The value of technology standards, the effect of European IS Policy and the success of GSM.

SUMMARY:

This essay will discuss the value of setting technological standards to obtain harmonization the market, which can make a given system successful and create a competitive environment in the industrial sector that produces the hardware/software or provides the services for this information system. It will also discuss the role that governments play in helping setting these standards. In particular I will concentrate in the discussion on the example of the GSM network in Europe and the effects of the adoption of a European standard in the larger and earlier success of mobile telephony in Europe in comparison with the United States. I also include a brief discussion about whether a similar approach could had been used to create the basis for a standard in the European/World operating system market to avoid monopolistic practices executed by companies that have managed to position their proprietary technology as a de facto standard.

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12 DECEMBER 2000

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[1] Not included in the word count.

A. INTRODUCTION

This essay discusses the value of technological standards and the role of governmental institutions in the creation of these standards.
I will concentrate mainly on the effects of the European Union policy on the worldwide success of the GSM (Global System for Mobile Communications) standard for mobile telephony. To clearly show the value of these policies I compare the European case with the United States, where the same framework for the adoption of a standard did not exist. This should clearly show the value of the role of the European government in promoting and facilitating adoption of the GSM standard. Other factors explaining the differences between the European and North American examples are also contemplated with less detail due to their smaller importance. Due to time and space constraints I will concentrate on Europe and the United States and ignore other regions of the world where there has also been an important development in mobile telephony, mainly Japan.

This essay also discusses the value of standards per se and the potential risks of de facto proprietary standards. It provides several examples of how a standard can create successful systems and generate both cooperation and competition among the industrial partners involved as well as benefits for the general public. Furthermore the essay studies the reasons that can make standards unsuccessful and provides examples to illustrate it.

Finally, I will discuss the role of Government in setting standards and the benefits that certain government initiatives can have in the development, promotion and ultimate success of these standards.

Note that the terms: cellular phone, wireless phone, portable phone, handy phone will be used indifferently in this essay.

I will refer as *standards* to a uniform set of rules approved by a recognized standardisation organization an to *de facto standards* to those technologies that have managed to impose themselves by achieving market domination (e.g. Microsoft Office and Windows, Compact Discs etc). Furthermore, the word standard will usually refer to a technological standard, which, in many cases is equivalent to a given technology.

B. THE GSM EXAMPLE

The success of the GSM standard provides one of the best examples of the success of a technology standard and the important role that a governing body, in this case the European Commission, can have in promoting and facilitating the adoption of such a standard (Amor 2000). Furthermore the GSM example also demonstrates how a common Europe-wide collaboration between the public and the private sector can be successfully transformed into a market driven, job-creating operation. Based on a common development effort from the very beginning, resulting common standards and a consistent European Community approach to the area, GSM has established a new model for the development of trans-European networks and systems (European Commission Green Paper on mobile communications 1994). This model has

allowed Europe to become an important leader in mobile communications through adoption around the world of its standards for digital communications (Bangemann, Fonseca et al. 1994).

The development of the GSM standard

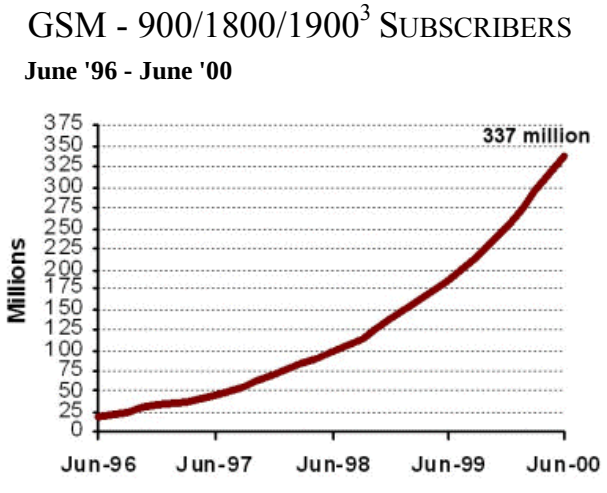
Work on GSM standardisation started in 1982 under the CEPT (the European Conference of Post and Telecommunications Administrations) and was transferred to ETSI (European Telecommunications Standards Institute) following its formation in 1987. In this year and in response to the imperatives of the internal European market, specific measures were taken to promote the Union-wide introduction of GSM along with DECT (Digital European Cordless Telecommunications), and ERMES (European Radio Messaging System).
GSM introduction was from the start strongly supported by the European Community,European Council Directives were adopted to set out common frequency bands to be allocated in each Member State to ensure pan-European operation, together with European Council Recommendations promoting the co-ordinated introduction of services based on these systems (J. Schwarz da Silva, B. Arroyo-Fernándes et al.).
In the 1987 Green Paper on the development of the common market for telecommunications services and equipment (European Commission Green Paper 1987), the Commission promoted the introduction of more competition in the telecommunications market combined with a higher degree of harmonisation in order take maximum advantage of the opportunities offered by a single EC market, in particular in terms of economies of scale. (European Commission Telecommunications Legislation 1997)
Increased support of the policies that made GSM successful continued in the 1994 Bangemann report on "Europe and the global information society", in which the High-Level Group on the Information Society laid out the strategy to follow in order to succeed in the creation of the *Information Society* in which mobile telephony and mobile services have a crucial role. The report, once again, calls for a fully liberalized environment for the telecommunications sector in order to create a competitive and at the same time harmonized environment (Bangemann, Fonseca et al. 1994).
Also in 1994, the European Commission adopted the Green Paper on Mobile and Personal Communications with the aim of establishing the framework of the future policy in the field of mobile and personal communications. (European Commission Green Paper on mobile communications 1994; J. Schwarz da Silva, B. Arroyo-Fernándes et al.). This Green Paper should be seen against the general background set by the White Paper on growth, competitiveness and employment (European Commission White Paper 1993) for the future development of the information society in the European Union. It proposed to adapt, where necessary, the telecommunications policy of the European Union to foster a European-wide framework for the provision of mobile infrastructure, and to facilitate the emergence of trans-European mobile networks, services, and markets for mobile terminals and equipment. (J. Schwarz da Silva, B. Arroyo-Fernándes et al.). Based on the mobile and personal communications Green Paper, the European Commission set out general positions on the future development of the mobile and personal sector, and defined an action plan (European Commission Action plan 1994) which included actions to pursue the full application of competition rules; the development of a Code of Conduct for service providers; and the agreement on

procedures for licensing of satellite-based personal communications (J. Schwarz da Silva, B. Arroyo-Fernándes et al.)[2].
The GSM implementation also was supported by the GSM Memorandum of Understanding (MoU) in which all European Community operators are members. These MoU between operators and/or manufacturers in key areas of mobile systems have substantially assisted the development of Europe-wide networks, not only GSM (European Commission Green Paper on mobile communications 1994). In a number of cases, and in particular in the GSM example, these MoUs have been extended to cover both EFTA (European Free Trade Association) countries and countries in Central and Eastern Europe and have sometimes been extended beyond Europe.
The combination of the regulatory changes in the European Union along with the further development in the cooperation among industrial partners, will contribute to a substantial acceleration of the EU's mobile communications market and speed the progress towards Third Generation mobile/personal communications (European Commission Green Paper on mobile communications 1994; J. Schwarz da Silva, B. Arroyo-Fernándes et al.).

