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THE DEVELOPMENT OF CELLULAR TELEPHONY
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THE DEVELOPMENT OF CELLULAR TELEPHONY IN FRANCE: A COMPARATIVE ANALYSIS BETWEEN FRANCE, GERMANY AND THE UK.

By

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ABSTRACT

THE DEVELOPMENT OF CELLULAR TELEPHONY IN FRANCE,
A COMPARATIVE ANALYSIS BETWEEN FRANCE, GERMANY AND THE UK.
By

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The objective of this thesis is to understand how the shaping of market, regulatory and socio-cultural factors has resulted in the current development of the French cellular market. It compares and constrasts this development with respective ones in Germany and the United Kingdom.

French cellular market laggs behind developments in Germany and above all the United Kingdom. A regulatory and market analysis of the market helps to understand this uneven development. Also, this thesis emphasizes the relevance of the socio-cultural environment in the France's case, and how this specific environment has prevented the market from developing before late 1995.

To my mother and father.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Chapter 1

INTRODUCTION

In only a few years, mobile communications have become one of the fastest growing areas within the entire Telecommunication industry. This development has been shaped by a wide array of technical, economic, regulatory, market and socio-cultural factors. The goal of this thesis is to explain how this shape of different key factors has led to the current situation in the development of cellular telephony in France. This development will be compared to the respective ones in Germany and the UK. Despite a relative dynamic market in France (more than 3% monthly growth in 1995), its situation on the European cellular market is deteriorating. Second digital market in the beginning of 1995, it has been exceeded by the UK and Sweden at the end of 1995. This report is even more unfavorable to France considering penetration rate. In April 1995, the penetration rate for 1000 inhabitants was respectively 15.91, 34.97, 70.36 in France, Germany and the UK.

Before any tentative study of the specific factors that explain the uneven development of mobile communications in France, Germany and the UK, an overall view of these key

factors is provided in the first section of this chapter. Then, a second section is devoted to a brief historical background about the evolution of cellular telephony in France with respect to other European countries. The third section presents the method that has been used for the study. Finally, the fourth section outlines the different steps that were followed to explain the slow development of cellular telephony in France.

1.1 The key factors affecting mobile communications

The field of telecommunications in general, and the sector of mobile communications in particular, is affected by a wide array of technical, economic, regulatory, market and socio-cultural factors. They all, to greater or lesser extents, participate in the shaping of mobile communications systems (see Figure 1[1]).

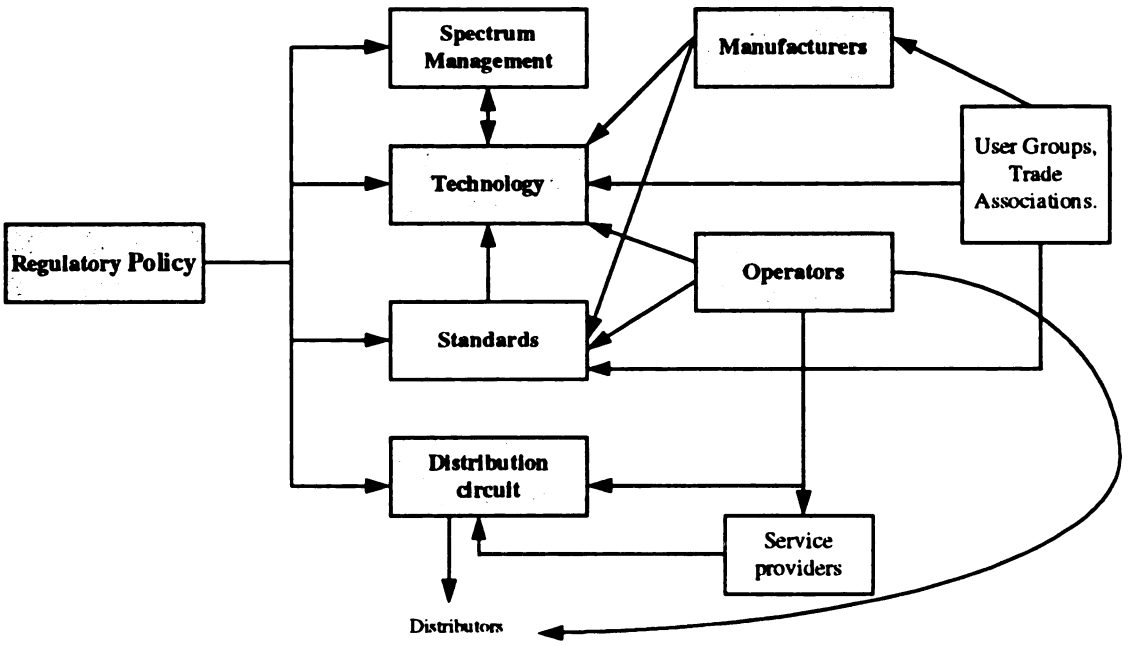


Figure 1 - Key factors affecting mobile communications

Original Source : Michael Paetsch, Mobile communications in the US and in Europe, 1993. Author's adaptation.

Regulatory policy

Regulatory policy aims to insure a harmonious development of the sector. It implies an arbitration role on numerous aspects such as interconnection tariffs, frequency allocations, market structure and technology.

Technological factors

The main technical difficulty that remains is the scarcity of the spectrum. Since the most useful part of the spectrum

is already allocated, the development of cellular telephony depends upon the introduction of technologies that use the less crowded and higher frequency bands. Also, technological evolution makes new communication services and new features possible.

Manufacturers

Due to rapid technological evolution, equipment manufacturers often allocate funds to the development of new services before the allocation of spectrum frequencies. In this way, they attempt to impose a de facto standard and gain competitive advantage. Then, they directly influence the standard-setting bodies.

Operators

In Europe, except for the UK and Sweden, the fixed market is still monopolized by national PTTs[2]. The first steps toward liberalization have allowed the grant of few mobile licensees to non wireline system operators; for example, in France, la Societe francaise de radiotelephone (SFR) and Bouygues, in Germany, Mannesman and Veba.

Marketing channels

Since mobile services are evolving from a business market to a mass market, marketing channels are becoming more important in the development of cellular telephony. They are fragmented and differently structured from one country to

another. Regulatory bodies can set up a special type of marketing channels to favor market development. This has been the case in the UK with the introduction of a two-tier service structure in 1985.

Other factors

The above factors can be considered as the direct key factors. Of course, many factors such as the overall economy of the country, the geography or the socio-cultural factors indirectly shape the development of cellular telephony.

1.2 A historical background

Cellular services were first launched in the beginning of the 1980's in the Scandinavian countries and then in the other European countries during the mid 1980's. For example, the four largest countries of the European Community (France, Italy, Germany and the UK) launched their own cellular system in 1985. Each of these national markets was using a standard incompatible with the other ones. And globally, the European market was characterized as very fragmented and non-homogeneous. In December 1991, the penetration rate for mobile services varied from 7 subscribers per 100 in Sweden to less than 1 per 1000 each for Greece, Portugal and Luxembourg.

In 1991, the four major European countries had captured around 57% of the European subscriber base with 33% for the UK and around 8% for France, Germany and Italy. At the European Community (EC) level, the UK was far ahead in terms of subscribers. France, Germany and Italy were at the EC average in terms of penetration rate.

With the introduction of a Pan European solution for the second generation of cellular phones (GSM and PCN), a leveling of these discrepancies between individual countries was expected. This standardization has been noticeable through the evolution of the market share of the major EC countries. With approximately the same population, each country should capture on the long term, the same market share. In April 1995, Germany and Italy each had 17% of all European subscribers, while the UK still dominated with 25%[3]. At the same time, France's share decreased to 5% and was still decreasing at the beginning of 1995[4].

France is paradoxically lagging far behind other European countries. Nevertheless, France is considered an innovative country in the telecommunication industry : its network is highly digitized, the CNET[5] has initiated and developed many mobile programs (one of which is GSM technology), Alcatel is one of the world manufacturer leaders. Therefore, it is surprising that its penetration rate in cellular telephony is the lowest in Europe along with Spain. Even Greece, which

started its first service in 1992, has bypassed France in 1995.

1.3 Method

The model followed in the thesis separates the study into three different levels:

1. Market variables are variables that directly impact the individual's decision to subscribe -or not- to a cellular service. They will also be named micro variables all along the study.

2. Key factors or major variables do not directly impact the consumer decision process. They affect market variables. They all to greater or lesser degrees, aim to favor the market growth.

3. The socio-economic environment is the third level of analysis. The debate about the impact of the socio-cultural factors upon the adoption of cellular telephony is just starting. For now, the social evolution that will allow mobile services is being questioned. Mobile services can be perceived as a direct threat to personal freedom[6] or as a way to improve our everyday life[7].

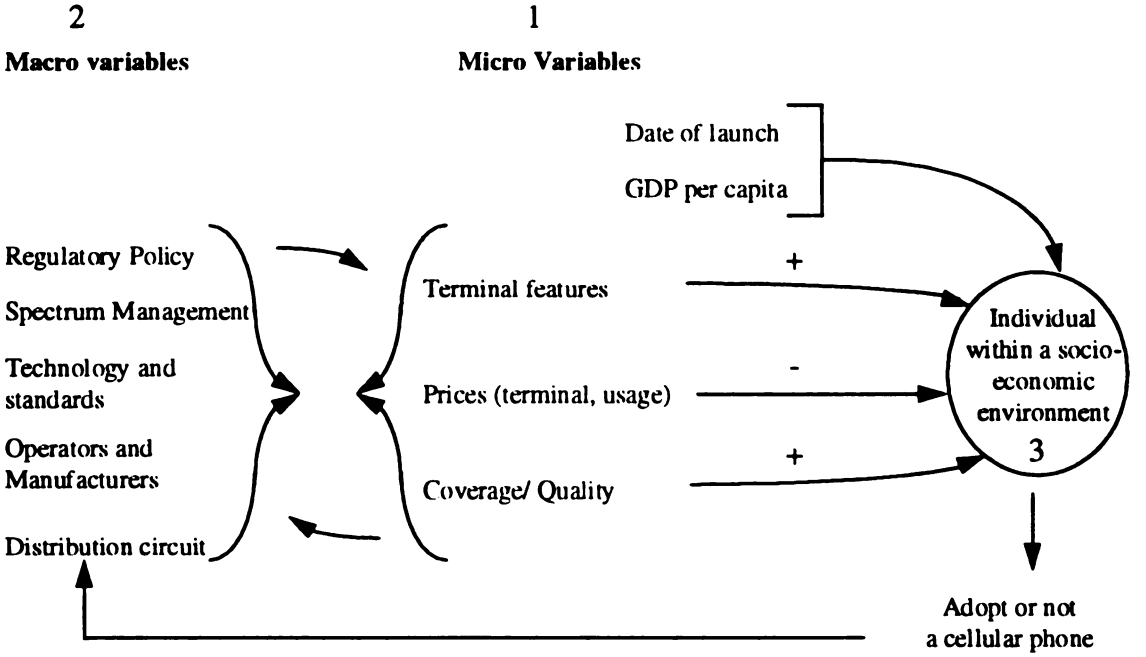


Figure 2 - Shematic structure followed during the study

Since the introduction of cellular telephony in 1981, the European mobile market has evolved gradually. Some countries were quickly able to develop their analog systems, while others were stuck and unable to move forward. Starting from these differences, the first part of the study will take the form of a brief statistical analysis (See Appendix A) in order to evaluate the significance of some micro variables and especially of the different kinds of prices. It will reveal the importance of the pricing policy, i.e. the cost partition between usage and fixed charges. Sixteen European countries will constitute the sample. Two

kinds of variables will be studied: the indirect market variables -GDP per capita, date of launch- (see Figure 2) and the direct market variables -fixed charges, usage charges, terminal price and coverage. The dependent variable is the penetration rate in December 1991.

Then, the results of part one will be used to explain the slow development of cellular telephony in France with respect to Germany and the UK. They will also help evaluate the different market variables in the cases of France, Germany and the UK. The study will specifically analyze the micro variables in these three countries in order to elucidate their uneven development. It will take the form of a case study using articles and books on the three countries. The factors influencing the development of cellular telephony will be noted in each article and then interpreted when possible.

Finally, the analysis of the macro variables and of the socio-cultural environment will help in fully understanding the development of cellular telephony in France. If the market variables are able to explain some of the variance in the penetration rate, the study will reveal that only an overall analysis can explain the overall development of cellular telephony in a country.

1.4 Outline

The objective of this study is to understand how the shaping of a set of different factors has resulted in the current situation. This thesis strives to analyze and evaluate the past and present factors that influence the development of cellular telephony in France. In order to better understand the reality and the impact of these factors, the study will take the form of a comparative analysis with Germany and the UK. These two countries are in terms of size, population and economical development, the most similar to France in Europe.

The seconder is devoted to a literature review. A statistical analysis of the market factors will be done in chapter 3 Its aim is to understand what market factors significantly influence the variation of the penetration rate of cellular telephony, and to what extent. Then, a comparative study of these variables in France, Germany and the UK, will be performed. In chapter 4, a comparative study of the major variables (see figure 1) will give an overall framework of the regulatory approach of the three countries studied. It will explain to a certain extent the results seen in chapter 3. In chapter 5, some unsolved questions will lead to the analysis of the external factors such as the socio-cultural influence on the decision process to purchase cellular phones. Finally, Chapter 6 will

conclude by outlining the weaknesses in the study and proposing possible research.

