

Making decision on innovation : the example of UMTS (Universal Mobile Telecommunications System) in Europe

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1. INTRODUCTION

The landscape of UMTS in Europe unravels . The initial impetus was given by strong European equipment makers, followed by the European Commission. Japanese were ahead, and rapidly passing from second generation mobile telephony (allowing the transmission of voice, only) to third generation (allowing the transmission of voice and data at a high speed) was considered a necessity . National States could choose the mean, to select operators (bids or « beauty contests ») . Some have chosen bids, other beauty contests . The licences have been awarded in most of the European countries . The surprising event was the high prices paid at the time of the early bids (United Kingdom, Germany) and the comparatively low prices paid at the time of the latest bids .

In this text, we try to explain all the process, by using tools coming from the theory of games . Complex models for successive bids exist, but we cannot use them . We shall use simple models, allowing qualitative reasonings on the situations which were observed during the process.

Briefly, we saw the appearance of a few global operators, paying high prices at the time of the earlier bids, to obtain a reputation . They have revealed their project (to buy many licences) at the beginning of the process . We shall demonstrate that an opposition to these operators, later, was impossible . The possibility of buying or selling assets, was useful to some global operators to succeed in their project (or to catch up) . Also, bids and beauty contests (with no price paid, or a low price) are equivalent from the point of view of the operators (but not from the point of view of the States).

Finally, there are in the sector a few global operators, active in most of the European countries, some strong operators active in several countries, and local operators active in a single country . As investments are huge (to buy the licences, to roll out the networks) , there is a question on the future behaviour of the industry . Either it will be innovative . Either it will be the kind of behaviour called « strategic competition » by Chandler (prices being not lowered, agreements between competitors ...) .

First, we shall tell the « Story » . Then, we shall expose the methodology.

2. THE «STORY»

Let us classify the concerned operators (the bidders) in four groups :

- Global operators⁽¹⁾ . They are active in most of the European countries .
- Strong operators⁽²⁾ . They are active in several European countries .
- Local operators . They are active in a single European country .
- Victims⁽³⁾ .

We know the names of the operators in each group, only after the bids . If an operator is really in the group of the « global operators » , it will buy many licences, and its profit per user will be big :

$$P = R - L_m - c_m .$$

P : profit per user .

R : revenue per user .

L_m : mean price of the licences, in all the European countries, per user .

c_m : mean cost to roll out and operate the networks, in all the European countries, per user .

We suppose that R is the same for all the operators . L_m is not so high, because if L is high at the time of the earlier bids, it is low at the time of the last bids (we shall demonstrate that) . The cost c_m is of low value because of two reasons :

- Economies of scale . The global operators obtain lower prices from the equipment makers, because they buy huge quantities . When they operate the networks, the costs are lower . Also, the costs of advertising are lower (they have a global brand) .
- Cost of roaming . For pan-european operators, roaming agreements are not necessary . They can sell services at an european level, at a low price . For the other operators, agreements are necessary . The costs of roaming services are higher.

The prices paid at the time of the earlier bids were high . Being ready to pay for licences at high prices, some operators reveal that they are global operators . Accepting these prices, they show their involvement in the project of a global operator . If the number of the would be global operators is high, the prices at the time of the earlier bids, are high . In the case of the UMTS licences, the global

(1) Vodafone, France Telecom and at a lesser degree, Telefonica and Hutchison . Deutsche Telekom is not a global operator at the European level, having chosen to enter the US market (buying Voicestream) .

(2) Deutsche Telekom, Telecom Italia, British Telecom .

(3) Mannesmann, KPN . Mannesmann was bought by Vodafone, then dismantled . KPN, having bought the German operator E-plus and a licence in Germany, is too heavily loaded with debt .

operators were four . With Mannesmann, they were five, too many . Mannesmann being the weakest (and an interesting target, being essentially a mobile operator), was bought by Vodafone, allowing this operator to be active in Germany with D2 and its UMTS licence, and in Italy with Omnitel . Then Vodafone sold Orange (bought by Mannesmann) to France Telecom, allowing this operator to catch up and join the group of the global operators⁽⁴⁾ . This part of the story is explained by the theory of games (bargaining games) . According to the theory, when two buyers want to buy an asset, the seller chooses the buyer for which the value of the asset is bigger (the proposed price is higher)⁽⁵⁾ .