The success of the GSM standard.

From the beginning the implementation of GSM in Europe was very successful. Commercial service was started in mid-1991 and only one year after its effective launch, GSM accounted for over 10% of the installed cellular mobile telephony base in the European Union (European Commission Green Paper on mobile communications 1994). By 1993 there were already 36 GSM networks in 22 countries and by the beginning of 1994, there were already 1.3 million subscribers worldwide (Protocols.com 2000). *Figure 1* shows the fast growth in the number of subscribers to GSM networks in the last four years (until June 2000), which have seen the largest development in mobile telephony. It can be observed in this graph that the number of subscribers has roughly doubled every year in this period.
It is estimated that the market is mature once the mobile phone penetration reaches 70% of the population (Muñoz 2000). Today several

Figure 1



Source: EMC World Cellular Database.
(GSM World.com 2000)

[2] The action plan also advocated the possibility of allowing service offerings as a combination of fixed and mobile networks in order to facilitate the full-scale development of personal communications; the lifting of constraints on alternative telecommunications infrastructures and constraints on direct interconnection with other operators; the adoption and implementation of Decisions of the ERC (European Radiocommunications Committee) on frequency bands supporting DCS-1800 and TETRA; the opening up of an Europe-wide Numbering Space for pan-European services including personal communications services; and continuing support of work towards UMTS. J. Schwarz da Silva, B. Arroyo-Fernándes, et al. (2000). "Evolution Towards UMTS.".

[3] GSM 1900 has been recently introduced in the USA.

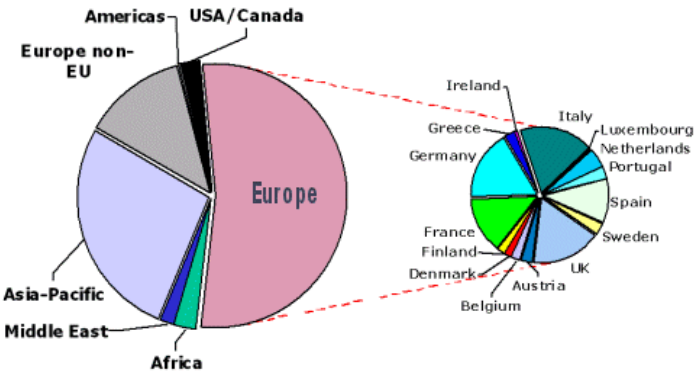
European countries have already surpassed this number, mainly Nordic countries, (Norway, (76,8%); Finland (71,7%); Sweden (71%) and Iceland (78,3%)) and in Italy (73,5%) . Other countries such as Holland (63.3%), Spain (58.7%), Greece (55.4), UK (61.2%) and Portugal (60.2%) (November 1st 2000) follow closely behind and are expected to reach or exceed the 70% level sometime in 2001 (Mobile Communication and CMT 2000; Muñoz 2000).

Figure 2

WORLD CELLULAR SUBSCRIBERS BY REGION

Subscriber Growth & Estimate to June 2000

337 Million



Source: EMC World Cellular Database.
(GSM World.com 2000)

Figure 2 shows the leading position that Europe (EU and non-EU countries, which also adopted GSM) holds in number of cellular subscribers. Today there are 396.6 million GSM subscribers (to end of October 2000) in 161 countries/areas of the world with more than 400 GSM operators. GSM accounts for 68.5% of the World's digital market and 60.6% of the World's wireless market (GSM World.com 2000). Only in Western Europe there are more than 211 million mobile phone subscribers and 98%[4] of these use GSM.

The development of digital mobile systems has been a major success for European industry, the European standardisation system, in particular, the European Telecommunications Standards Institute (ETSI), and for European operators. A number of recently developed European systems are poised to become world standards and Europe is now considered to be the world leader in digital cellular systems (European Commission Green Paper on mobile communications 1994). The adoption of the GSM standard, the new regulatory environment added to the liberalization measures in the telecommunications sector, allowed all European cell phone manufactures and mobile service providers to be equipped to participate successfully in the mobile phone market, or at least not to start with significant handicaps (Bangemann, Fonseca et al. 1994). This provided a great opportunity for expansion for European mobile phone manufactures and mobile service providers (Silberman 1999) making companies such as Ericsson, Nokia and Vodafone some of the world leaders in the industry.

[4] Calculated from data from GSM World GSM World.com (2000).

Factors in the success of the GSM standard.

It must also be considered that not all the factors involved in the success of mobile communications and the GSM system in Europe are due to the EU policies alone or to the value of GSM as a technology or as a standard. Factors such as more creative pricing strategies, good implementation, marketing and even cultural issues (not treated here due to their small importance compared with other factors) also had an effect in the fast adoption and development of mobile telecommunications in the European Union countries.

Technology

When analysing the success of mobile telephony in the early 90s with the advent of digital technology, we should also consider the factor of the maturity of the technologies involved in mobile communications. New improved battery technologies, increase in microchip power at a reduced cost and size and many other factors made the technology more viable for mainstream use. In the mid-80s, mobile phone technology, then analogue, was still not mature enough, telephones still had briefcase sizes and were usually installed in cars. These limitations, along with the initially small market, made the cost of ownership for a portable phone too high making it clearly a luxury item. Obviously, these problems with initial lack of maturity, high prices and low usage, affects most technologies in their early stages (Cuadriello and Amor 2000), consider for example the initial stages of television, when the technology was in its infancy, user base was small and prices were high.

Standards and pricing, the US example.

Although technological improvements have had an important role in the success of mobile telephony throughout the World, without the measures taken by the European Union the success of mobile communication in Europe in the late 90s could have been limited to the level success of this technology in the United States during the same time period. The best way to examine the non-technical reasons for the success of mobile telephony in Europe and to show how European Union policy and the adoption of a standard made a significant difference, is by comparing the different factors that affected the growth of mobile phones on both sides of the Atlantic.