[1] Michael Paetsch, Mobile Communications in the US and Europe : Regulation, Technology and markets. The Artech House Mobile Communication Library, 1993.

[2] PTT stands for Post Telegraph and Telephone.

[3] Michael Paetsch, 1993.

[4] Direction Generale des Postes et Telecommunciations, Ministere des technologies de l'information et de la poste, etat des lieux. Juin 1995.

[5] The CNET is a research center. It has played an important role in the development of digital switches, the minitel, GSM technology or ATM.

[6] Yves Lafargues, le harcelement des telecommunications, *Le monde* du 7 octobre 1992.

[7] Phillip L. Spector, Wireless communications and personal freedom, Telecom policy, August 1993.

Chapter 2

LITERATURE REVIEW

This chapter will outline the theoretical framework used for the study. It can be divided into two parts. The first part is a review of some statistical studies and of the independent variables that have been studied to explain the development of mobile communications. The second part will review the literature that deals with the factors affecting telecommunications in general, and mobile communications in particular. It will mainly focus on the literature about the three countries in the case study: France, Germany and the UK.

On the whole, the development of telecommunication infrastructures is linked to its overall level of economic development. For example, there is a close correlation between the density of telephone lines and the Gross Domestic Product per capita. For the 24 countries of the OCDE[i], the result of a regression analysis showed an R square of 0.78[ii]; 1.0 would indicate a perfect correlation.

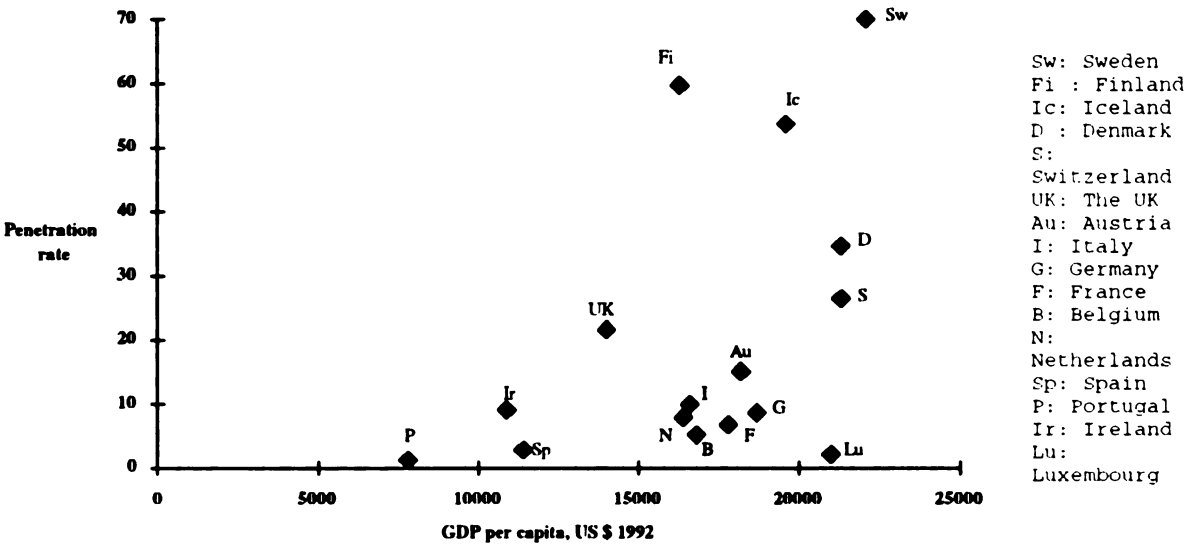


Figure 3 - Penetration rate and GDP in 16 countries, 1992

Source: OCDE, Services de communications mobile et fixes: concurrence ou complementarite, Paris 1995.

There is no such correlation for mobile communication services. A study done by the OCDE indicates that the relation between the GDP per capita and the penetration rate per 1000 of cellular phones is relatively low (see Figure 3). The result shows a high standard error and an R square of only 0.39. According to the OCDE, it means that the overall economic development of a country is a poor determinant of the development of mobile communications. Other factors may influence the development of cellular telephony and can help explain these important differences. Michael Paetsch, for instance, studies some factors that

influence the development of cellular telephony. His study uses three variables[3]:

. The price (equipment services and service charges
. The number of year the first cellular system has been launched.
. The Gross Domestic Product.

First, in order to analyze the factor price (equipment services and service charges), he performs a multiple regression analysis. The results show that the "price" is a poor predictor of the penetration rate. The regression analysis has a high standard error (16.82) and an R square of 0.33. Then he adds two variables (the GDP per capita and the number of years since a cellular system was first launched). The result of his second regression analysis reveals a more significant R square (0.77) and also a lower standard error (10.5). It means that 77% of the variation of the penetration rate can be explained by these four variables when dealing with European countries (EC, EFTA countries and Sweden). The variable studied are market variables. They are variables that directly affect the consumer in his process of buying a cellular phone. Paetsch also mentions coverage as a market variable. In his explanation of the development of the French cellular market, Bruno Salgues considers handset features as a

possible market variable[4]. Finally, the market variables that can be found in the literature are:

. Cost: The cost of a mobile phone can be divided into equipment costs, initial connection charge, monthly charge and usage charge.

. Coverage / quality of the network

. Handset features : weight, size, battery and different options such as call back, answering machine, pager.

. Gross Domestic Product

. The number of year the first cellular system has been available in a country.

These market variables are affected by indirect factors that have been mentioned in chapter one. Some authors have studied more directly the impact of one key factors on the telecommunication industry. For instance, Katz considers the growth of "telecommunication technology is strongly determined by government policy"[5]. In the telecommunication industry, the role of the state and the regulatory framework is often mentioned as an important factor, if not the most important. And the history of French telecommunications reveals how a strong interventionism of the State has allowed the telecommunication industry to advance from one of the least developed networks among the industrialized nations in the 1970's to one of the most advanced in the

1990's. This will help us consider how the different regulatory choices have shaped the development of mobile communications in France, Germany and the UK.

However, there are other factors that influenced the telecommunication development. Robin Mansell[6] investigates the political, economic and technical factors contributing to the future of telecommunication networks. She mainly focuses on electronic communication networks. In her study, she also outlines the different development of the UK, France, Germany, Sweden and the USA. It will help us shape our comparative analysis between France, Germany and the UK and also understand how political, economic and technical factor do impact a telecommunication network.

Bella Mody states that the development of a technology can be understood thanks to a contextual analysis that includes the political, the socio-cultural, the economic and the technical factors. She analyses the contextual determinants and the contextual consequences of a technology within a social system[7]. The study will reveal the importance of considering the social system in the development of cellular telephony in France, Germany and the UK. It will also structure the methodological approach of the study and help understand the interaction between all the factors that influence the development of a technology.

For most European countries, the Radiocommunication sector was one of the first services to be deregulated in the whole Telecommunication sector. And consequently, it has been studied as a kind of a laboratory for the regulation function. The European commission has written a new Green Paper on a common approach in the field of mobile and personal communications in the European Union[8]. It analyzes market evolution and major changes required to create a favorable environment for the development of mobile communication within the Union. This study will be used as a reference study in order to see how fast does the national regulatory bodies have respond to the EC requirements. Recently, Bruno Salgues[9] has studied mainly the strategies and the commercial offers of some European states and the impact on the market. It allows us to level the importance of the marketing channels and how crucial the issue is in the development of cellular telephony. It makes us wonder how does the two tier structure adopted in the UK has influenced the whole development of mobile communications.

In 1993, Michael Paetsch[10] analyzed the key factors that influenced the development of mobile communication systems. He compared the technological, regulatory and market environment of the United States and Europe with respect to mobile communications. The factors commonly mentioned as affecting the development of mobile services are mentioned in chapter one (see figure 1). These factor have an indirect

impact on the decision of the individual to subscribe -or not- to a cellular service. all these variables influence, to greater or lesser degrees, the variables that have a direct impact on the individual. This study has structured our methodological approach and help understand how the key factors were interacting the one with the others.

Different articles published in the French newspaper *Le Monde* or in *Telecom Interview* will be used as a starting point in the analysis of the socio-cultural factor. They will help evaluate the impact of this intangible factor on the development of mobile communication in France. The study of critical Mass Theory given by Markus Lynne[11] and the model given by Eli Noam[12] on the stages followed during network expansion will allow us to draw a specific model in the case of the mobile network. Because of the limits of the critical mass model, this study will show the relevance of the "diffusion of innovation" theory by Rogers[13]. It will also determine to what extent a social demonstration can prompt a turnabout in the development of a network.

The documents used for this study can be divided into two categories. Some have been used as a database in order to perform the statistical study(ITU, OCDE publications or other studies made by different authors). Others have help analyzing more specific factors that influence the development of mobile communications.

[1] OCDE : Organization de cooperation et de developement economique

[2] OCDE, Services de communications mobiles et fixes: concurrence ou complementarite ? , OCDE publications, Paris 1995.

[3] Paetsch Michael, Mobile Communications in the US and Europe : Regulation, Technology, and Markets. The Artech House Mobile communications Library, 1993.

[4] Salgues Bruno, Les telecoms mobiles, Edition Hermes, 1995.

[5] Katz R., The information society : an international perspective, Praeger, New York, 1988.

[6] Mansell Robin, The new Telecommunications: a political economy of network evolution, Sage Publication, 1993.

[7] Mody Bella, Contextual analysis of the adoption of a communication technology : the case of satellite in India, Telematics and informatics Vol 4, No.2 pp151-158, 1987.

[8] European Commission, Towards a personal communication environment, The Green Paper on a common approach in the field of mobile communications in the European Union, April 1994.

[9] Salgues Bruno, Les telecoms mobiles, Edition Hermes, 1995.

[10] Paetsch Michael, Mobile Communications in the US and Europe : Regulation, Technology, and Markets. The Artech House Mobile communications Library, 1993.

[11] Lynne Markus, Toward a "Critical Mass" Theory of Interactive media, in Organization and Communication

Technology, Edited by Janet Fulk and Charles Steinfield. Sage Publications, 1991.

[12] Noam Eli, Network Tipping : The Rise and Fall of the Public Network Monopoly.

[13] Rogers Everett M. with F.Floyd Shoemaker, Communication of innovations: A cross-cultural approach, The Free Press, New York, 1971.

Chapter 3

A MARKET ANALYSIS

This chapter is devoted to the analysis of the micro variables that influence the consumer in his process of buying a cellular phone (see figure 2). The first section will be a statistical analysis in order to determine the influence of some independent variables on the penetration rate of cellular phones in European countries. Then, in the second section, the study will focus on the significance of this statistical analysis in the specific cases of France, Germany and the UK.

In order to better understand the evolution of market variables, the following figure shows the evolution of the number of subscribers in France, Germany and the UK (see Figure 4).

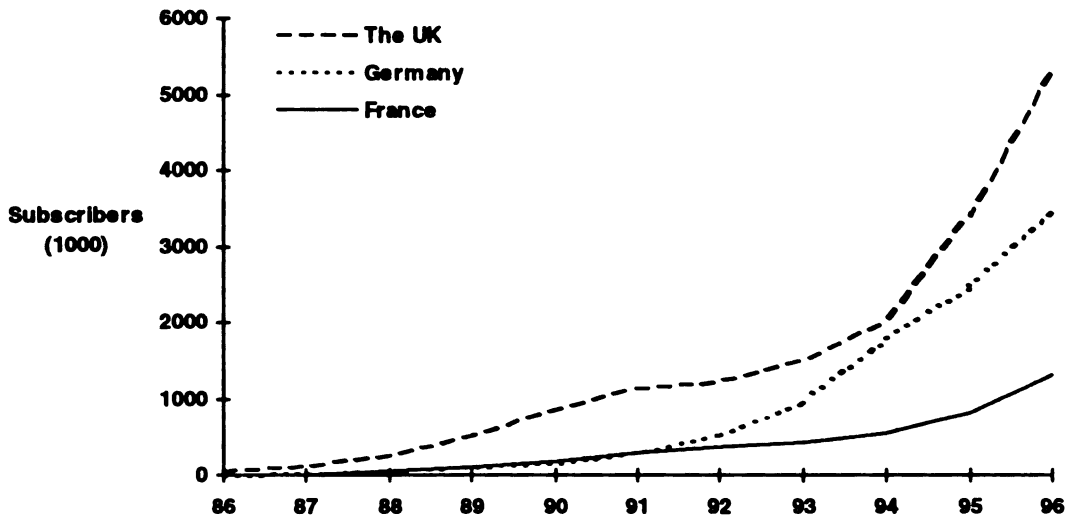


Figure 4 - Evolution of subscribers 1985-1995

Source: ITU, OCDE

3.1 A statistical analysis

In the decision process of having -or not- a cellular phone, a customer will wonder if it is worth getting a cellular phone considering factors such as cost, coverage, usefulness and other social factors. In the following study, only price and coverage are studied[1]. Variables such as terminal features have not been considered in this study[2]. Intangible factors such as marketing environment (marketing channels and advertisement) or the socio-cultural

environment do affect directly the consumer. They will be studied in chapter 4 and 5.

