under their control ("Brussels worried," 2000). Governments argued that individual states had the right to decide methods for awarding licenses. After the U.K. auction, commission officials confessed that they never expected 3G bidding prices to be so high ("Brussels worried," 2000). They are concerned that high license costs could slow down the development of innovative services and raise prices to consumers. EU's competitive advantage in mobile communications, built on the successful GSM deployment, may be undermined in the near future.

4.4 Towards the information society

The EU's current situation in the mobile communications sector may also have a significant impact on its information society vision. The European Commission considers mobile communications as an integral part of its information society framework. The Commission's 29 May 1997 Communication states that UMTS has potential for providing greater choice, lower prices, and full mobility to Europeans, including the elderly and disabled (Commission, 1997). This vision, making new interactive services accessible to every citizen in the EU, is clearly derived from the concept of universal service. Universal service in the EU means an obligation to provide a defined service of specified quality to all users everywhere at an affordable price (Commission, 1996c). Since transmission of speech via mobile and personal communications networks is not voice telephony according to the EU definition, it is not a universal service item (Commission, 1996b). Nevertheless, the Commission hopes that UMTS, that enables multimedia services and applications, will bring the wireless information society to a reality. It expects that, after the successful creation of the 2G environment, demand for further evolution in mobile communications is emerging. However, its vision will not be easily realized without affordable pricing.

Affordability is one of the key requirements of universal service and the information society. The definition of affordability, however, has no EU-wide reference point. Instead, its interpretation is left to each Member State. Two main factors to determine affordability are the cost of service and the incomes of subscribers (Scanlan & Neu, 2000). Affordability in the sense of the cost of service means whether the tariff of the service is based on the cost the telecommunications operator has actually spent. The issues associated with the licensing procedures and their outcomes are a great concern for Commission officials, telecommunications operators, investors, and consumers.

5. Conclusions--Challenges Ahead

After years of sound growth, resulting in 194 million mobile phones in 2000, the mobile communications sector in the EU is struggling to move from the GSM environment to the next-generation, high-speed, multimedia arena. The 3G technology promises to deliver futuristic gadgets and applications such as small-screen videoconferencing, online play stations, and video wristwatches. Time and more money will be required to realize the full capability of 3G. It is hard to predict how the EU's mobile communications market will evolve over the next few years, but the combination of various conditions stated above suggests difficulties and challenges ahead. It is likely that the 3G market will be slow in growth initially because of high tariffs and limited coverage areas.

On one hand, the EU market may see disparities between countries. Some EU countries, such as Finland and Sweden, charged almost nothing to their 3G licensees, while other countries, such as the U.K. and Germany, raised staggering sums of money. The issues surrounding 3G licensing could be interpreted as market-entry barriers and unfair competition that Member States created. A result might be varying degrees of tariffs and availability from country to country and from operator to operator.

On the other hand, since most EU operators have obtained or are obtaining 3G licenses outside their home countries through their subsidiaries or consortia, they all might be facing financial difficulties, including the operators based in countries that charged none or low license fees. For example, Finland's Sonera joined consortia to bid in several countries and acquired 3G licenses not only in Finland but also in Germany, Italy, and Spain. The overall

financial pressures on all mobile operators might discourage rapid deployment of infrastructure and development of innovative applications, force high tariffs, and reduce market demand throughout Europe.

Unlike corporate mergers, which also usually involve a large amount of payment, many European 3G mobile operators had to make huge up-front investments for a market that does not yet exist and whose future demand is highly uncertain. While the Commission could not put a common licensing process in place, European governments extracted unexpectedly large sums of money from their sale of 3G spectrum to large telecommunications companies, most of which are based on their own respective countries. Governments were ecstatic because the money helped them reduce national deficits. However, their joy may be short-lived. Bidding amounts were inflated due to high expectations for a future market. The subsequent fall in technology stock prices and investors' increased skepticism drove European telecom giants to disadvantageous positions. It is possible that governments have created a crisis that might hurt their own countries in the long run. The nature of the problem is broad in scope--not only financial and political, but also social and technological. A few years' time, people may be debating why the EU 3G market does not grow as rapidly as its predecessor, GSM.

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