Why revealing their projects is advantageous to the global operators ? In the last bids, the prices are low, if we take into account the high value of the licences, for these operators . The prices correspond to the lower value of the licences for some strong operators, and local operators . An opposition is impossible . Predation would be terrible for a global operator, because it makes huge expenses and borrows money . What operator would be the predator ? For a single local operator, it is impossible⁽⁶⁾ . We can imagine two local operators, or a kind of « league » of local operators . The first takes the risk of being the winner, and the second, at the time of an other bid, later, buys a licence at a low price (it is the effect of the predation) . The contract between them is impossible . What operator will be the first (it takes the risk) ? How to share the benefits ? How to forecast, and share, the costs ? A powerful operator could do that⁽⁷⁾ , but either it is already a global operator (buying a licence in each country, surely) either it is a strong operator (buying licences in some countries where it is interested in being active, surely) . In this reasoning, we suppose that the bidders know what are the global operators . It is known because of the high prices at the time of the earlier bids . An operator choosing to predate because it does not know that the « target » is resolute, is avoided .

The last point is the equivalence between a bid and a beauty contest, from the point of view of the operators . In a bid, an operator pays money . In a beauty contest, it accepts a loss in the future, when it will operate a network not very rentable, rolled out in peripheral regions . From the point of view of the operators, it is the same : the benefit of the project is the same, and the effect (to be a winner or not) is the same . However (but it is difficult to demonstrate that) global operators could prefer bids at the time of the earlier sales of licences . It was the case in the United Kingdom and in Germany . Perhaps, only a high price displays the involvement of a global operator (a total coverage being insufficient) . We suppose that the price displaying an involvement is p , the bigger loss (with a total coverage of the country) being p' , and $p > p'$. This is not the point of view of the States (we consider this question later).

Finally, when the process of the bids is ending, we know what operators are in each group . Each group corresponds to a kind of project, and a kind of behaviour at the time of the bids .

3. THE METHODOLOGY

We use schemes coming from the theory of games, which are useful to explain some points :

3.1 Model of bids

In a simple model of bids, there are two bidders, each proposing a price . Then, the winner is the bidder whose price is higher. The value V of the project (the benefit from purchasing the asset) , V , is known by each bidder, but it does not know what is the other's value . The optimal strategy is to propose the price $p = V/2$. Therefore the bidder whose project is of bigger value, is the winner . It is efficient, because the total surplus is bigger⁽⁸⁾ . It is the same for the firm, to pay a price or to accept a loss (because of a coverage beyond the requirements) of the same amount . The result of the sale of the licences will be the same . In a country where the problems in the peripheral regions are not too serious (or it is considered that they are not too serious) , the bid is chosen . In a country where the problems in the peripheral regions are serious, the beauty contests will be chosen, because the political welfare is

(4) Mannesmann was excluded from the group of the global operators, when it was bought and dismantled . Similarly, KPN was excluded from the group of the strong operators . Now, it is not able to find money to finance its activity, because of its huge debt . We see two forms of the « winner's curse » . Either the firm does not survive, either it survives in a bad financial situation .

(5) For this reason, the shareholders of Mannesmann chose to sell Mannesmann to Vodafone . The same theory explains why KPN paid for E-plus at a too high price . The price paid by the buyer is higher because another firm wants to buy the asset . When KPN bought E-plus, France Telecom wanted to buy E-plus, too .

(6) If it wins, it is the winner's curse . If it does not win, there is no loss, but why to take the risk of the winner's curse, if there is no gain ?

(7) There would be no contractual problems . The same firm would make a loss (when predated) and have a benefit (when buying a licence at a low price) .