3.1.1 A price analysis

The study done by M.Paetsch (see chapter 2) did not take into account the initial connection charge and the monthly rental charge. Consequently, in order to determine the influence of the total price (equipment price + initial connection charge + monthly rental + usage charge), it was relevant to set up a new study that integrates these different variables (see Annex 1 for detailed analysis). It would also determine to what extent each price is influencing the penetration rate. First of all, in comparison with the study made by Michael Paetsch, the result indicates a more important correlation between the different prices and the penetration rate[3] (see Table 1, Annex 1). The regression has an adjusted R square of 0.49 and a standard error of 15.43 (as opposed to an R square of 0.33 and a higher standard error -17.5- for Paetsch study). The study also reveals an R square of 0.61 when the GDP per capita and the date of launch of the first analog system are included as independent variables (as opposed to an R square of 0.77 for Paetsch study). Moreover, it reveals that all variables are statistically significant in their relation to the penetration rate. As the β Weight shows, total price is the best predictor of penetration rate (β = -0.54) while the

date of launch and the GDP account for the same amount of the variance (β = 0.27).

Even more interesting, a new regression analysis was performed in order to evaluate the impact of each of the different prices (see Table 2, Annex 1). It uses data from 1995, three years after the introduction of the GSM in the European Union. By examining the increase in the penetration rate as the dependent variable, it is easier to evaluate the significance of micro variables on the development of the network at a precise point in time. Moreover, as all European countries have introduced GSM at the same time, it shows how each market has evolved and what factors are the most important. Finally, the product has become a mass market product in most of the countries, and consequently the incentive to buy a cellular phone has evolved.

The result shows that the three independent variables were statistically significant in their relation to the penetration rate (see Table 2, Annex 1). But the β weight shows that the fixed charge is the best predictor of the dependent variable (β = 0.53) while the terminal price accounts for the least amount of the variance (β = 0.20). Hence, a good pricing plan can influence the adoption rate of mobile telephones. This statement is confirmed by another statistical study. In order to see the correlation between the growth of the penetration rate and fixed and

usage charges, a new multiple regression is performed. The regression has an adjusted R square of 58.2 with a very low standard error (1.33). Moreover, the β weight shows that the fixed charge is the best predictor of the dependent variable (β=-.79) while the usage charge is not a significant variable (β=-.02).

Of interest also is the question of to what extent terminal prices, usage charges and fixed charges are related to each other. Three linear regression analysis were performed between the three price variables. The highest correlation found had an R square of .04 with a very high standard error. It means there is no correlation between each different prices[4].

These statistical studies show that from all the market variables studied, fixed charges are the best predictor of penetration rate. Moreover, only 61% of the variance of the penetration rate can be explained by the market variables - not considering coverage.

3.1.2 The coverage

The coverage of the population is an independent variable relatively hard to analyze. For instance, the study of the influence of GSM coverage on GSM penetration rate in

European countries did not reveal a significant relationship between these two variables. The average GSM penetration rate of countries that had not yet attained a full coverage before 1995 was 22.90[5] whereas it was 24.13[6] for countries that have not yet attain a full coverage. Some countries have favored the development of other technologies (analog services or DCS 1800), and this explains the above paradoxical figure. This also reveals the difficulty to evaluate the influence of network coverage.

3.2 The impact of these micro variables on mobile service penetration in France, Germany and the UK.

The analysis of these variables will be divided in 2 periods: before and after the appearance of digital services. The first section has shown that the Gross Domestic Product per capita, the number of months since the cellular system was first made available in a country, and the difference in prices explained 61% of the penetration rate (with a relative high standard error : σ = 13.5). France, Germany and the UK started their first cellular system approximately at the same time (1985), and at the same time they experienced the same economic development (the GDP per capita of Germany is slightly higher than in the UK and France). Consequently, price and coverage are the only market variables that best help to explain the

differences in the development of cellular telephony in these three countries.

3.2.1 The analog market or the first generation

3.2.1.1 The prices

On the analog market, the three countries pricing policies were different.(see Table 1). In the UK, the two-tier approach allowed for an inexpensive terminal price and consequently the total charges were significantly lower than in Germany and France.

Table 1 - Prices in France, Germany and the UK, in 1991

	Fixed charges (US $)[7]	Usage charges (US $)[8]	Terminal price(US $)[9]	Total (US $)
The UK	498.69	1336.08	20[10]	1854.77
Germany	440.99	1961.56	2530	4932.55
France	929.56	1218.88	2190	4338.44

The differences between France and Germany are interesting since they have had a relatively similar regulatory environment up until 1991 (adoption of their own technology

-Radiocom 2000 and C Netz-). While the total charges paid by German subscribers is 4932.55 US$, it is only 4338.44 US$ in France. Nevertheless, the fixed charges paid by the Germans are twice as low as the ones paid by a French subscriber. The first section showed that the fixed charges were the most important factor in the explanation of the penetration rate. When in 1990 Deutsch Telecom decided to reduce its tariff, it mainly cut the fixed charges. Coming back to 1989, the fixed charges were 842.19 US$ in France and 618.54 US$ in Germany while the usage charges were 260 US$ higher in Germany. The terminal price was also higher in Germany. At this time the penetration rate was similar in the 2 countries with around 3 subscribers per 1000 inhabitants. The subscription fee fell from 88 US$ to 55 US$ early in 1991 and the number of subscribers suddenly doubled. During the same period, if the usage charges significantly decreased in France, the fixed charge increased by more than 80 US$.

Consequently, it seems that there is a critical price for the monthly subscription. And a low subscription fee with high usage charges seems a good pricing policy in the early stages of development of a mobile network.

3.2.1.2 The coverage

In 1991, more than 90% of the French population was covered compared to almost 100% in Germany and the UK. It means there was not a big difference in terms of population coverage between the three countries. The next chapter will reveal that it is more the network capacities in France or Germany that have acted as an obstacle on the development of cellular telephony.

3.2.1.3 Conclusion

The above study reveals that the delay of the analog network in France -and to a lesser degree in Germany- can mainly be explained for the most part by high tariff. Moreover the cost policy in France (i.e. maintaining high fixed charges and relatively low usage charges) was poor. It might have been more judicious to decrease the fixed charge (and as a compensation, increase the usage charge) in order to attract more consumers. In 1991 France and Germany had the same number of subscribers. The German subscriber base doubled in less than a year when the total price of using a mobile phone remained relatively the same in the two countries. Thus the pricing policy in Germany can partially explain the sudden German growth.

However, the study is consumer oriented and it does not take into account the state of the offer -the network capacity-. As long as the offer does not prevent the demand from

developing, a consumer oriented approach can explain the development of mobile communications. In fact, until 1991 the demand could not freely develop in France due to network congestion. This factor will be further explain in chapter 4.

3.2.2 The digital market or the second generation

The European council recommended the adoption of a Pan-European solution: the GSM technology. Article 1 of the Memorandum of Understanding stipulated that the members would start the commercial service of the GSM by July 1991.

3.2.2.1 The prices

The use of the same standards in the three countries significantly reduced the price differences between them. It is especially true for the equipment prices. The GSM terminals were initially higher in Germany and France, but they quickly decreased. The new distribution structure they adopted for GSM services allows a more flexible pricing policy. So, by 1993, some distributors in France (Mammouth and Interdiscount) were proposing some free GSM terminals. With this type of distribution structure, it is hard to evaluate the price of terminal equipment. Moreover, the multiplication of GSM manufacturers has increased the choice

of terminals. Commonly, the price of terminal vary from 300 US$ to 1000 US$ in the three countries.

Considering the fixed and usage charges, the differences noted with analog services have significantly been reduced.

Table 2 - GSM tariffs in France, Germany and the UK and Mercury one2one tariffs in 1995.

	France (FT)[11]	Germany (DT)[12]	UK-GSM (Vodaphone)[13]	UK-PCN (Mercury)[14]
Connection fee (US$)	73.29	47.56	81.12	31
Monthly rental (US$)	39.79	51.23	40.56	15-23
Usage(US$/mn)				
Peak	.52	.82	.41	.31-.39
off peak	.31	.36	.16	free-.15

The Table 2 reveals that the UK still has the lowest tariffs, especially if the usage charges are taken into consideration. Comparing France and Germany, one notices that the rental cost is approximately the same and the connection fee is higher in France. But the usage charges are lower in France.

A study made by Mobile Europe[15] in October 1995 analyzed European tariffs for mobile communications. This allows us to compare how France and Germany have responded to the accelerated pace of competition. While it shows that France Telecom has taken the most adventurous and penetrative

pricing strategy by slashing prices across the board, German operators have excelling in the art of market avarice (see Table 3).

Table 3 - French and German operator tariffs[16] in 1994 and 1995 in US$[17]

Operator	Connection fee	Monthly access	Peak calls	off-peak calls
FT 95	73.29	39.79	.52	.31
SFR 95	73.29	39.79	.71	.43
DT 95	47.56	51.23	.82	.36
Mannesman 95	62.92	49.77	.76	.36
FT 94	71.92	48.53	.71	.43
SFR 94	71.92	48.53	.75	.47
DT 94	46.62	50.37	.81	.35
Mannesman 94	49.15	48.93	.72	.35

The above table shows that when the overall net reduction in tariffs for France Telecom is 34.6%, it is also 7.8% for SFR. At the same time, the German duo is continuing to edge up their tariffs to increase their revenues.

3.2.2.2 The coverage

The higher density of the UK and Germany facilitated a quick coverage of their respective population. Nevertheless a relatively quick coverage has been done in France considering the size of the country (see table 4)

Table 4 - Coverage of the GSM IN France, Germany and the UK

	Coverage (8W)			
	start	end 92	end 94	end 95
Itineris	2.92	< 70%	90%	95%
Mannesman	8.91	80%	100%	100%
Vodaphone	10.91	80%	100%	100%

Source : Michael Paetsch, Mobile communications in the US and Europe: Regulation, technology and markets, Mobile Communications Series, 1993.

But these figures only show the coverage for 8W terminals. This means mostly cellular phones for cars, but does not include portable telephones. At the end of 1994, the coverage for 2W terminals represented around 35% of the population in France, and FT expected to invest 400 million dollars in 1995 in order to extend this coverage to 65%. Today, in Germany and the UK, the entire population is

already covered for 2W terminals. Guy Lafarges, the strategic marketing director of FT said that "the principal brake remains the territory coverage, or rather the perception that people have about it".

3.2.3 Conclusion

The analysis of price and coverage variables does not really explain the slow development of the second generation of mobile communication. Prices are lower in France than in Germany, but the growth is still higher in Germany.

The Figure 5 links the subscriber growth to the penetration rate. A general model can be made[18]. The curb that relate subscribers growth to penetration rate should be relatively the same for each country. At a specific period of market development, each market should experience a relative same growth. Three periods can be mentioned (see footnote 18):

1. A first one which corresponds to the launch of the mobile service. The growth is high (>100%) and the penetration rate is low(<3%).
2. A second period when the curves reach a critical period (the curve of curb).

3. A third period of stabilization. The penetration rate increases while the growth remains constant (between 20% and 40%).

Reality reveals a more chaotic structure. Nevertheless it is relevant to compare the price and coverage of the French network in 1995 with the ones in Germany and the UK at the same penetration rate (i. e. 15 per 1000, in 1992 and 1988 respectively). One notes that France should experience a more important growth because the market factors are more favorable to France (total price is really higher in Germany in 1993 in comparison with France in 1995, and the coverage is better in France in 1995 than in Germany in 1993). But figure 3.1 reveals that this growth is stronger for Germany and the UK. It means that even in a most favorable market environment, the French market still does not reach the same expected growth.

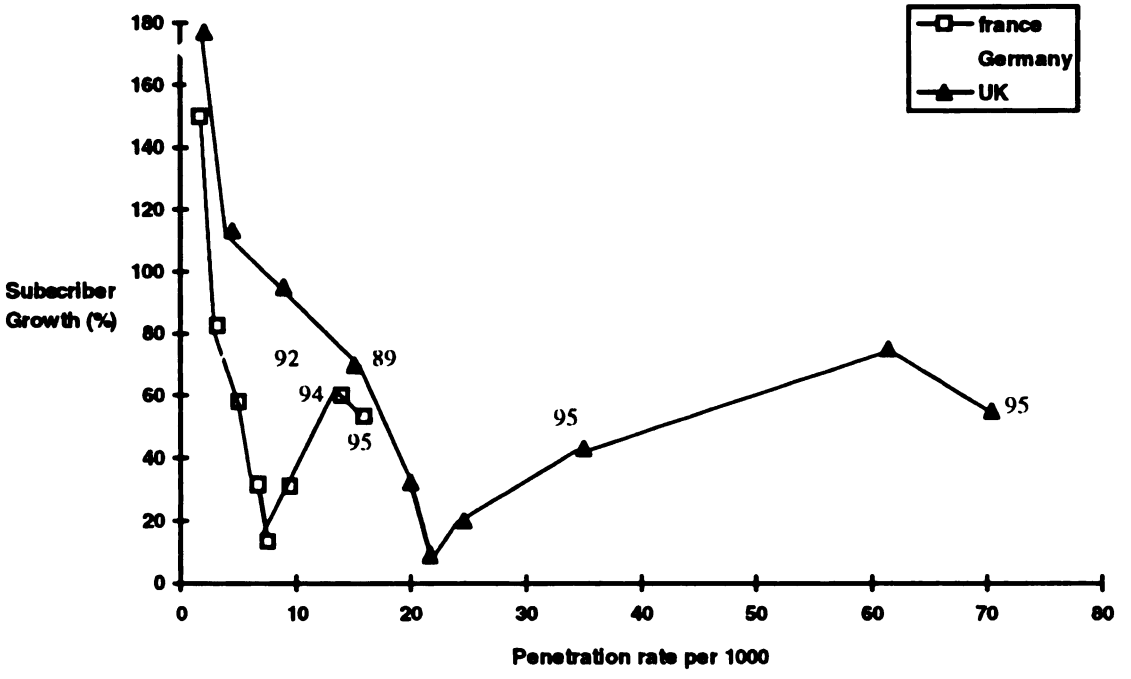


Figure 5 - Penetration rate and subscriber growth in France, Germany and the UK from 1985 to 1995.