Comparison between the United States and Europe's mobile telephony adoption

In the US wireless the government and regulatory authorities are committed to allowing industry to compete in an open wireless market, from the licensing of spectrum through the choice of technologies deployed. The FCC (Federal Communications Commission), in particular, wants to ensure that only a minimum set of technical requirements be mandated such that new technologies and innovations are allowed to flourish based upon the demands of the market. As was seen in the recent PCS (Personal Communication Systems) auctions, the FCC tends to favour allowing market competition to determine what technologies will prevail, in contrast to mandated standards as is the case in Europe and other parts of the world (J. Schwarz da Silva, B. Arroyo-Fernándes et al.).

Two main interconnected factors derived from the North American approach to competition and regulation, have slowed down the adoption of mobile telephony in the United States.

(a) Lack of a standard, operators and geography.

The lack of a common standard for mobile telephony in the United States had two main negative effects.

i. Different operators and service providers work in different geographical areas throughout the US. The lack of a standard initially made roaming[5] outside the local area difficult. Roaming charges tend to be expensive and therefore, the influence of roaming in the success of GSM in this sense is limited. However, it is important to consider that some of the first candidates for the adoption of mobile telephony are business users who need to be able to use the phone in different areas/countries and can easily afford roaming charges. A 1999 Nokia market study concludes that *without lead uses the diffusion to mass markets and thus standardization of a new technology will not take place*. This study, also shows that *being successful among innovators in the lead markets provides a basis for eventually being successful in the mass markets* (Nokia Market Study 1999). Therefore, the limited roaming possibilities of the initial mobile phone services in the US and its impact in some groups prone to be early adopters, can be considered as a factor that slowed down mobile phone penetration in the US.

ii. The existence of different systems made it more difficult for mobile phone manufacturers to release new models quickly and economically in the US, as a given model had to be created in different versions for different networks using different technologies. In comparison, a given GSM phone can be sold in every country in Europe without considerable changes. This decreased the unit price of the digital mobile terminals in Europe and allowed more modern models to be available before in Europe. Therefore, the development of a Union-wide market mobile services and mobile equipment allowed operators, service providers and manufacturers to achieve important economies of scale and scope, which were reflected in improvements in innovation and services quality and decreasing prices and (European Commission Green Paper on mobile communications 1994) allowed to respond to the call made in the Bangemann report for promotion of lower tariffs by the European Union (Bangemann, Fonseca et al. 1994).

(b) Pricing plans

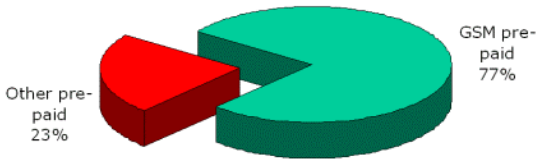
Pricing plans offered by mobile phone operators in the United States have been somehow less flexible and less imaginative than those offered in Europe. In part, the GSM technology and its SIM card (Subscriber Identity Module) system offered the flexibility to offer these plans. A normal monthly connection to a mobile phone service provider in the USA usually includes a relatively large number of *airtime* minutes; this *air time* includes the calling time regardless of call being made or being received. Additional time after the monthly airtime is finished is usually paid per minute.

[5] Roaming is the ability to place and receive calls on cellular networks outside your home service area.

These pricing policies in the US had two main negative effects:
First, the initial cost for acquiring a mobile phone in the United States was high, not only because the price of handsets was more expensive than in Europe (as mentioned before, this was influenced by the lack of a standard), but because of the high fixed monthly fees. In comparison a phone in Europe could be acquired with smaller inclusive minutes in the monthly contract or as pre-paid[6] phones[7]. Although the final monthly expenditure per customer including calls could be the same, if not higher, the European system creates an initial perception of lower cost and this is important for initial penetration into the market. Pre-paid contracts have proven to be a popular option, at December 99, 128 million cellular phone users out of the then total 501 million, used pre-paid services (EMC database 2000). It can be clearly seen in *Figure 3* that most of the pre-paid users are using GSM (EMC database 2000; GSM World.com 2000). Pre-paid services have been important to reach a wider range of people, in to capture customers with less purchasing power (Muñoz 2000).

Figure 3

WORLD PRE-PAID
% of Pre-paid subscribers represented by GSM
June '00



Pre-paid = 128 million at December 99, of a world total of 501 million

Source: EMC World Cellular Database.
(GSM World.com 2000)

Another factor against the US pricing strategy is that having to pay (or use *airtime* minutes) for received calls creates a less positive experience for the first time user. It reduces mobile phone usage time, as users try to keep conversations short, not only when they are calling, but also when they are receiving calls. This will make people initially feel uncomfortable with it.

The effects of pricing structures are not treated in more detail in this essay as it is considered as a less important cause in comparison with the other reasons supporting the main argument of the value of adopting a standard.

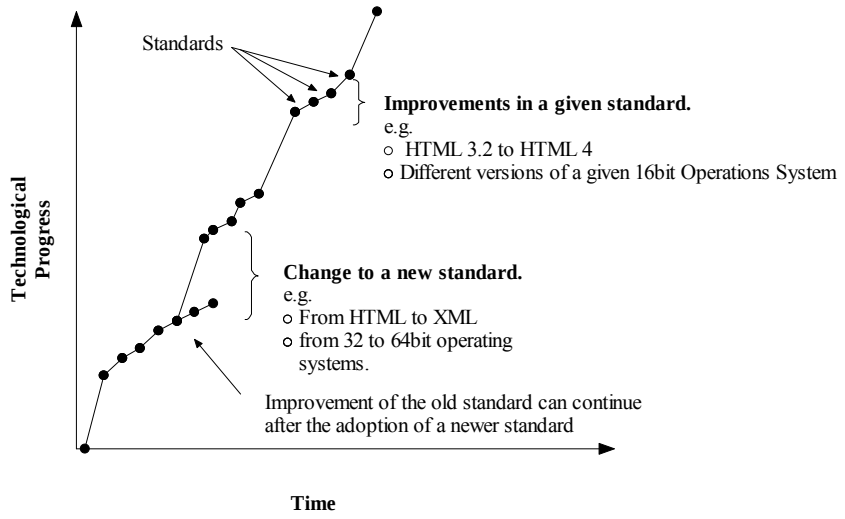
C. DISCUSSION ON THE VALUE OF A STANDARD

A standard is defined as what can be used as a type, model, norm, pattern or reference (Real Academia de la Lengua Española 1992). When considering new technologies, this norm or model can be used to set the basis for the development of highly successful systems. A standard is also a way to increase communication; XML (eXtensible Markup Language), internet protocols, GSM and even a language simply allow the users or systems to have a common norm or reference to communicate with each other. Systems

[6] Also known with other names such as “pay as you go”, “pay as you talk” etc.
[7] With this option there is no monthly contract or included minutes or “air time”. Users buy cards or vouchers to add money into their accounts with is used to pay for the calls. The cost of the calls is , however, usually more expensive than with monthly contracts.

that effectively allow better communication are usually successful. Achieving a standard is desirable once a certain level of innovation has been achieved, naturally innovation should be continued to create the next improved standard. Consequently, standards, at least when referring to information systems or technologies, could be understood as steps in progress as seen in *Figure 4*. The graphs also shows that the previous standard can continue to improve even after a bigger leap in technology has creates a new standard. In some cases, improved versions of the old standard can approach the technological capabilities of the new standard and in extreme cases slow and even stop its adoption. For example further improvements of GSM network will provide some of the benefits, of the new UMTS system, these improvements are sometimes referred as 2.5 generation, and some believe that it may slow down the adoption of purely 3G systems.