(8) The firm E_1 (with a value of its project V_1) is more efficient than the firm E_2 (with a value V_2) , since $V_1 > V_2$. For instance, its cost is lower . Therefore it creates a consumer' surplus which is higher ($S_1 > S_2$) . The total surplus is $S_1 + V_1 > S_2 + V_2$. There are three parts : $V_1/2$ (for the State) , $V_1/2$ (for the firm) , S_1 (for the consumers) .

bigger⁽⁹⁾. In theory, the requirements could be chosen to maximize the total surplus, but it requires the value V of the more efficient operator, known by the regulator⁽¹⁰⁾.

In a complex bid (with more than two bidders), each bidder proposes a price « corresponding to the value of its project ». Let us define three values :

V_1 : value of the project of a global operator .

V_2 : value of the project of a strong operator .

V_3 : value of the project of a local operator .

$V_1 > V_2 > V_3$. Therefore : $p_1 > p_2 > p_3$.

The winners in a bid will be the global operators (which are bidders), the strong operators (which are bidders), one or two local operators⁽¹¹⁾. For instance, a local operator which is an incoming firm could be a loser. The value V of its project is low, and the price proposed p is low. V is low because it has no customers. Also, it has to obtain agreements with a 2G operator, to allow roaming to its customers (in the regions where its 3G networks will not be rolled out). Thus, for customers, calls and data transmission through GPRS (General Packet Radio Services) are possible. The incumbent firms have not to cope with these problems. Perhaps, an incoming global operator can solve these problems, but not an incoming local operator.

3.2 The number of successive periods and the reputation

If the number of the periods of a repeated game is bigger, the reputation is easier to obtain. In a well known game, the « Selten's chain of supermarkets », the incumbent firm is active in n markets and is threatened by an incoming firm in each market. If the incoming firm enters the market, the incumbent firm chooses either predation (with a smaller gain if it predated). Using a recurrent reasoning, one demonstrates that each incoming firm enters the market. Now suppose two types of incumbent firm, « strong » and « weak ». If the incumbent firm is of the strong type, by predating it gains more than by adaptation. The weak type is as in the case of the « Selten's chain of supermarkets ». The incoming firm has a belief x_i on the type of the incumbent firm (it is the probability of the incumbent firm being strong). When the number of the markets is bigger, it is easier to the incumbent firm to obtain the reputation of a strong firm. The first incoming firm does not enter the market, if $x_i > 1/2^{n-1}$ ⁽¹²⁾.

Similarly, it is easier to benefit from a reputation of « global operator » when the number of bids is bigger. However, it is necessary to reveal the project of a global operator. If there are too many operators with the ambition of a global operator, high prices at the time of the earlier bids will result in a smaller number of operators having the reputation of being global operators.

3.3 Predation

The theory of games allows to study predation. For instance, there are two firms, a « strong » firm and a « weak »

firm, in a market. The strong firm has the capital which is necessary to invest at the time of the second period. The weak firm is obliged to borrow money (partially or totally) to invest, at the time of the second period. If the strong firm predated, it chooses a low price during the first period. The benefit of the weak firm during the first period is smaller, it has to borrow more money at the time of the second period, and it prefers to give up. From the point of view of the strong firm, its benefit is smaller during the first period, and bigger during the second period (it is the monopoly profit). If the sum of these two profits is bigger when it predated, than when it chooses adaptation, it predated.

Therefore, predation is possible when a firm is supposed « weak » for financial reasons. In the process of UMTS licences, some global operators were obliged to borrow money. However, the predator is a strong firm (as it is showed by the theory).

Either it would be a global operator (but it has been successful in revealing its project), either it is a strong operator (but it is able to obtain several licences, and does not need to predate). There is no any bidder which could choose to predate.

3.4 The bargaining game theory

With this theory we can explain both the result of the « winner's curse », and one of its causes :

- When Mannesmann revealed that it wanted to be a global operator, it was bought by Vodafone. Thus Vodafone appeared as a global operator (having bought operators in Germany and Italy). Also, France Telecom, when it bought Orange to Vodafone, appeared as a global operator. Probably, Mannesmann was able to be a strong operator (active in Germany and Italy). When it bought Orange in England, and obtained an UMTS licence, it was clear that it wanted to be a global

⁽⁹⁾ The surplus is either :

$V + S$: V , value of the project corresponding to the requirements S , consumer's surplus .
either :

$V/2 + S'$: S' consumer' surplus when the operator accepts a coverage beyond the requirements (its loss being $V/2$). Of course, $S' > S$. In principle, the political welfare is taken into account. The services being at disposal in peripheral regions, is a political goal. In these conditions, the second total surplus is considered bigger.