Note: this is a figure with three dimensions (subscribers growth, penetration rate and time). For example, in 1995, the penetration rate in the UK was 70 per 1000, and the annual growth from 1994 to 1995 was 58%.

More specifically, in 1993, the monthly growth of the GSM subscribers was around 15% in Germany until it reached a million subscribers. Then it decreased until 1995 at around 4% per month. In France, in 1995 with only 500,000 subscribers, the GSM growth was only 6% per months. During the first four months of 1995, the French cellular penetration rate has only grown by 0.17 point with respect to 1.3 in the UK and 0.45 in Germany.

Now that the coverage of the population is not an obstacle anymore, and the prices have decreased to a point where it is more expensive to own a GSM in Germany than in France, it can be concluded that the market variables cannot sufficiently explain the important differences in the rate of adoption of cellular telephony in France, Germany and the UK. The next chapters will describe the regulatory and socio-economic environment and analyze how the interaction of these factors can help us understand this inconsistent development.

[1] The study did not take into account the product substitution as a variable. One can think that there is a relationship between the number of public phones in a country and the penetration rate of cellular phones: the more public phones, the less incentives to get a cellular phone. It acts as a product of substitution. In 1992, the penetration of public phones in the UK was 0.65 per 1000 inhabitants, while it was 0.33 in Germany, and only 0.31 in France. On the contrary, one can consider that the number of public phones increase the need for calling anytime and anywhere. So the long run it favors the habit of calling. It seems there are no real products of substitution for cellular telephones.

[2] There has never been a lot of differences between terminal handsets in France and Germany. The use of a national norm prevent the market from having a very diversed offer. The coming of the NMT 450 standard in 1989 increased the number of handset terminal available in France. Nowadays the number of terminal features is not a factor considering that GSM is a European norm.

[3]This relative difference in results might come from a different analysis of the price. M. Paetsch does not take into consideration the initial connection charge and also the monthly rental charge. Moreover, the usage charges have been calculated differently. The source from his study, Mc Cartney, bases the usage charge on five two minute calls per day during peak time, five times a week. So it becomes a basket of 520 calls per year. On the other hand, in the current study, the data is coming from the OCDE. The OCDE considers a basket of 910 calls of different distances and duration made at different times of day or week.

[4]Michael Paetsch showed that there was no correlation between terminal prices and service prices. He performed a regression analysis between these two variables and found an R square of only 0.07.

[5] The following countries did have a 100% GSM coverage at the end of 1994: Belgium, Germany, Luxemburg, Netherlands, Sweden, the UK, Italy.

[6] The following countries did not have a 100% GSM coverage at the end of 1994: Austria, Denmark, Finland, France, Greece, Norway, Portugal, Switzerland.

[7] OECD communication outlook, OECD publications, Paris 1993

[8] OECD communication outlook, OECD publications, Paris 1993

[9] Michael Paetsch, Mobile communications in the US and Europe: Regulation, technology and markets, Mobile Communications Series, 1993.

[10] This exceptional low price is due to the two tier service provision structure.

[11] Mobile Europe, 1995 GSM Tariff update, the terrible truth about tariff is..., October 1995, pp75.

[12] Mobile Europe, 1995 GSM Tariff update, the terrible truth about tariff is..., October 1995, pp75.

[13] Mobile Europe, 1995 GSM Tariff update, the terrible truth about tariff is..., October 1995, pp75.

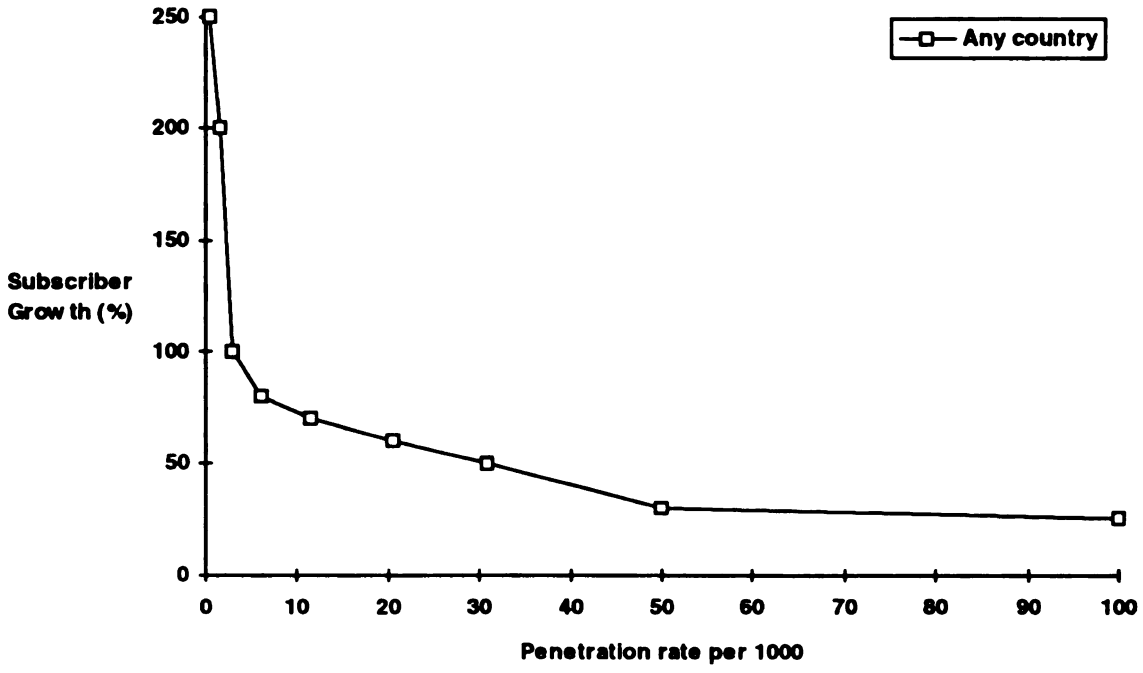
[14] Tariffs in September 1995. Found on internet at the Mercury one o one homepage.
The web adress is: http://www2.one2one.co.uk/one2one

[15] Mobile Europe, 1995 GSM tariff update, the terrible truth about tariff is..., October 1995, pp73-77.

[16] The value added Tax is not taken into account. In October 1995, the VAT was 18.6% in France, and 15% in Germany. In the UK, it was 17.5%.

[17] 1US$ = .2094 Ffr (04/15/1995)
1US$ = .7318 DM (04/15/1995)

[18] The model should look like the following chart.



Chapter 4

THE REGULATORY FRAMEWORK

This chapter consists of a comparative description of the regulatory framework in France, Germany and the UK. Its purpose is to make the differences described in the third chapter more clear. The controlling of the regulatory bodies covers numerous fields such as the management of the spectrum, the degree of competition, the standardization process and the distribution circuits. This chapter will focus on these various parameters and how they impact the market variables.

4.1 The regulatory policy.

In examining the regulatory framework in the UK, Germany and France, important discrepancies are revealed.

The United Kingdom is considered by some to be one of the most open telecommunication market in the world. The liberalization process started in the early 80's with the transformation in the provision of telecommunication from the original state-owned monopoly into a privately owned

duopoly -British Telecom and Mercury. The current framework is based on the 1984 Telecommunication Act that "allows any person or company to operate a telecommunication system in the UK provided their license has been authorized by the Secretary of State for Trade and Industry and OFTEL". The duopoly ended in 1991 and numerous operators are now competing on the fixed market.

In Germany the liberalization process began in 1989 with the Postal Reform I which separated the operational and regulatory functions of Deutsch Telecom (just after the postal and telecommunication services were separated). DT depends on the Bundesminister fur Post und Telekommunikation'. In June 1993, the decision was made to privatize DT and the first shares are scheduled to be sold in mid 1996 (20%).

France embraced early on the concept of a more liberalized telecommunication industry. The first structural move in 1988 was to place all the France Telecom subsidiaries under the control of a new holding company, COGECOM. A more obvious step was taken when the terminal equipment market stopped being subjected to supply restriction. Moreover, the arrival of the Societe Francaise de Radiotelephone as a second analog operator in 1989 triggered the era of competition. In order to remain competitive, France Telecom receives the status of an autonomous Operator which makes it

responsible for its own budget. Since January 1993, the DGPT is regulating independently the telecommunication sector. Its mission is:

"to elaborate and implement governmental policy in the field of Post and Telecommunications at a national, community and international level, and to regulate these two sectors of activity by defining clear economical, legal and technical ground roles".

In addition, ideas are being exchanged on the possible transformation of the state-owned France Telecom into a private company. The new liberal government intends to privatize France Telecom but has had to deal with the disapproval of the civil workers.

4.2 The key factors of regulation

4.2.1 Spectrum management

Despite the technological advances, there are still technical obstacles that limit the available amount of spectrum. The spectrum has to be shared between radiocommunication, broadcasting, government and other private uses. The possession for the radiocommunication use of the spectrum (especially in the most useful frequencies - between 30 MHz and 1 GHz) allows the operator to adopt a

flexible policy in terms of frequency allocations and technological choices. As mentioned by Simon Glynn[2], after considering the availability of the spectrum the:

"challenge for regulators is to determine what number of licenses will best achieve their objectives in the particular circumstances of their market, operators and regulatory system".

Each country has a special allocation procedure. In the UK the selection of the new PCN operators has been made by limited competition with a requirement to meet certain quality criteria. In Germany, they are selected by public tenders, while in France they are chosen by a "request for tenders" procedure.

In Germany and the UK the management spectrum has not been a big issue. The necessary frequencies have always been available when needed. When in 1989 the C network reached its saturation point, the spectrum availability was allowed to double the network capacity and thus to satisfy the growing demand.

Table 5 - Allocation of spectrum bands below 1 GHz, 1992

Use of the spectrum	France[3]	Germany[4]	UK[5]
Radiocommunication	15%	64.5%	48%
Broadcasting	50%	0%	3%
Government	35%	35%	22%
others	0%	0.5%	27%

France is the only European country that does not have a centralized spectrum management system. The organization comes from political, historical and cultural traditions which make it really unique. It is due to the strong historical division between telecommunication and broadcasting. In Germany or the UK, this division is not manifested in the spectrum allocation. For instance, the radiocommunication agency in the UK manages all the radioelectric frequencies including the ones for broadcasting. Moreover the importance of the military historicaly within the revenues of the companies of the telecommunication sector (2/3 for the military sector, 1/3 for the civil sector) has always influenced the French spectrum allocation policy. With regards to the more useful

part of the spectrum (below 1 GHz), only 15% is alloted to radiocommunications, while in Germany it is almost 65% and in the UK, 50%. In this context, the GSM frequencies have been liberated only because of the pressure applied by the European directives.

The situation has now evolved in France. The regulator has alloted the most important portion of the electromagnetic spectrum in Europe to the two GSM operators. Consequently, this factor can no longer be considered as an obstacle to the development of mobile communication services.

4.2.2 Competition

France, Germany and the UK have decided to introduce competition in cellular telephony. A competitive environment has been the UK "credo" from the beginning. The freeness with which licences are being awarded in the UK is currently raising the question on their ability to survive in such a competitive market. Considering that competition is the best environment for the development of cellular telephony[6], it is interesting to reflect upon the rhythm of introduction of competition and the effectiveness of this competition.

The rhythm of competition

Questioning rhythm of introduction of competition means considering calendar efficiency. With the passing of time, it seems that introducing competition in the analog network 4 years after the start of the first network was not judicious. Moreover SFR had only three years to develop its network before the advent of GSM on the market. Waiting a three more years, as did Germany, and introducing competition only with GSM might have been a better solution. Paetsch notes that:

"Countries with presently only one analog cellular-telephone network are likely to see the fastest implementation of the new Pan-European digital network"[7].

In the France's case, SFR did not have a sufficient cash flow to support both a GSM and an analog network. The investments were divided into 2 different networks. The participation of Southwestern Bell and Vodaphone in SFR's capital in 1994 finally provided 600 million dollars that will allow SFR to make the necessary investments for its GSM network.

Moreover, in a market of mobile communication that develops very quickly, it is important to award licenses on a specific market at the same time so equal competition can be

insured. In the UK, each service is in a competitive environment (Analog, GSM and PCN), and the market share of each operator is relatively equal in each market. Since 1985, and the launch of analog services, Vodaphone and Cellnet have relatively experienced the same growth, and they had approximately the same number of subscribers in 1995[8]. In Germany, the only competitive service (GSM) is equally divided between the two operators, Mannesman and Deutsch Telecom[9]. The French analog market has been competitive since 1989, and SFR has represented around 30% of it until 1993. In the GSM market, SFR represents around 25% of the market. Consequently, it can be concluded that the rhythm of introduction of competition in France has not been as efficient as in Germany or the UK which raises the question of the effectiveness of the French competition.