Figure 4

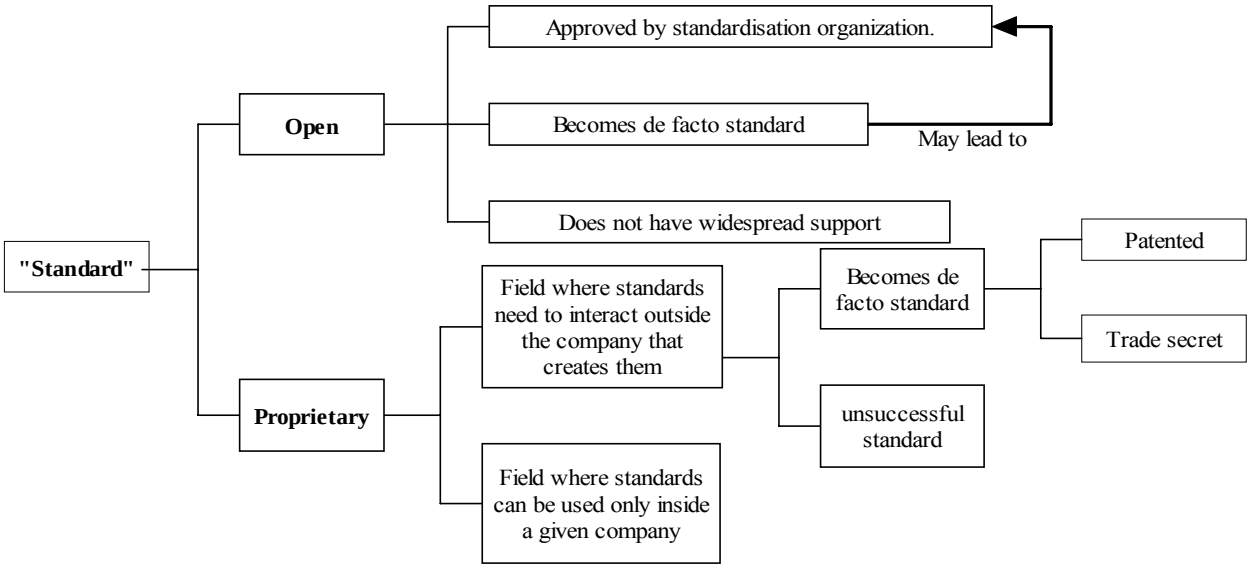


There are different concepts associated with the word standard, these are summarized in *Figure 5*. "Standards", understood as a model or norm, can be *open* or *proprietary*. Open standards are usually approved or recognized by industrial, professional, trade organizations or governmental bodies. This are the ones referred as *standards* throughout this essay. Open standards can achieve the status of de facto standards, although in this case, they will usually be eventually recognised by some standardization organization. Finally and open standard can just be used by a reduced group of people without gaining widespread popularity.

Proprietary standards may be created in fields where they can be used only by its creator(s), for example a given organization can standardise some technology for the production of certain parts. However in other cases, such as telecommunications standards, they may need to be used outside the organization that creates them. In this case, a given standard can achieve market domination and become a de facto standard, or can become victim of a *standard* as defined before or another de facto standard. Proprietary standards that manage to become a de facto standard can be kept as a trade secret (such as Microsoft Windows) or can be patented. In the first case the company that owns the standard will be the only one to be able to create products using this standard. However, proprietary standards are usually patented to protect them against intellectual property theft. Software is one of the exceptions; a binary file cannot be de-compiled into its source code and therefore it can be distributed without revealing too much information on how it actually

works. A patented technology can be licensed to other companies who must pay patent royalties to the owner. Patenting is also a way to improve the possibilities of that technology becoming a de facto standard as more companies develop products based in that technology (e.g. Compact Discs)

Figure 5



In this section, I will discuss how the adoption of an open standard for a given technology or information system is an important factor in making that system successful. Furthermore I will discuss how a standard can generate both cooperation and a competitive environment in the related industry and how the lack of it or the presence of a proprietary de facto standard, can be potentially harmful for competition. I will also consider the factors that can limit the success of a standard. Finally, I will discuss the role of governments in the creation of technology standards.

Standards create successful systems

Technology standards adopted at the right point in the development of technology usually create hugely successful systems. In this essay, I concentrate on the GSM standard as it not only provides an example of the value of a standard to make a given system successful, but also an example of how a governing body can have an important effect in the adoption of such a standard. However, there are multiple examples of technology standards or de facto standards that were achieved in different ways. As a recent and important examples the TCP/IP protocol (Transmission Control Protocol/Internet Protocol), the HTML (HyperText Markup Language) standard and the HTTP protocol (Hypertext Transfer Protocol), which made the Internet, and all the economic development associated with it, possible.

Standards create both cooperation and competition

Standards as previously defined, have the potential to generate increased competition in a particular industrial sector by providing the same starting point for developers of product based in that standard. These benefits for competition are not likely to be achieved if there is a de facto proprietary standard. If the technology in which the standard is based is patented, competitors that want to use it will have to pay patent royalties. This means that not all companies are at the same starting point and that it will be harder for smaller companies to compete. If the proprietary standard is a trade secret and still has managed become a de facto standard, it can have devastating consequences for competition. As an example we have seen how several Office suites competing with Microsoft Office have almost vanished. A common critic against standardisation is that products based on a common standard will be hard to differentiate. Multiple examples prove that argument wrong. For example not all GSM mobile phone manufacturers are equally successful.
Contrary to the FCC belief, it must also be remembered that the imposition of a technology by market domination does not always guarantee that the better technology will prevail. In many cases such as the famous VHS vs. Beta or Windows vs. MacOS and OS/2 Warp; technologies that were considered inferior achieved the status of de facto standards. Agreements to create a given standard can create very good technologies by combining the expertises of the different participants that cooperate in the agreement. In this environment one manufacturer can provide the same product to more people with less research and development costs, as they are shared with others. Although there are of course some intellectual property issues that have to be addressed, the GSM example presented before, clearly illustrates the value of this collaboration. The research effort made in Europe by telecommunications companies and research centres, especially under the RACE, ACTS and - most recently - IST programmes, where market leaders Siemens, Ericsson and Nokia were all involved, served to start the UMTS standard,(E.Commission-Information Society-RDT info 2000).