⁽¹⁰⁾ If t is a parameter for the coverage, the regulator chooses the value of the parameter :
 $dV/dt + dS/dt = 0$.

⁽¹¹⁾ We suppose that the winners are the operators proposing the higher prices $p_1 > p_2 \dots > p_n$, n being the number of the licences sold. The price paid is (approximately) p_n .

⁽¹²⁾ To simplify we suppose that there is $m : x_i > m$. The smaller $n : 1/2^{n-1} < m$ is n_0 . The incumbent firm is sure that there will be no entry, at the time of the $n - n_0$ first periods.

operator, and it was too ambitious . When the asset to be sold is of greater value for a buyer, it is this buyer which buys the asset . D2 in Germany and Omnitel in Italy were assets with greater value when possessed by Vodafone, therefore the Mannesmann's shareholders sold Mannesmann to Vodafone . In the group of the global operators, there was a member less . France Telecom, with Orange and its licence in England, appeared clearly as a global operator .

- When KPN bought E-plus, it was the way to the « winner's curse » . The theory shows that the price of an asset is higher when there are two buyers . KPN paid for E-plus a high price, because there was an other buyer, France Telecom. Then KPN paid for a licence in Germany at a high price . The result was a heavy debt . It is a case of « winner's curse».

When a firm buys an asset and pays for it at a high price, there is a loss . Later, the value of this asset is depreciated . If the depreciation of the asset is important at the beginning, the fiscal gain is immediate . It is an incentive, to buy assets at high prices . However, always the loss exists.

Finally, the possibility to buy assets allows operators to choose their project . For the buyer, the risk is to pay for an asset at a too high price . If it is the case, the operator does not succeed in its project . The bargaining game theory explains this kind of situation .

4. CONCLUSION

To tell the « story » of the UMTS bids in Europe, we have used several arguments :

- A simple model of bid shows that a bidder proposes a price equal to $V/2$, V being the value of its project . With this model of bids, we can explain successive bids in a single country (provided that there are two bidders when a licence is sold) . First, a licence is sold through a bid . After that, a second licence is sold through a bid . The same reasoning is available . However, some conditions are required⁽¹³⁾ . In the case of successive bids in different countries, the number of licences sold in each country being more than two, it is more complex . There is a correlation between the price chosen by a bidder, and the value of its project . With a price equal to 90% of V , it takes the risk of the « winner's curse » (if the evaluation of the value is not absolutely sure) . With a price of 10% of V , it is not sufficiently ambitious . The bidders the project of which are of greater value, are the winners .
- The « global operators » obtain a reputation at the time of the earlier bids, accepting high prices . Each of them displays an involvement in the project of being a global operator . In the latest bids, the price that they pay for the licences, is lower .
- The possibility of buying assets gets the game harder . An operator can enter the « upper level group », by buying an asset, before the bids or during the bids . There is a paradox, here . The same means used to play at a higher level, are used against the player having used it, if its behaviour is too risky (it is the story of Mannesmann and its rivals) . It is because the sale of an asset is either chosen, either not solicited .
- When high prices are accepted by the global operators, at the time of the earlier bids, it corresponds to two goals . First, they obtain a reputation . There will be no predator, after that . There will be no bidder which wants to oblige such an operator to give up, during a bid (it would be a drawback, because of a higher price of the licence)⁽¹⁴⁾ . There is a second goal . It is necessary that the global operators are not too many . If there are too many global operators, the less efficient bidder buying a licence will be a strong operator . The price corresponding to a competition between strong operators is higher than the price corresponding to a competition between local operators . It is this situation when there are a few global operators . It is interesting to the global operators, to be a few only, as the price paid will be lower, since it corresponds to a local operator being the less efficient bidder buying a licence .