The effectiveness of competition

Among all the forms and degrees of competition, only certain ones are effective :

"Effective competition requires strong mutual pressure applied among comparable rivals on a basis of competitive parity. At each point in the competitive process, there must be numerous comparable rivals, with comparable resources and prospects of winning in each episode. All

firms must be able to assert and defend themselves effectively"[10].

This statement makes even more sense in the mobile market where the competition is limited de facto to spectrum availability. Among the countries with a competitive environment within the analog market, France experienced the lowest penetration rate. The imperfections of the French market are a result of various parameters such as access to cheaper input for FT (capital, interconnection facilities[11]) and of disparity in the spectrum allocation. From the beginning, SFR has complained to the DGPT about the interconnection tariffs and spectrum allocation. In 1994 only, a ministerial directive cut the pay back on the mobile operators to FT by up around 50%[12]. In addition, the DGPT, in order to catch up with the European countries, has given mobile operators different options to reduce their interconnection tariffs:

. January 1994: The possibility to establish their own links (it can be electromagnetic links or fixed links). In Germany, the GSM operators are still not able to establish their own fixed links.

. June 1994: The possibility of renting network capacity from an independent network (SNCF, Air France...).

Mannesman, the GSM German operator, complained to its national regulator about the interconnection tariffs in 1992. Few month later, the commercial tariff for a connection to the fixed lines was reduced by up to 79%. In the UK, the competition within the fixed market facilitated the drop in interconnection costs of the mobile operators. They were also able in 1985 to rent some network capacity and to establish their own fixed link. These regulatory decisions gave a lot more flexibility to the mobile operators who were able to optimize their costs with a better management of their network.

As mentioned earlier, the French market's lack of efficiency can also be explained by the choice of the second operator (the natural one being the national PTTs). The SFR did not have the financial resources to heavily invest and thus compete with France Telecom. In Germany, Mannesman is a huge company with a significant cash flow. The introduction in 1994 of Southwestern Bell and Vodaphone into SFR's capital has finally helped it to compete on the same level as FT.

4.2.3 The technology and the standards

4.2.3.1 The first generation of cellular telephones

The choice of the analog technology has been largely influenced by the availability -or the scarcity- of the spectrum, and the presence of national manufacturers. The three major European countries have started to develop their own systems. Considering only the technical parameters, the tandard TACS, chosen by the UK, was using higher frequencies than the C network and Radiocom 2000. Consequently, as each cells was smaller (between 1 to 10 km for the TACS network, and between 4 and 25 for Radiocom 2000), the power needed for the emission was lower. So, if the use of lower frequencies allows for a better geographic coverage, it restrains the capacity of the network. In order to bypass this coverage problem, four kinds of terminals were defined and were introduced in 1985.

In the early 1980's, France Telecom banked on private mobile networks. The French operator developed the Radiocom 2000 systems as a network with divided spectrum possibilities. This system facilitates the re-allocation of frequencies. Moreover the "band III" (171/223 MHz) is not totally available in France as it is in the UK. This spectrum is being used by the private broadcasting channel Canal + on half of the French territory while military forces are making full use of their frequency in the 400 MHz band (Saphir network of the police forces, security networks). The French standard had to adapt to these restraints.

Radiocom 2000 was benefiting from large cells, and consequently was not acceptable for intensive frequency use. In the Radiocom 2000 system, the emission power of mobile devices is constant and does not allow for a reduction in cell size due to possible interference. In order to solve this problem, France Telecom set up an improved version called "Reseau a haute densite (RHD)" or high density network which allowed for hand over. Despite this improvement, the system was not productive enough in terms of spectrum efficiency when compared with a system in which emission power was regulated from a fixed base. This kind of system allows for a significant cell reduction in the densely populated areas. All in all, Radiocom 2000 used around 50 MHz. Most of it was shared with military forces, Broadcasting channels and the company networks. Only 6,4 MHz of the UHF band were exclusive and did allow for national coverage. It means that out of 250 000 subscribers in June 1991, only 25 000 had a national monthly subscription (more than a half were from Paris). SFR, who chose an NMT system, entered the market at the end of 1989. This system, relatively similar to the TACS system, has the advantage of having hand over and automatic power adjustment. Consequently it allows for a higher cell density in the most populated areas. But for both SFR and France Telecom their system reached their saturation point quite early. Jurgen Muller and Saadet Toker writes that the Radiocom 2000 system

"reached its saturation point of 8000 subscribers 1 year after the opening. As a consequence, spectrum originally allocated to the provinces had to be reallocated to Paris"[13].

When the demand exceeds the supply, the result is a scarcity rent. As shown in figure 4.1, the two competing operators have to increase their market price in order to avoid overloading their network and then reduce the waiting list of customers[14].

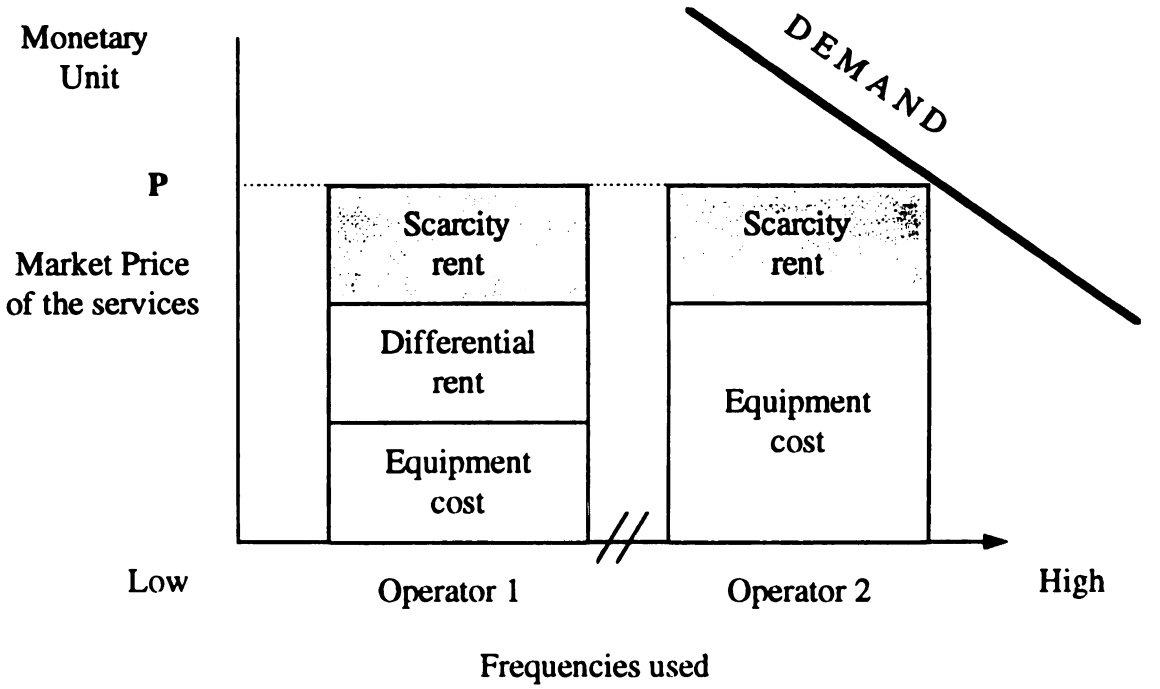


Figure 6 - Mechanisms creating scarcity rent.

Source : Ecole Nationale Superieure de Telecom Paris, Departement economie, 1992.

Moreover, when one of the operators has a frequency more suitable to their needs, then its scarcity rent is compounded with a differential rent (hatched part figure 4.1). This means that the operator with the most desirable frequency has a significant advantage over the other, and consequently the two operators can not compete equally. In France, the first frequency allocated to SFR did not allow it to compete on an equal level with FT. SFR started its network with only 2 MHz of spectrum which was then extended to 6 MHz. Both providers in Germany (Mannesman and DT) and in the UK (Vodaphone and Cellnet) received the same amount of spectrum when launching their analog or GSM. This scarcity rent was also apparent in the pricing policy of the SFR which charged Paris twice as much as the Provinces. This policy was more easily attainable since FT had the same one. The rent was directly related to the radio spectrum resource and was important to the cost structure of the market.

The adoption of one standard in several countries may directly influence the supply of the terminal handset. At the European level, countries that have standards other than the TACS or NMT systems had a penetration rate under 8.7 per 1000 inhabitants in 1991[15].

The standardization of the TACS system and its use in several countries (Ireland, Italy, Austria, Spain) lowered subsequently the terminal prices. This statement was found in an analogy of the NMT network implemented in the Nordic countries[16]. Nevertheless, it needs special attention. When, in 1991, the market for the NMT 450/900 network was adequately divided within the Nordic countries (45% in Sweden, 20% in Finland and Norway, 15% in Denmark), 83% of the TACS subscribers were coming from the UK. Moreover, other countries using the TACS standard started to launch their networks only in the early 90's. At this time, the UK already had 1 million subscribers. Therefore, it is harder to draw any correlation between the use of a common standard and the terminal price. Nevertheless, the development of the TACS standard was partial to the manufacturers investing in it (and consequently was reached a mass market that affected terminal prices). In France only 9 terminals were available for both the Radiocom and the SFR networks. The manufacturers considered the potential French market too small and they refused to heavily invest.

4.2.3.2 The second generation of cellular telephones

With the development of a European approach to the standardization of cellular phones -GSM, DECT-, the technological factors do not influence the growth

discrepancies as they did in the past. Nevertheless, it seems that each country is considering each standard differently. While France and Germany consider PCN as a natural extension of the GSM and as a way to extend its capacity, the UK looks at it as a direct competitor to the GSM. Consequently it is promoting the PCN as a more universal and less expensive service. In order to favor competition, the regulatory bodies in France and Germany have forbidden the GSM operators to participate in the allocation of the PCN frequencies.

4.2.4 The distribution structure

The distribution structure has often been cited to explain the success of the cellular phone in the UK[17]. The Department of Trade and industry (DTI) has imposed- since the launch of the analog service- a distribution via some intermediaries who are completely independent from the operators, "the Service Providers" or SCS (see figure 4.2). When a terminal handset is sold for a price P0 to the service provider, both the operator and the service provider often give a bonus of X1 and X2 to favor the demand. Then, if the benefits of the distribution are Y, the price paid by the subscribers becomes : Po+Y- (X1+X2). Consequently, if the reimbursement of the distribution benefits are inferior to the extras given by the operator and the service

providers, the price Pr paid by the subscribers becomes inferior to Po. It means that Pr can vary from 0 to Po or more. In such a structure the prices are varying from one day to another in function of the extras given by the three different actors (Operator (X1), Service provider (X2) and distributor (Y)).

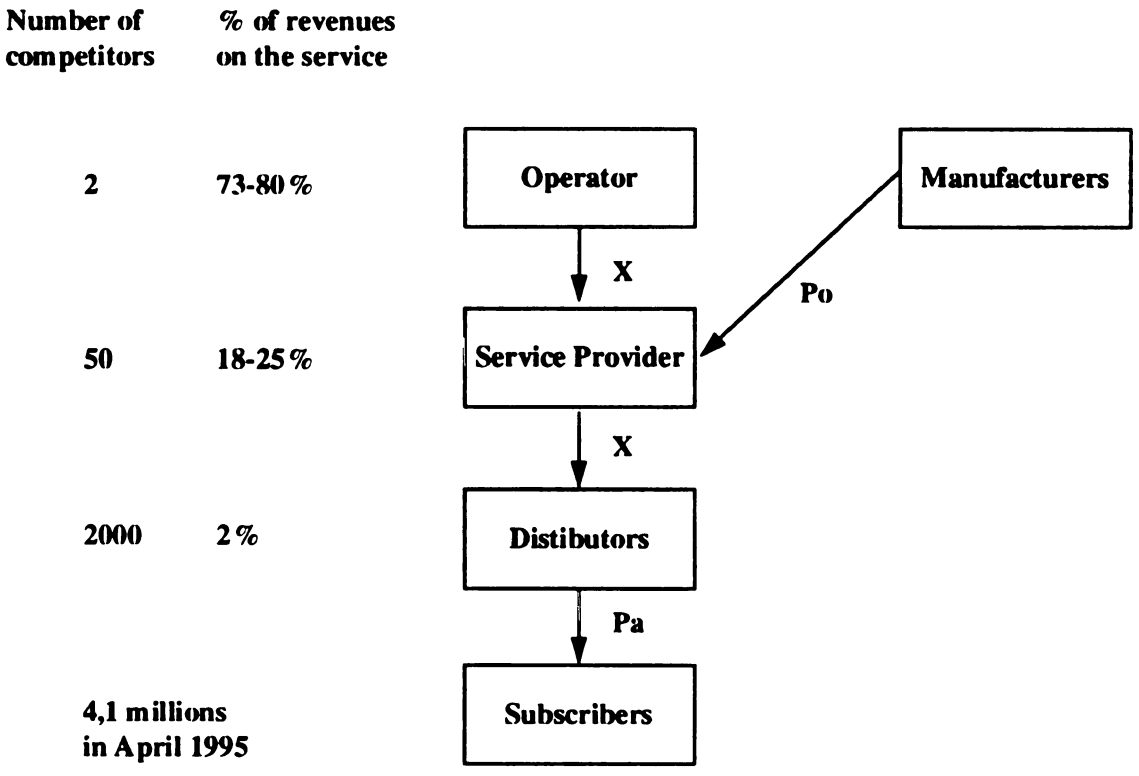


Figure 7 - Marketing channels in the UK

This distribution circuit completely separates the marketing and distribution functions. The distributors are free to fix their equipment prices with specific airtimes and monthly subscription deals. Within a non-homogeneous market, with a lot of different market niches, a pricing segmentation is allowed that fits several different profiles. Naturally it is hard to evaluate the influence of this "two tier approach" on the market. The terminal price can change from one month to the next by way of special discounts from the service providers.