I will present another example showing the inverse argument: the lack of a standard (not a de facto standard) can reduce competition.
We could consider the benefits of an hypothetical operating system standard rather than the current monopoly by Microsoft Corp. with its Windows operating system (Penfield Jackson 2000; Supreme Court of the United States 2000).
There have already been some attempts to create some uniformity in the development of operating systems, in particular the POSIX[8] standard. POSIX stands for *Portable Operating System Interface* for computing environments. It began as an effort by the IEEE[9] community to promote the portability of applications across UNIX environments by developing a clear, consistent, and unambiguous set of standards (Cort 1993). However, lack of support for the POSIX standards by Microsoft Windows 95 and 98, which dominate the desktop market, limited compliance to the complete POSIX specifications in Windows NT (Cort 1993; Noveck 1999) and the limited scope of POSIX in covering all the aspects of a modern and

[8] POSIX.1 (Systems API ,C Language) , POSIX.5 (ADA language bindings to POSIX.1) and POSIX.9 (FORTRAN language bindings to POSIX.1) are ISO standards. POSIX.1 and POSIX.2 are IEEE approved standards Cort, R. (1993). Understanding Windows NT POSIX Compatibility, Microsoft Corporate Technology Team..
[9] Institute of Electrical and Electronics Engineers.

complex operating system (Pareja 2000) have relegated POSIX to the UNIX environment. POSIX has fall short of achieving a useful standard for all operating systems. However, we can make the following observation; For UNIX systems, among which porting applications is relatively easy , in great part due to their POSIX compliance; there is not a clear monopoly in the UNIX market; Sun Microsystems, IBM, SGI[10], Hewlett-Packard and others all develop different UNIX environments and compete against each other. This does not happen in the consumer operating systems market, where Windows managed to become the de facto standard at the expense of other competing systems (MacOS , OS/2, Amiga, etc). In this market Microsoft clearly dominates. If there had been a common standard to develop a consumer operating system, with differentiating features (such as user interface etc.) it would have been easier to maintain a competitive environment.

Linux is another interesting example *open standard* in the operating system market. It creates an open system (also POSIX compliant) which allows developers to create compatible products that can be used on the different version of this operating system based on the open source code. Several companies (RedHat, S.U.S.E., Mandrake etc.) have been created around this open standard. They all compete against each other, but also collaborate, along with individual programmers, in the development of parts of the code and differentiate their products with additional features and added services (customer support, consulting etc).

Unsuccessful standards

Sometimes adopted standards fail to be successful. This can mean that they either do not perform as expected or that they do not reach the expected widespread acceptance.
As an example we could present the relative lack of success of WAP (Wireless Application Protocol). Although it is relatively soon in the development of the technology, its adoption, seems to be providing disappointing results (Cuadriello and Amor 2000; Grande 2000).
WAP is an open, global standard for mobile communication that allows mobile users to access and interact with different informational services. Ericsson, Nokia, Motorola and Unwired Planet (now Phone.com) co-founded the WAP Forum in June 1997 to provide a worldwide standard for the delivery of Internet-based services to the mass-market of wireless devices. The WAP Forum has been joined no less than 195 companies from around the world and it controls and manages the continued development of the Wireless Application Protocol.. (Cuadriello and Amor 2000). Therefore, the development of WAP includes many of the characteristics described in this report as desirable for the creation of a standard.
However, WAP has been a very over hyped technology, often ignoring the limitations of the current devices for data input, their speed and limited screens. Wireless phones can currently transmit data only at 9.6 kbps in most current GSM networks. This, added to the small low resolution monochrome screens on most phones, makes the use of graphics impractical and writing text using a conventional mobile phone keyboard is very restrictive. Looking at some of the new Japanese mobile devices and newer European devices (such as the Nokia 9210[11]) and with the fast development in technology in this area, it seems that the current

[10] Former Silicon Graphics.
[11] This device also incorporates a WAP browser, however it technical characteristic already allow to go beyond WAP and provide a browsing experience more similar to that of a conventional computer.Uimonen, T. (2000). Nokia 9210

WAP technology will quickly become obsolete. As said before, the WAP Forum was created in 1997, relatively early in the development of mobile communication, by 2002 it will mean that WAP's ideas are five years old, which is an extremely long time in the world fast developing world of mobile communications. I would conclude that premature creation of the WAP standard and its late introduction will severely limit its success and significantly shorten its useful life as a standard. However, we must acknowledge that WAP does have a value as a bridging technology to more sophisticated services and that the current WAP system is better than complete lack of access to the Internet.

Concluding, I will identify four reasons that can compromise the success of a standardized system.

i. Not a good standard, poor technology.
ii. Standard adopted or implemented either too soon when the technology is too immature and is going to be surpassed very quickly by something new, or too late, when other technologies have already surpassed or are about to surpass that one. If it takes to long to go from approval of the standard to actual implementation, it may become obsolete before it is widely adopted. Of course, it must be remembered that the life of a standard is limited but a successful standard must remain useful for a reasonable period of time.
iii. Other technology is already a standard (or de facto standard) and its roots are too strong (e.g. the strong roots of the floppy disk still keep it as a de facto standard even if it is technologically obsolete)
iv. Is it something people need or want? It could happen that a lot of money could be spent developing a standard for a technology that lacks interest from the general public. Furthermore, sometimes the diffusion is hindered because markets are unwilling to utilize new technology. This type of diffusion barriers does not have to do with user experience or the technological complexity of the service, but it is merely psychological or social. Some people simply resist to perform old tasks in new ways.(Nokia Market Study 1999).

Role of Government in setting standards.

The role of a governing body in the creation and adoption of a standard should be that which, without enforcing, creates a framework and facilitates and brings together the necessary private and public institutions to create agreements such as the Memorandum of Understanding (MoU) which was created for the previously mentioned GSM case and other European telecommunications standards (European Radio Messaging System (ERMES), telepoint services, the European digital Terrestrial Flight Telecommunications System (TFTS) etc.). A Government can use its position as a supra-private company institution to achieve standards faster and, as explained previously, promote competition. This particularly applies to governing bodies that have influence over large populations and ideally over several countries. The European Commission has these characteristics and as shown with the GSM example seems to be taking advantage of it to promote its industry and improve the quality of life of its citizens. Other large organizations such as NATO also have the potential to achieve this. In the case of NATO (North Atlantic

handset packs colour, Java, 'Net access, not slated for U.S. market, IDG News Service,.,Nokia.com (2000). The Nokia 9210 Communicator at a Glance.