Finally, the winners are global operators, strong operators and local operators . For a long time (about twenty years) they will have no new competitors . They have huge sums of money to spend (buying the licences, rolling out the networks) . The question of their behaviour is posed . In a « Schumpeterian » scenario, the demand is big, operators are innovative . In a « Chandlerian » scenario, the operators have the behaviour of an oligopoly . « Strategic competition » according to Chandler would consist in prices which are not low, shared networks, some competition through quality (even if it is the consequence of the regulators' controls) . From the point of view of the consumers, the first scenario is preferable . It requires an efficient management from the operators .

We cannot avoid the question of the success or failure of UMTS in Europe . Our opinion is that UMTS in Europe can be successful . It corresponds to three trends, trend to mobility, trend to individualism, trend to professional services :

(13) For instance, increasing costs and a concave demand . We consider a competition through quantities . The more efficient firm is the winner . The growth of the total surplus is bigger . We can consider a competition through prices . In this case the two bidders sell the same product, different from the product sold by the incumbent firm (the firm with the first licence) . The two products are partial substitutes . The winner is the more efficient firm (its cost c_1 is lower, $c_1 = c + \Delta c$, Δc constant, $\Delta c < 0$) . Each price is lower .

(14) Here, a difficult question is posed, about the behaviour of the other bidders, at the time of the latest bids . Are they « afraid »? Or do they fear only some operators, those which have accepted high prices? The first hypothesis would be bad, from the point of view of the global operators . Happily, from the point of view of these operators, this hypothesis is not correct . The second hypothesis is correct .

In the first hypothesis, a free rider would be possible . An operator let other operators accept high prices, then buy licences at a low price, benefitting from the effect provoked by the other operators . Here the risk is all the ambitious operators choosing this behaviour, since the profit is bigger . Nothing would happen . Obviously, this behaviour is impossible . An operator having not accepted high prices, has not the reputation of being a global operator . An other bidder can believe that it will give up (even if it is not true) , and the result will be a higher price of the licence .

- Trend to mobility . If people do not move, increasing distant communication means the success of fixed telephony . However people move more and more . It is proved by the growth of the transportation sector (when it concerns persons) .
- Trend to individualism . According to Simmel, the penetration of money allows more individualism, in the modern society . It is because of the reduced form of wealth (a check of a big amount) , abstraction of money, and the possibility of acting from a distant place . All this allows some secrecy to an individual . Individualism is strengthened, as there is this choice, to reveal or not a secret . If communication is indispensable to social life, some secrecy is also necessary, allowing links between very different individuals . When acting from a distant place matters, telecommunications in general are useful . Mobile phone completes this kind of liberty . Obviously, the user of a mobile phone can reveal, or not, from what place he (or she) makes the call . The use of a mobile phone is individual, and the use of a fixed line is inside family .
- Trend to professional services . Currently Intranet and Extranet are expanding in European countries . It is better if these Internet services can be accessed by moving people . For instance, it could be useful to up level sales people . More and more, sales people are responsible of a product, not a geographical zone . They use the databases of their firm more efficiently, as the numbers have a sure meaning when they are global (regional variations compensate one another) . Finally, up level sales people make more trips . UMTS will be useful for them, to keep contact with their firm, making calls or retrieving information from the Intranet of their firm, during a trip . The Hashimoto's paper shows that the change has begun in Japan (in the big firms producing consumer goods) . The level between the headquarters and the local agencies wins more and more responsibility in sales . There are several causes of this change, but one is that trips are easier (one reason is that mobile phones can be used) .

Probably, voice and professional services will be the main segments of UMTS . UMTS phones could be used very much for calls . According to Simmel, large social circles are established on social contents, which are standard . For this Internet is adequate . UMTS phones could be used to retrieve data . Small social circles suppose more personal contents . Here, voice is often used . In the modern society, an individual is at the intersection of many homogeneous social circles, in a unique way . To be in one of these social circles implies contacts with the other members of the circle . Circles are homogeneous, and constituted with heterogeneous individuals . In the case of small circles, the communication is not coded (voice) . Also, inside the smaller circles (family, friends) , voice is used when the contact corresponds to a distant communication .

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