Otherwise, the distribution of the analog service in France was divided into three main actors : the manufacturers, the operators and the distributors. In this distribution circuit, there was a strong variation between the sale of a terminal and the sale of services -airtime + connection- (see figure 2.4). Bruno Salgues[18] considers that this commercialization circuit welcomed between 120,000 and 140,000 new subscribers every year. It was sufficient to get a return on an investment (estimated at 350,000) for the upcoming digital network.

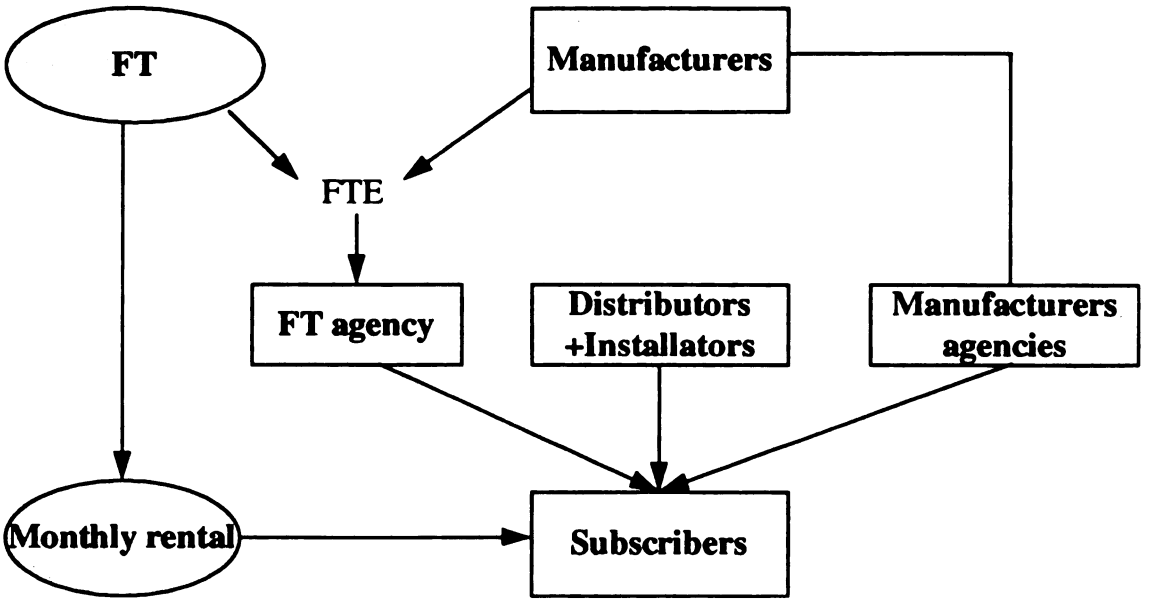


Figure 8 - Marketing channels of Radiocom 2000 in 1991.

Source : Bruno Salgues, Les telecoms mobiles, Hermes, 1995.

Note : EGT, a subsidiary of FT, commercializes its cellular telephones through the brand FTE (France Telecom equipment) via its network of big agencies to the administrations and companies of more than 50 employees.

The success of the marketing channels in the UK has encouraged FT and SFR[19] to reevaluate their distribution policies. The distribution circuit for the GSM has also

witnessed the arrival of the SCS[20] which has caused a considerable decrease in terminal prices. The "war on prices" began in France in October/November 1993. In April 1995, the SCS had gained more than 60%[21] of the French market. The war on price is also contributing to the change in social mentality with regards to cellular phones in France by shortening the gap between the market price and the psychological price threshold of the population (see chapter 5).

4.3 Conclusion

The descriptive regulatory framework outlined in this chapter provides key information for the understanding of mobile communication development in France. First of all, the lack of consensus on key decisions, on the technology and on cellular telephony in general prevented the market from increasing. Until the early 90's, a global lack of interest in mobile communications from both regulators and operators was apparent. Nobody thought that mobile communications would obtain such a mass market. For example, Alcatel, who has been the leader in technological telecommunication French moves, did not follow the mobile path. And in a short time, Alcatel has lost its world leadership as a telecommunication manufacturer.

More specifically, the lack of frequencies, the use of a standard with different frequencies, including low ones (<200 MHz), and a regulatory context that does not favor the emerging competition has resulted with poor coverage and high tariffs. Above all, it is the incapacity to react promptly to the market moves at the regulatory level that prevented the market from developing. If Germany experienced a low penetration of analog services in the 80's, it also succeeded in quickly taking control in 1990 when the demand began to thrive(by doubling the C network capacity).

When Mannesman complained to the German regulatory body in 1992 about the high interconnection tariff, a decision was made to encourage competition. It took 2 years in France for the DGPT to decrease the interconnection tariff as well as the usage cost of the fixed network for mobile operators.

Table 6 - regulatory structure in F, UK and G

	1990			1995		
	France	Germany	UK	France	Germany	UK
Spectrum management						
Frequency spectrum allocation (MHz)	3,2:FT 2: SFR	10	15	Not a factor anymore		
Number of competitors in the:						
Analog market	2	1	2	2	1	2
GSM market	0	0	0	2	2	2
PCN	0	0	0	1	1	2
Interconnection						
1. Problems about interconnection tarrif	Yes / with SFR	No	No	No only in 1994	No only in 1992	No
2. Rent network capacity from independent network	No	No	Yes	Yes	No	Yes
3. Establish your own fixed network	No	No	Yes	Yes	No	Yes

Individually, some decisions made by the French regulatory body can not be considered inappropriates. For example, the introduction of competition in the analog network should have boosted the market rather than to financially weaken the SFR. At that time, SFR did not have enough cash flow to compete with France Telecom. A stronger competition would have urged France Telecom , as a state owned monopoly, to invest more heavily, even on a relatively unknown market.

Consequently, it is no surprise that until 1994, the French market had only 400 000 subscribers. Competition is not effective in France, and France Telecom is focusing more on its technological "wonder" -the Bi-bop- than on GSM technology. Nevertheless, several changes have taken place in the French regulatory framework in 1994. In January 1994, mobile operators were allowed to establish their own fixed links, the interconnection tariffs were slashed by 50%. In June, the DGPT allowed them to rent network capacity from independent networks. In this context, the French mobile operators can enjoy a favorable regulatory environment (see table 4.2). If the regulatory situation was a factor of the delay in the penetration rate of mobile phones in France, the recent efforts made by the DGPT should prevent any complaints of lack of incentives in the mobile sector. Nevertheless, when everybody was expecting the French market to take off in 1994, and again in 1995, it remained relatively inactive in comparison with other

European countries at the same penetration rate. And in the first semester of 1995 there were only 250,000 new GSM subscribers in France. This is compared to the nearly 400,000 new subscribers in Germany during the first semester of commercialization -in 1992.

Despite the fact that France has one of the lowest cellular phone penetration rates in Europe, the growth of this rate during the first four months of 1995 was the lowest in Europe. The hope of a real expansion has been once again postponed to the opening of a PCN network by Bouygues Telecom early in 1996.

In this favorable regulatory framework, and with current market variables that should encourage the growth of cellular telephony, why does the French market still long to flourish? Coming back to figure 1.1 (see chapter 1), one has to consider the socio-cultural factors and their impact on cellular telephony.

[1] BMPT stands for the Federal Minister for Post and Telecommunication.

[2] Simon Glynn, Spectrum frequency allocation, 1992.

[3] La Direction Generale des Postes et Telecommunications (DGPT), Les services de radiocommunications mobiles, Juin 1995.

[4] OECD, The economics of radiofrequency allocation, OECD Publications, Paris 1993.

[5] OECD, 1993.

[6] OCDE, Services de communications mobiles et fixes: concurrence ou complementarite ? ,pp50-59. OECD publication, Paris 1995.

[7] Michael Paetsch, 1993.

[8] In April 1995, Cellnet had 1 752 900 subscribers on its analog network, and 41 000 on its GSM network. Vodaphone had 1 685 450 subscribers on its analog network and 194 750 on its GSM network. This means a 51% market share for Vodaphone and 49% for Cellnet (not considering PCN operators).

[9] In April 1995, D1 DeTeMobil (Deutsch Telecom) had 1 010 570 subscribers on its GSM network while D2 Mannesman had 981 000 subscribers. This means a 50,8% market share for D1 and 49,2% for D2 (not considering PCN and analogic services)

[10] William G. Shepherd, Potential competition versus actual competition.

[11] Robert Albon, Interconnection pricing: an analysis of the efficient comparing pricing rule, Telecom Policy, 1994.

[12] La Direction Generale des Postes et Telecommunications (DGPT), Les services de radiocommunications mobiles, pp1-3, Juin 1995.

[13]Jurgen Muller and Saadet Toker, Mobile communications in Europe, in Charles Steinfield, Johannes M.Bauer and Laurence Caby (Ed), Telecommunication in Transition, Sage publication, 1994.

[14] ENST, department of economy, 1990.

[15] Michael Paetsch, 1993.

[16] OCDE, Services de communications mobiles et fixes: concurrence ou complementarite ? ,pp50-59. OECD publication, Paris 1995.

[17] Bruno Salgues, les telecoms mobiles, Hermes, 1995

[18] Bruno Salgues, les telecoms mobiles, Hermes, 1995

[19] The SFR has approximately the same marketing channels. It does not have an equipment subsidiary like FT, and so its number of agencies are slightly lower.

[20] In France the SCS are: Carrefour, Cellcorp (Affiliate to SFR), CMC (Communications de Mobiles Cellulaires), Debitel France (ex-Mades), Hutchison Telecom, Locatel Service (Alcatel affiliate), Motorola Telco, Sagem, Sodira (affiliate to France Telecom), Vodaphone

[21] La Direction Generale des Postes et Telecommunications (DGPT), Les services de radiocommunications mobiles,pp60-61, Juin 1995.

Chapter 5

THE SOCIO-CULTURAL FACTOR

It was revealed in the last two chapters that the slow development of cellular telephony in France could not be adequately accounted for considering only market or regulatory factors. For instance, the mobile communication market, because of its visible presence (For example, who has not already be awakened in a train or a subway by a GSM) has been affected more than other telecommunication markets by intangible social factors that have either promoted the use of cellular telephony (as a social status symbol in Italy), or hindered its social acceptance.

Presently, the social debate is focusing on assessing the socio-cultural impact of a technology that allows anybody to be contacted "anywhere and anytime". France, Germany and the UK all come from the same European unity. They have experienced the same kind of technological development and one can see that the degree of innovation is equal all three countries. So at first sight, there are no strong cultural differences that could explain why the social acceptance of cellular telephony would be different in each of these

countries. Then, the economic factor should prevail over the socio-cultural ones.

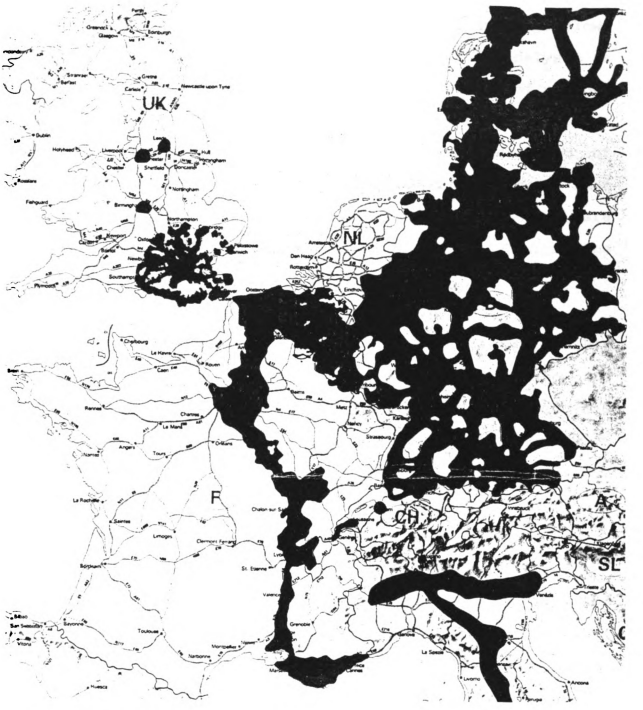
Nevertheless, there are some historical and cultural differences inherent to France that when linked with the particular development of cellular telephony may influenced its slow development. The first section of this chapter will analyze the effect of the French centralizing tendency on the development of mobile systems. Then a second section will analyze how the particular development of cellular systems has impacted the perception of the individual toward cellular telephony. Finally, a third section will outline how a social demonstration has acted as a critical point in the development of mobile communication in France.