Treaty Organization) its influence is usually applied to the adoption of technology and quality standards for weapon systems among the member states.
Ultimately, the importance of government in the adoption of standards also provides a good example of the role of the governing institutions in a deregulated and liberalised economy. That is, a promoter of technology standards to increase competition, private investment, harmonization and to achieve objectives of public interest, such as the "Information Society".

Assuming that, as argued before, some kind of participation by a governmental institution is desirable, these are the actions that the government should take:

- Government identifies the need for a standard to achieve a given goal with benefits for the both the society and the industry, for example the creation of an accessible mobile phone system as a step towards the "information society". Then it creates and action plan to achieve the objectives and if possible creates time guidelines for implementation and introduction of the standard.
- Invites private companies to participate in a common forum to develop a standard and facilitates the creation of memorandums of understanding.
- Tries to expand the participation in this agreement to other partners outside its area of influence (e.g. the GSM standard and the non-EU countries that adopted it)
- Government acts as an observer and coordinator leaving technical development mainly to the private sector, but facilitates the creation of R&D frameworks such as the European RACE (R&D programme in advanced communications technologies for Europe)
- Creates and approves the necessary groups for the creation and approval of standards (European Telecommunications Standards Institute, ETSI)
- Creates the necessary regulatory framework and measures to ensure that competition is "fair and effective"(Liebenau and Thatcher 1998).
- Create an action plan to create the framework

D. CONCLUSION

Most widely used technologies destined for the mass consumer market, are not successful only for technical merit but because for one reason or another (promoted by EU policy, market dominance, first mover advantage etc) they have become a standard. It has been argued in this essay, that, if in the field of information systems a technological standard is created at the right point in the technology and at the right time for the market, it has the potential to provide enormous benefits for the society in general and the private sector. Furthermore it has been extensively discussed, how the adoption of a standard can in fact increase competition and cooperation in the private sector. However a proprietary de facto standard achieved by market domination can, in fact, severely affect competition as the Microsoft anti-monopoly trial has shown.
I would also argue that governing bodies such as the European Commission can generate great benefits for the economy (look at the benefits of internet or GSM) and their citizens by stimulating, promoting and creating the necessary framework for the creation of technology standards. They must create the necessary regulatory framework to maintain the equilibrium between liberalization, harmonization and competition.

E. GLOSSARY[12]

CEPT - European **Conference of Postal and Telecommunications Administrations**. CEPT is now confined to National Regulatory Authorities, and encompasses the twelve EU Member States, and most other European countries, including the countries of Central and Eastern Europe.

DCS 1800 - Digital Cellular System 1800. Standard for micro cellular communications systems developed by **ETSI,** building on the **GSM** standard, also referred to as **PCN** system standard. Such systems operate with very small cells, varying in size between a few hundred metres and a few kilometres.

DECT - Digital European Cordless Telecommunications. New digital cordless standard developed by **ETSI**, supported by Directive 91/288/EEC establishing harmonised frequency bands for **DECT** and a Council Recommendation on its coordinated introduction.

EFTA - European Free Trade Association.

ERC - European Radiocommunications Committee The European Radiocommunications Committee (ERC) is one of the three committees created under the new structure of **CEPT**. The ERC develops radiocommunications policies, assists **ITU** conferences and plays a general coordinating role in frequency matters.

ERMES - European Radio Messaging System. New digital paging standard developed by **ETSI,** supported by Directive 90/544/EEC establishing harmonised frequency bands for ERMES and a Council Recommendation on its coordinated introduction. **ERMES** permits the reception of tones and/or numeric or alphanumeric messages.

ETS - European Telecommunications Standards.

FCC - Federal Communications Commission.

Green Paper(s) - Green Papers, in the European Union context, are European Commission consultative documents setting out basic policy goals for public debate.

GSM – Global System for Mobile Communications. The central standard, developed by **ETSI**, for digital (2nd generation) mobile systems. GSM has been supported by Directive 87/372/EEC establishing harmonised frequency bands for GSM and a Council Recommendation and Resolution on its coordinated introduction. The system supports **Roaming**, and a broad range of features.

HTML - HyperText Markup Language

HTTP - Hypertext Transfer Protocol

Mobile Network Operator - Operator of mobile network infrastructure, supporting the transmission and provision of radiocommunications services. The activities of Mobile Network Operators in most cases also integrate mobile **Service Provider** functions (direct service provision to end users) within their overall business.

MoU - Memorandum of Understanding . MoUs in the telecommunications field in Europe have been entered into between operators and/or equipment manufacturers or other market participants for the roll out of new products and services. Within the mobile sector, MoUs have been entered inter alia for **GSM, ERMES, TFTS**

[12] In part from European Commission Green Paper on mobile communications (1994). On a common approach in the field of mobile and personal communications in the European Union.

and **Telepoint**.

NATO - The **North Atlantic Treaty,** signed in Washington on 4 April 1949, created an alliance of ten European and two North American independent nations committed to each other's defence.
Four more European nations joined the Alliance between 1952 and 1982, bringing the number of members to 16. The admission of Czech Republic, Hungary and Poland on March 12, 1999 brought the number of members to 19.
NATO's members are Belgium, Canada, Czech Republic, Denmark, France, Germany, Greece, Hungary, Iceland, Italy, Luxembourg, Netherlands, Norway, Poland, Portugal, Spain, Turkey, United Kingdom and the United States.

PCS - Personal Communication Systems.

RACE R&D programme in advanced communications technologies for Europe. Technological development programme in the field of telecommunications technologies (1990 to 1994). Within the Mobile and Personal Communications line, a number of projects participate in the work towards third generation mobile systems **(UMTS & MBS)** A number of other R&D projects in the RACE framework also contribute towards the definition of UMT/MBS.

Roaming Facility, supported by commercial arrangements between operators and/or service providers, which enables a subscriber to use his/her radio telephone equipment on any other network which has entered into a roaming agreement in the same or another country for both outgoing and incoming calls.

Service Providers Service providers offer services to end users involving the use of mobile networks and services. The role of service providers may vary between that of airtime reseller to the provision of sophisticated value added services. Service providers may be independent or form part of a mobile network operation.

SIM –Subscriber Identity Module. A plastic card containing a microprocessor and memory issued for use with **GSM** and **DCS 1800** networks. The card contains details of the subscriber.

SMG - Special Mobile Group. ETSI Technical Committee (TC), with special responsibility for **GSM**, **DCS 1800**, and the development of **UMTS**.

Standards Institute (ETSI) The European standards organisation in the Telecommunications field, having the task of producing European Telecommunications Standards **(ETS)**, having Europeanwide application and acceptance, in the area of telecommunications. ETSI is a non-profit making organisation whose mission is to produce the telecommunications standards that will be used for decades to come throughout Europe and beyond. ETSI unites nearly 700 members from 50 countries inside and outside Europe, and represents administrations, network operators, manufacturers, service providers, technical bodies and users.
The Institute's work programme is determined by its members, who are also responsible for approving its deliverables. As a result, ETSI's activities are maintained in close alignment with the market needs expressed by its members. ETSI plays a major role in developing a wide range of standards and other technical documentation as Europe's contribution to world-wide standardisation in telecommunications, broadcasting and information technology. ETSI's prime objective is to support global harmonisation by providing a forum in which all the key players can contribute actively. ETSI is officially recognised by the European Commission and the EFTA secretariat.(GSM World on 3G **1999**)

TCP/IP - Transmission Control Protocol/Internet Protocol)

Telepoint Applications Generic term for applications allowing subscribers over a wireless link between a handset or other radiocommunications device to place calls via the public network infrastructure, but not generally to receive calls.

TETRA - Trans European Trunked Radio .Mobile communications system to be used for applications on a shared basis.

TFTS - The Terrestrial Flight Telephone System. A digital standard developed by **ETSI**. The system comprises airborne equipment and a series of ground stations through which telephone calls can be initiated by users whilst in flight.

UMTS - Universal Mobile Telecommunications System. A technology and standard for third generation mobile digital systems, currently under development within **ETSI** and by the **RACE** programme. UMTS should support full personal communications services, delivered over a combination of fixed and mobile networks.

XML – eXtensible Markup Language

F. REFERENCES AND BIBLIOGRAPHY

Amor, P. (2000). Science, Technology and Education Counsellor, Delegation of the European Commission. Washington DC.

Bangemann, M., E. C. d. Fonseca, et al. (1994). Recommendations to the European Council. Europe and the global information society - Bangemann report. Brussels, European Council.

Cort, R. (1993). Understanding Windows NT POSIX Compatibility, Microsoft Corporate Technology Team.

Cuadriello, J. and P. Amor (2000). An overview of the electronic publishing industry and trends. A US perspective. Washington D.C., Delegation of the European Commission , Washington DC. and Information Society Directorate.

E.Commission-Information Society-RDT info (2000). “In the lead in the wireless world.”.

EMC database (2000).

European Commission Action plan (1994). Europe's way to the Information Society. An action plan. Brussels,.

European Commission Green Paper (1987). Towards a dynamic European economy: Green Paper on the development of the common market for telecommunications services and equipment.

European Commission Green Paper on mobile communications (1994). On a common approach in the field of mobile and personal communications in the European Union, European Commission.

European Commission Telecommunications Legislation (1997). Status report on European Union telecommunications policy. Telecommunications, Information Market and Exploitation of Research Telecommunications; Trans-European Networks and Services; Postal Services. Brussels, EUROPEAN COMMISSION DIRECTORATE GENERAL XIII.

European Commission White Paper (1993). Growth, Competitiveness, Employment: The Challenges and Ways Forward into the 21st Century - White Paper.

Grande, C. (2000). Very little call for mobile linked to the internet. Finantial Times. London.

GSM World on 3G (1999). 3G is key to renewed GSM association & ETSI agreement.

GSM World.com (2000).

J. Schwarz da Silva, B. Arroyo-Fernándes, et al. (2000). “Evolution Towards UMTS.”.

Liebenau, J. and M. Thatcher (1998). The European Union Telecommunications Market: regulation, Competition and Change. London, London School of Economics and Political Science.

Mobile Communication and CMT (2000). Mobile Telephony Market.

Muñoz, R. (2000). Las compañías de móvil preparan un vuelco de estrategia por la saturación del mercado.(Mobile phone companies get ready for a change in strategy due to the saturation in the market). El Pais. Madrid.

Nokia Market Study (1999). The demand for Mobile Value-Added Services - Study of Smart messaging.

Nokia.com (2000). The Nokia 9210 Communicator at a Glance.

Noveck, D. (1999). Nfs-v4 Working Group Meeting - Posix vs. NY - What is Different. Proceedngs of the forty-fifth internet engineering task force.

Pareja, V. (2000). Hewlett-Packard, Stuttgart, Germany. Informartion about Windows NT POSIX compliance.

Penfield Jackson, T. (2000). Conclusions of Law. Washington DC., United States District Court for the District of Columbia.

Protocols.com (2000).

Real Academia de la Lengua Española (1992). "Diccionario de la Real Academia de la Lengua Española (Dictionary of the Royal Academy of the Spanish Language)."p: 640.

Silberman, S. (1999). Just say Nokia. Wired Magazine. Sept.

Supreme Court of the United States (2000). Microsoft Corporation, appellant vs. United States of America, et. al.

Uimonen, T. (2000). Nokia 9210 handset packs colour, Java, 'Net access, not slated for U.S. market, IDG News Service,.

ADDITIONAL REFERENCES.

Cnn.com (2000). Judge orders breakup of Microsoft.

Commission to the European Parliament, t. C., the Economic and Social Committee and the Committee of the Regions (1999). Towards a new framework for Electronic Communications infrastructure and associated services. - The 1999 Communications Review. Brussels.

Davies, S. (1998). Europe to U.S.: No privacy, no trade. Wired Magazine. May.
E.Commission-Information Society-RDT info (2000). "In the lead in the wireless world.".

European Commission (1987). "87/95/EEC: Council Decision of 22 December 1986 on standardization in the field of information technology and telecommunications." Official Journal ,(l L 036): p. 0031 - 0037.

European Commission (1990). "90/446/EEC: Commission Decision of 27 July 1990 relating to a proceeding under Article 85 of the EEC Treaty (IV/32.688 - Konsortium ECR 900) (Only the German, English and Dutch texts are authentic)." Official Journal(L 228): p. 0031 - 0034.

European Commission (1994). "Commission Directive 94/46/EC of 13 October 1994 amending

Directive 88/301/EEC and Directive 90/388/EEC in particular with regard to satellite communications." Official Journal(L 268):, p. 0015 - 0021.

European Commission (1995). "Council Resolution of 18 September 1995 on the implementation of the future regulatory framework for telecommunications." Official Journal(C 258): p. 0001 - 0003.