5.1 France and the centralizing tendency.

France is a centralized country in many ways. Geographically, economically and culturally this centralizing tendency is prevalent. More than one sixth of the French population lives in Paris or in nearby suburbs while 11% of the UK population is living in London and less than 4 % of Germans live in Berlin. And other than the main metropolitan city in France, there are only two cities with more than 1 million inhabitants in France (Lyon and Marseilles). In the UK, Birmingham and Manchester have more

than 2 million inhabitants, and Leeds Sheffield, Liverpool, Glasgow or Edinburgh are also cities that can counterpart London. In Germany, there are 12 cities that have more than 1 million inhabitants[1]. This French centralizing tendency is also emerging through the rail lines and the road network architecture, since they all lead to Paris. The following map (figure 5.1) reveals this tendency through highway constructions. Consequently, when it comes to coverage of the mobile network, the Parisian area is well covered while the rest of France suffers from a diversified coverage.

Figure 9 - GSM coverage in 1993



Source: France Telecom, 1993.

This centralizing geography is fundamental in the case of cellular telephony. The operator has to be able to separate the traffic flow respectively in vocal, data or image flow, and also to locate the point of emission. This analysis is very important because it allows the optimization of network architecture and the organization of geographic coverage. Location of emission sites and geographic partition of frequencies attempt to answer this question[2]. It means that it is important to search for places were people are "consuming" mobile services. In the case of France, the answer is Paris.

Moreover, Paris is economically the center of France. Big companies try to rebuild what decentralization laws are trying to reform. Headquarters, big decisions and big business take place in Paris while the remaining ones are in the Provinces. Counterexamples in Lyon or Toulouse will not alter this trend. The buying power also concentrates around Paris which is the first target for cellular telephony[3].

Above all, there is a large mentality gap between Paris and the Provinces which is more significant than in any other European country. The French expression "monter a Paris" means that one is going to move from one world to another. One does not say "monter a Londres" or "monter a Berlin", because these cities are economically and culturally opposed. The French Provinces develop other ways of living,

more discrete, more calm, less engaged. The response to cellular telephony would be less popular in the Provinces than in Munich or Manchester.

5.2 Perception about cellular telephony

As mentioned earlier, only 10% of the Radiocom 2000 subscribers had a national coverage subscription due to the lack of available spectrum. Consequently, this poor coverage linked with poor network quality gave the feeling that cellular telephony would result in lost calls and the inability to call from anywhere. And the arrival of the GSM did not alter this social perception. As mentioned by Francois Pilleron, sales director at Ericsson in 1995, "the main obstacle remains the perception that people have about the coverage territory"[4]. In Germany and the UK, the national analog networks were not perceived as inefficient.

Moreover, the transition between analog and digital network has not been very outstanding. In Germany, the reunification helped moving from one system to another. And since the beginning, heavy commercial and marketing investments have been made to favor the transition to cellular telephony from a specialized to a mass product. The enormous need for communication equipment in East Germany required a quick deployment of digital technology.

In the UK, cellular telephony was already considered to be a mass product, and consequently, there was no real need for a clear transition between analog and digital technology.

The arrival of the BI-bop as the alternative technology in 1992 prevented a clear and outstanding transition in France between analog and digital services. Once again, the rhythm of introduction of a new service on an embryonic market is crucial.

France, Germany and the UK have all tried to implement a cordless system. Deutsch Telecom abandoned its Birdie system at the end of 1992. The existing competition (GSM + analog) and that of the future (PCN) were considered as a threat that was not worth the risk of making this service available. In the UK, Rabbit failed, partly due to poor marketing. On the other hand, it is relatively successful in France (even if the goal of 150,000 subscribers by the end of 1994 was not attained). At the end of 1994, the Bi-bop acquired approximately 80,000 subscribers and 10% of the cellular telephone market. Above all, its impact on the perception of the individual with regards to cellular telephone has been of primary concern. France Telecom displayed the Bi-Bop as the symbol of technological advancement in the mobile field. Most of FT's advertising campaigns for mobile services have been directed exclusively to this product. On one hand, its affordability and its

convenient portability demystified the concept of the cellular phone as an expensive and unfriendly technology. On the other hand, the Bi-Bop features (inability to receive incoming calls -in the beginning-, no handover, limited use of services only when near a cell) became characteristic of "every" cellular phone. It is only at the end of 1994 that France Telecom started to market the GSM.

Moreover, the BI-bop is not available nationally. In the beginning, it started with coverage in Paris and Strasbourg, and is now expanding to Lilles and Lyon. Consequently, it gave the impression that cellular phones were mainly a "wealthy gadget for Parisian people". This might have widened the socio-cultural gap between Paris and the Provinces in terms of perception about cellular telephony. Because of this gap, cellular telephony is mainly a Parisian technology. In 1994, more than 1 subscriber of Itineris in 2 was from Paris while more than 80% of the population was covered.

5.3 Relevance of the socio-cultural factor by way of a social event and critical mass theory.

5.3.1 A basic model

The notion of critical mass for mobile communication is hard to evaluate. The figure 3.1 in chapter 3 showed that in the case of France, Germany and the UK, it was hard to relate subscriber's growth to the penetration rate. Thus, there was no "economical" critical mass. Oliver, Marwell and Texeira define critical mass as "a small segment of the population that chooses to make big contributions to the collective action while the majority do little or nothing"[5]. Another definition is given by Noam who describes critical mass as "the smallest number of users such that a user is as well off as a nonuser u(n) = P(n)", with u being the benefits of participation in the network and p the price.

Cellular telephony is the interactive media that allows any member of a community to communicate with all other members at all time and places. Applying critical mass theory to cellular telephony means to study an interactive media[6] which is also a subnetwork of telephony. The concept of utility mentioned by Noam is different for the mobile network. When social utility of the telephone network steadily increases with the first subscribers, the increase in subscribers to the mobile network does not augment social utility at the same rate. In the OCDE countries, where telephone has already reached universal access, the early adopters do not need the mobile network to grow so that the number of subscribers adds to utility. They can call and be called anytime and from any location. Utility is above all

an individual variable: each individual is more or less benefited by using it, but these benefits are not a function of the size of the mobile network. All in all, cellular telephony is the extreme case of interactive media in which an isolated user can obtain benefit from using it.

Coming back to Noam's network tipping model, in the beginning, the function U(n) -benefit of participation in a network-, is not steadily increasing with network size as it is a subnetwork of telephony. In the case of a mobile network, the benefit of participating in this network steadily increases only when a certain amount of people are using the media. Then it becomes a network all by itself and becomes less dependent on the telephony network. It can be shown schematically in figure 10.

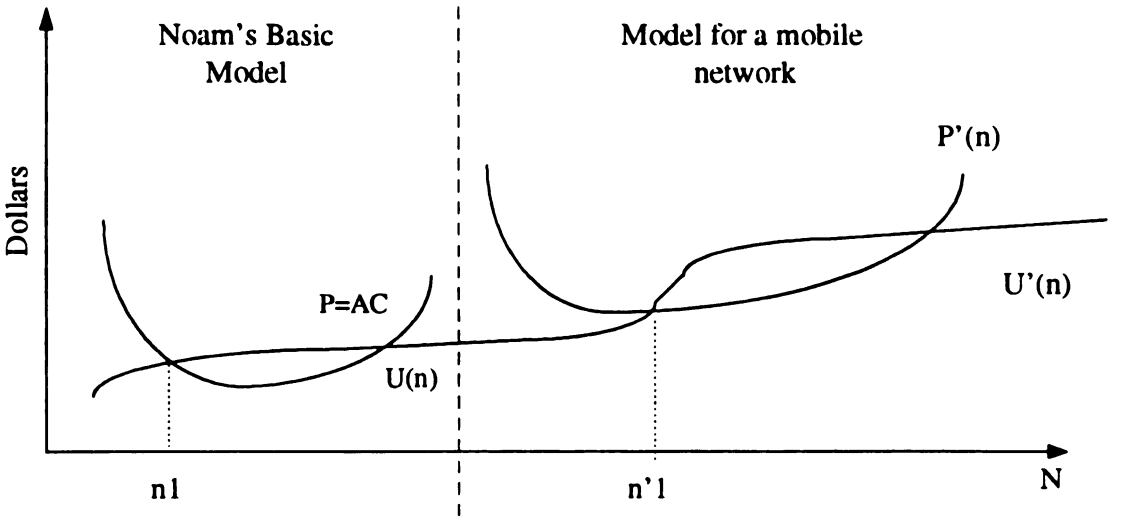


Figure 10 - Critical Mass in a mobile network

Source : Eli Noam, Network Tipping: The rise and the Fall of the Public Network Monopoly. Author's adaptation.

U(n) = benefits of participation in a network.
P(n) = the price of participating in the network.
n1 = critical mass point.

For instance, in terms of communication, when in 1991 in the UK the communication between mobile networks represented only 3% of the communication with a mobile telephone, it is predicted to be more than 20% by the year 2000. Then the media will become an interactive media on its own. People will subscribe not only to call and be called at their convenience, but also to reach others conveniently.

All in all, critical mass can be defined as a sum of individuals which considers individual benefits of participating in the network worth the price. But this sum of individuals varies from one country to another.

If the critical point in the critical mass theory of Noam can hardly be defined in the specific cases of France, Germany or the UK, nevertheless one can talk about some crucial events in the development of these networks.

The social move in December 1995 appears as a critical event. In France, the take off of the mobile market might have been postponed if not for the social movement in December 1995 and the next section will explain how. In the UK, important events occurred in 1992 with prices being suddenly slashed in the analog network or 1993 with the appearance of Mercury on the market. In Germany, following reunification, the appearance of GSM in 1992 is an important date for reaching a critical point.

Whereas critical mass is hard to define, it seems the theory of innovation is more appropriate to explain the relevance of a social event. The diffusion of an innovation has to come through different kind of events, more or less important. An event participates in the diffusion of this innovation but its real impact remains blur.

For instance, Rogers mentions that "an important factor affecting the adoption rate of any innovation is its compatibility with the cultural beliefs of the social system"[7]. Then he analyzes different categories of social change. What Rogers called "selective contact change" is the most relevant to our study. He states that "selective contact change results when members of a social system are exposed to external influences and adopt or reject new idea from that source on the basis of their needs. The exposure to innovation is spontaneous or accidental"[8]. Consequently, different kinds of social (or economic, or political) can facilitate the adoption or the rejection of an innovation.

5.3.2 The French case

This chapter has already described the socio-cultural environment and how it affects the development of mobile communication in France. The benefits of using a mobile

phone were not clearly evident for a portion of the French population.

November and December 1995 have seen the biggest strikes of the last 30 years in France. People were striking against a social security reform, and France was paralyzed for one month. There were 300 miles of traffic everyday in Paris which greatly affected communications. As mentioned by the French newspaper Le Monde, it seems that the strike has shown that mobile communications is not only made up of simple gadgets but that it can be really useful, especially in extreme situations. While there were around 35,000 new subscribers each month before the strike, FT and SFR registered 100,000 new subscribers during the first three weeks of December. New Bi-Bop subscribers have increased 500% from November to December. For the professional, it is no doubt that this growth is linked with the strike in public services. Alain Lenoir, CEO of France Telecom Mobile Telephone, said that "the strikes acted as a trigger mechanism for some people. It revealed that mobile phone was not a gadget, but also a useful tool during isolation"[9].

The growth suggests also that the mobile telephone is now given as a gift to a close person. French are using more and more mobile communications in their business life, but also, more recently, in their private life. This indication shows that mobile phones have finally become a mass product,

and so have finally attained a "critical segment of the population".

5.4 Conclusion

This chapter shows the importance of the socio-cultural factor on the development of cellular telephony in France. First of all, it notes the relevance of the French centralizing tendency. Then it analyzes how the introduction of the Bi-Bop has impacted the perception of the individual toward cellular telephony. Finally, the critical mass model developed in the last section aims to confirm the strong impact of the socio-cultural factor by linking a social event to the critical mass point. It also shows that the uneven development of mobile communication in France, Germany and the UK can partly be explain through the analysis of critical mass.

This chapter did not really focus on the social debate about the use -or not- of cellular telephony. Mobile communications is often referred to as a technological tool that will be an essential element of our personal liberty in the close future.

"Mobile communications stand at the forefront of this move toward liberalization because they allow each of us to use our time most efficiently. If I can return business calls

while driving home from work, I can spend more time at home with my children. Any intrusions in our private time are intrusions that we have chosen, often in order to have more or better quality"[10].

Yves Lafargues, in 1992, questioned the connection of the business and private life through communication tools. He mentions the harassment by the telecommunication sector. It would be interesting to study how the differentiation between private and business life within a social system can affect the adoption of a technology such as cellular telephony. France is often characterized as a country that clearly separates their private and their business life, a trait that may be different for Anglo-Saxons and Latin countries. In a technology-oriented French Telecommunication magazine Telecom interview, one could expect to welcome technological moves such as mobile telephony. Then, it is surprising to note its conclusion. Eric Fries outlines that cellular telephony is going to change our lives... and he describes all the everyday life situations where cellular telephony is able to disturb our lives[11]. This example confirms the perception of cellular telephony in France before the strike. Then, this social demonstration helps understand, via critical mass theory, the recent development of mobile services in france.

[1] Cities with more than 1 million inhabitant in Germany in 1995.

City	Population in million
Aachen	1.0
Berlin	3.3
Biedefeld	1.3
Cologne	3.0
Dusseldorf	3.0
Essen	6.5
Frankfurt	3.6
Hamburg	2.6
Mannheim	1.6
Munich	2.2
Nuremberg	1.2
Stuttgart	2.6

[2] Bruno Salgues, les Telecoms mobiles. 1995, Hermes.