European Commission (1995). "Council Resolution of 29 June 1995 on the further development of mobile and personal communications in the European Union." Official Journal C 188: p. 0003 - 0004.

European Commission (1996). "Commission Directive 96/2/EC of 16 January 1996 amending Directive 90/388/EEC with regard to mobile and personal communications." Official Journal(L 020): p. 0059 - 0066.

European Commission (1996). Green Paper on a Numbering Policy for Telecommunications Services in Europe. Brussels, European Commission.

European Commission (1996). Towards a European numbering environment. Brussels, Commision of the European Communities.

European Commission (1997). "397D1336
Decision No 1336/97/EC of the European Parliament and of the Council of 17 June 1997 on a series of guidelines for trans-European telecommunications networks." Official Journal(L 183 ,): p. 0012 - 0020.

European Commission (1997). "97/114/EC: Commission Decision of 27 November 1996 concerning the additional implementation periods requested by Ireland for the implementation of Commission Directives 90/388/EEC and 96/2/EC as regards full competition in the telecommunications markets (Only the English text is authentic) (Text with EEA relevance)."
Official Journal(L 041): p. 0008 - 0021.

European Commission (1997). "97/181/EC: Commission Decision of 18 December 1996 concerning the conditions imposed on the second operator of GSM radiotelephony services in Spain (Only the Spanish text is authentic)." Official journal(L 076): P. 0019 - 0029.

European Commission (1997). ETNO Common Position on the European Commission Green Paper on Numbering Policy for Telecommunications Services in Europe-COM(96)590. Brussels.

European Commission (1997). Green Paper on the Convergence of the Telecommunications, Media and Information Technology Sectors, and the Implications for Regulation. Towards an Information Society Approach. Brussels, European Commission.

European Commission (1999). "Council Conclusions of 27 September 1999 concerning the results of the public consultation on the Convergence Green Paper (in particular the aspects relating to the media and the audiovisual sector)." Official Journal(C 283 ,): p. 0001 - 0002.

European Commission (1999). "Decision No 128/1999/EC of the European Parliament and of the Council of 14 December 1998 on the coordinated introduction of a third-generation mobile and wireless communications system (UMTS) in the Community." Official Journal(L 017): p. 0001 - 0007.

European Commission (2000). "Commission Recommendation of 25 May 2000 on unbundled access to the local loop: enabling the competitive provision of a full range of electronic communications services including broadband multimedia and high-speed Internet." Community legislation in force- Official Journal(L 156): p. 0044 - 0048.

European Commission (2000). Mobile Sevices.

European Commission (2000). On the Overall evaluation of a set of guidelines f the development of the Euro-ISDN (Integrated Services Digital Networks) as a trans-European Network (TEN-ISDN. Brussels, Commission of the European Communities.

European Commission (2000). The results of the public consultation on the 1999 Communications Review and Orientations for the new Regulatory Framework. Brussels.

European Commission (1991). Council recommendation of 3 June 1991 on the coordinated introduction of digital European cordless telecommunications (DECT) into the Community,91/288/EEC. Official Journal: p. 0047 - 0050.

European Commission and European Council (1997). Communication from the Commission to the European Parliament and the Council regarding the consultation on the Green Paper on a Numbering Policy for Telecommunications Services in Europe.

European Commission Green Paper on Liberalization (1994). On the Liberalisation of Telecommunications Infrastructure and Cable Television Networks - Part II - A Common Approach to the Provision of Infrastructure for Telecommunications in the European Union.

European Council (1986). "86/659/EEC: Council recommendation of 22 December 1986 on the coordinated introduction of the integrated services digital network (ISDN) in the European Community." Official journal: NO. L 382 , 31/12/1986 P. 0036 - 0041Official journal NO. L 382 , 31/12/1986 P. 0036 - 0041.

European Council (1987). "87/371/EEC: Council recommendation of 25 June 1987 on the coordinated introduction of public pan-European cellular digital land-based mobile communications in the Community." Official Journal(l L 196): p. 0081 - 0084.

European Council (1987). "Council Directive 87/372/EEC of 25 June 1987 on the frequency bands to be reserved for the coordinated introduction of public pan-European cellular digital land-based mobile communications in the Community." Official Journal ,(L 196): p. 0085 - 0086.

European Council (1989). "Council Resolution of 27 April 1989 on standardization in the field of information technology and telecommunications." Official Journal(C 117): p. 0001 - 0001.

European Council (1990). "Council Directive 90/544/EEC of 9 October 1990 on the frequency bands designated for the coordinated introduction of pan-European land-based public radio paging in the Community." Official Journal(L 310):, p. 0028 - 0029.

European Council (1990). "Council Resolution of 14 December 1990 on the final stage of the coordinated introduction of pan-European land-based public digital mobile cellular communications in the Community (GSM)." Official Journal(C 329): p. 0025 - 0026.

European Council (1991). “Council Resolution of 18 November 1991 concerning electronics, information and communication technologies.” Official Journal ,(C 325): p. 0002 - 0004.

European Council (1993). “Council resolution on the review of the situation in the telecommunications sector and the need for further development in that market.”.

European Council (1995). “395Y0722(02)
Council Resolution of 29 June 1995 on the further development of mobile and personal communications in the European Union.” Official Journal(C 188 ,): p. 0003 - 0004.

European Council (1995). “Commission Decision of 4 October 1995 concerning the conditions imposed on the second operator of GSM radiotelephony services in Italy (Only the Italian text is authentic).95/489/E.” Official journal(NO. L 280): P. 0049 - 0057.

Financial Times (July 2000). Mobile Communications.

G. Harindranath, J. L. (1998). National Information Infrastructure Policies in International Perspective. Vienna., United Nations Industrial Development Organization.

Garrard, G. Cellular Communications: Worldwide Market Development.

Heilemann, J. (2000). The Truth, The Whole Truth, and Nothing But The Truth - The untold story of the Microsoft antitrust case and what it means for the future of Bill Gates and his company. Wired Magazine.

Nokia (2000). Mobile Network Transmission. Nokia’s vision of evolution of the transmission capacities, medias and technologies in mobile networks. GSM, EDGE, WCDMA.

Nokia and Financial Times (August 2000). “Movile Services.”.

Nokia White Paper (1999). Mobile Network Evolution to Multimedia Messaging.

Pozzi, S. (2000). Bruselas alerta sobre el dominio de los antiguos monopolios (Brussels alerts of the dominance of the former monopolies). El Pais. Brussels.

StatMarket (2000). Operating System usage distribution , June 2000, StatMarker.com , a division of WebSideStory Inc.

The World Wide Web Consortium (W3C) (2000).

Wired (2000). Experts Voice Doubt Over 3G. Wired.com.