[3] Eric fries, Introduction, Telecom Interview, Revue de l'association des anciens eleves de l'Institut National des Telecommunications, Numero 27, pp.2, Decembre 94.

[4] Stanislas Noyer, Telephone mobiles, La course aux abonnes, Les enjeux, Octobre 1995, pp.98-101.

[5] Oliver, P.E., Marwell, G., and Texeira, R., A theory of critical mass I, Interdependence, group heterogeneity, and the production of collective action, American journal of sociology, 1985.

[6] Markus Lynne, Toward a "critical mass " theory of interactive media, in Organization and communication Techonology edited by Janet Fulk and Charles Steinfield, 1990.

[7] Everett M. Rogers with Floyd F. Shoemaker, Communication of innovations: A cross-cultural approach, pp.5, The Free Press, New York, 1971.

[8] Everett M. Rogers with Floyd F. Shoemaker, Communication of innovations: A cross-cultural approach, pp.9, The Free Press, New York, 1971.

[9] Jean-Michel Norma, La diffusion des outils de telecommunication mobiles s'accelere, *Le Monde*, 15th of December 1996.

[10] Phillip L. Spector, Wireless communications and personal freedom, Telecom policy, August 1993.

[11] Eric fries, Introduction, Telecom Interview, Revue de l'association des anciens eleves de l'Institut National des Telecommunications, Numero 27, pp.2, Decembre 94.

Chapter 6

CONCLUSION

In this document, the slow development of cellular telephony in France has been qualitatively defined through a comparative analysis with Germany and the UK. This study has been separated in three different level of analysis (micro-macro variables, and the socio-cultural environemnt). In order to understand the development of the cellular network in France, and in any other country, it is necessary to consider these three level of analysis. If the micro variables have been directly related to penetration rate, it has been shown that they could not explain everything. Not only the macro variables help understand how micro variables evolved, but they also may impact on the social perception of this technology.

Nevertheless, it is possible to highlight the main factors that explain the lag of the cellular network in both the analog and the digital network. This lag in the analog system was mainly a consequence of the global disinterestedness in the main actors (France Telecom, the manufacturers and the DRG). The use of an inappropriate national standard considering the lack of spectrum

prevented the demand from freely developing. Moreover, it was shown that a better price policy would have been beneficial. The comparative example of the German network showed how a quick reaction to the market moves and an adequate pricing policy allowed the market to grow. Nevertheless, at the end of 1991, Germany and France experienced the same penetration rate which was in the EC average.

The introduction of a Pan European solution to the GSM aimed to redistribute the various factors that attempt to explain the national differences. The EC set up a Memorandum of Understanding (MoU) which required different measures to favor an adequate development, such as the Open Network Provision. Consequently, the influence of the national regulatory bodies have become restricted because they are partially dictated by the EC. "The global objective of the proposed positions is to allow European-wide markets to develop and barriers to be lifted"[1]. If regulatory differences remain between countries, they tend to decrease. The introduction of GSM has been accompanied by a fundamental change with regard to the provision of the Telecommunication services in these countries. The French and German previously monopolistic PTTs have begun liberalizing their market. In 1996, France, Germany and the UK will experience almost the same kind of competition: 3 services (Analog, GSM and PCN), 3 different operators for

France[2] and Germany[3], and 4 for the UK[4]. And while the effects of the European approach were visible in most European countries(especially in the countries that had a low penetration rate in 1991 -Spain, Belgium, Portugal, Luxembourg-), the French cellular market was still attempting to flourish.

The analysis of market variables in chapter 3 reveals that the price has decreased significantly in France -especially when being compare to Germany- but still remains higher than in the UK. Despite this improvement the French growth lagged behind Europe in the beginning of 1995. When comparing France and Germany, it is important to note that the German network is not experiencing a significant growth due to internal factor such as the reunification. Table 2 in Annex 1 reveals that the German growth remains slower than the EC average. Then, the French network is trailing behind the most in cellular telephony.

A first explanation of the lack of success of GSM technology -technology therefore developed by a French research center- has been given through the analysis of the rhythm of introduction of competition and the effectiveness of this competition. Not only a fair regulatory environment is necessary to insure an efficient competition but the timing of the introducing of this competition is also important. SFR did not have enough cash flow to

develop a GSM network 4 years after having received the authorization to implement an analog network. Moreover, the development of a cordless system in a few big cities has prevented France Telecom to focus more on the most promising technology: GSM. Consequently, it delayed the transition from a business product to a mass market product.

This critical transition, and the notion of critical mass, has been analyzed in chapter 5. It has been concluded that the strikes of 1995 have prompted a shifting in how individuals perceive mobile communications. When studying intangible factors such as the socio-cultural environment of a country, it is difficult to make clear assumptions. It will take time to see if the strike of December 1995 in France has really acted as a critical point in the development of cellular telephony in France. Nevertheless, the figures in December 1995 and January 1996 are tending to support this thesis. But more than a critical mass theory on mobile network, the study tried to bring out the significance of the socio-cultural factors to explain the current slow development of cellular telephony in France. When factors such as price and spectrum inefficiency are obviously important in explaining the French lag, the socio-cultural environment can not be neglected.

However, this study is limited, and should only be taken as a tentative attempt to analyze the various factors that influenced cellular telephony in a particular environment, mainly France. When considering the results of the study, one should keep in mind several limitations.

First, the study remains qualitative. The objective of the brief statistical analysis in chapter 3 was to scientifically relate the influence of some market variables -and especially three kinds of prices- to the variance of the penetration rate. But this analysis remains incomplete because of the lack of scientific relation in all the market variables. This limitation may be lifted through further studies. It needs to integrate statistical data on the coverage of the territory and the population.

However, rational on which the explanation is based has been discussed in the literature, and most of the factors inherent to one country have already been observed several times in different countries.

[1] European Commission, Towards a personal communication environment, The Green paper on a common approach in the field of mobile communications in the European Union, April 1994.

[2] France Telecom and SFR (Analog + GSM), and Bouygues (PCN)

[3] Deutsch Telecom (Analog and GSM), Mannesman (GSM), Veba (PCN)

[4] Vodaphone and Cellnet (Analog and GSM), Mercury and orange (PCN)

APPENDICES

Appendix

Table 1. Appendix A: Data from several European countries in 1991.

	Penetration rate[1]	Fixed Charge (US $)[2]	Usage charge (US $)[3]	Terminal price (US$)	GDP per capita (ECU)[4]	Launch (in months)
Sweden	70.0	93.37	882.97	1140	22100	111
Iceland	53.7	87.96	380.16	1330	19600	54
Denmark	34.7	103.32	602.88	1470	21300	108
Switzerland	26.4	377.98	398.25	2010	23000	40
UK	21.6	498.69	1336.08	600	17800	62
Italy	9.9	461.76	931.99	1590	16600	64
Ireland	9.0	462.96	1229.90	1110	10900	61
Germany	6.5	440.99	1961.56	2530	18700	64
Netherlands	7.9	492.21	1040.30	1720	16400	72
France	6.7	929.56	1218.88	2190	17800	62
Belgium	5.1	484.69	923.32	2140	16800	45
Spain	2.8	720.26	997.88	2780	11400	103
Luxembourg	2.1	1526.72	990.29	2150	21000	66
Portugal	1.2	660.60	1368.63	2700	7800	24

[1] Michael Paetsch, Mobile communications in the US and Europe: Regulation, technology and market, mobile communications series, 1993.

[2] OECD communications outlook, 1993 Paris.
The basket is weighted so that the fixed charges are one fifth of total charges. the fixed charges include monyhly rental plus one fifth of the initail connection charge.
The usage basket includes a basket of 2783 calls of different distance and duration made at different times of day or week

[3] OECD communication outlook, 1993, Paris.

[4] Eurostat, the European statistical body.
The datas are of 1991. Found on the World Wide Web at : http://www.cec.lu/en/comm/eurostat/eurostat.html

Multiple Regression

Equation Number 1 Dependent Variable.. PENETRATION RATE

Block Number 1. Method: Enter TOTAL

Variable(s) Entered on Step Number
1.. TOTAL

Multiple R	.72610
R Square	.52723
Adjusted R Square	**.49346**
Standard Error	**15.43364**

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	1	3718.83908	3718.83908
Residual	14	3334.76030	238.19716

F = 15.61244 Signif F = .0014

---------- Variables in the Equation ----------

Variable	B	SE B	Beta	T	Sig T
TOTAL	-.014669	.003713	-.726103	-3.951	.0014
(Constant)	69.168603	12.869700		5.375	.0001

Multiple Regression

Equation Number 1 Dependent Variable.. PENETRATION RATE

Block Number 1. Method: Enter TOTAL GDP SINCE

Variable(s) Entered on Step Number
1.. SINCE
2.. TOTAL
3.. GDP

Multiple R	.83180
R Square	.69189
Adjusted R Square	**.61486**
Standard Error	**13.45761**

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	3	4880.31077	1626.77026
Residual	12	2173.28861	181.10738

F = 8.98235 Signif F = .0022

---------- Variables in the Equation ----------

Variable	B	SE B	Beta	T	Sig T
TOTAL	-.010940	.003595	-.541506	-3.043	.0102
GDP	.001357	9.2941E-04	.265647	1.460	.1700
SINCE	.234701	.144305	.279844	1.626	.1298
(Constant)	16.679590	24.666820		.676	.5117

Multiple Regression

Equation Number 1 Dependent Variable.. PENETRATION RATE

Block Number 1. Method: Enter FIXED USAGE TERMINAL

Variable(s) Entered on Step Number
1.. TERMINAL
2.. USAGE
3.. FIXED

Multiple R	.78969
R Square	.62362
Adjusted R Square	.52952
Standard Error	14.87411

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	3	4398.73112	1466.24371
Residual	12	2654.86826	221.23902

F = 6.62742 Signif F = .0069

---------- Variables in the Equation ----------

Variable	B	SE B	Beta	T	Sig T
FIXED	-.031106	.011817	**-.526518**	-2.632	.0219
USAGE	-.017595	.010306	**-.316751**	-1.707	.1135
TERMINAL	-.006306	.006020	**-.202883**	-1.047	.3155
(Constant)	65.544700	13.429701		4.881	.0004

Linear Regression

1.. USAGE / FIXED

Multiple R	.29445
R Square	.08670
Adjusted R Square	**.02147**
Standard Error	363.09120

2. TERMINAL / FIXED

Multiple R	.40242
R Square	.16194
Adjusted R Square	**.10208**
Standard Error	347.81398

3 TERMINAL / USAGE

Multiple R	.16116
R Square	.02597
Adjusted R Square	**-.04360**
Standard Error	398.80188

Table 2, Appendix A: Relationship between penetration rate growth and charges in April 1995.

	Penetration rate growth in April 1995[5]	Fixed charges (US$)[6]	Usage charges (US$)[7]	Total charges (US$)
Sweden	7.22	204	2876	3080 (6)
Finland	5.05	150	2545	2695 (1)
Norway	4.48	95	2773	2868 (4)
UK	2.57	568	2442	3010 (5)
Denmark	2.54	243	2558	2801 (3)
Italy	1.55	478	2290	2768 (2)
Germany	1.11	645	5003	5648 (13)
Austria	1.08	524	3536	4060 (10)
Portugal	1.06	610	3050	3660 (7)
Greece	1.02	645	3305	3950 (9)
Belgium	0.98	882	3276	4158 (11)
Switzerland	0.61	806	4295	5101 (12)
France	0.54	551	3376	3927 (8)

Penetration rate growth in April 1995 means the increase of the penetration rate in April 1995. 0.54 in Fance means that the penetation rate has increased from 0.54 from Mars to April. The penetation rate was 15.36 in March 1995, and 15.91 in April 1995.

[5] Ministere des technologies de l'information et de la poste, Direction generale des postes et telecommunciations (DGPT) - Juin 1995.

[6] Fixed charges are : Connection fee + 12 * monthly access fee

[7] Usage charges are: 100mn of peak rate calls per week and 40mn of off-peak rate calls per week and during a year.

Multiple Regression

Equation Number 1 Dependent Variable.. PENETRATION RATE

Block Number 1. Method: Enter FIXED USAGE

Variable(s) Entered on Step Number
1.. USAGE
2.. FIXED

Multiple R	.80727
R Square	.65169
Adjusted R Square	**.58203**
Standard Error	**1.33273**

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	2	33.23257	16.61628
Residual	10	17.76182	1.77618

F = 9.35506 Signif F = .0051

---------- Variables in the Equation ----------

Variable	B	SE B	Beta	T	Sig T
FIXED	-.006609	.001857	-.796573	-3.559	.0052
USAGE	-5.09919E-05	5.9732E-04	-.019105	-.085	.9337
(Constant)	5.710470	1.631511		3.500	.0057

Multiple Regression

Equation Number 1 Dependent Variable.. PENETRATION RATE

Block Number 1. Method: Enter FIXED

Variable(s) Entered on Step Number
1.. FIXED

Multiple R	.80712
R Square	.65144
Adjusted R Square	**.61975**
Standard Error	**1.27118**

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	1	33.21963	33.21963
Residual	11	17.77476	1.61589

F = 20.55813 Signif F = .0009

---------- Variables in the Equation ----------

Variable	B	SE B	Beta	T	Sig T
FIXED	-.006696	.001477	-.807116	-4.534	.0009
(Constant)	5.591448	.808177		6.919	.0000