3G MOBILE POLICY:

THE CASE OF SWEDEN

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1 Background Information

Undisputedly, the two biggest success stories in telecommunications over the last decade have been the Internet and the mobile phone. It is their seamless combination that heralds the promise of information access on the move. However, in order to provide mobile data communications, different technological solutions will need to be combined in order to provide transparent access to mobile services and applications. Third Generation Mobile Communication, according to the UMTS standard, will obviously be one part of the infrastructure providing seamless information access. The market-introduction of the technology will influence the way mobile access will be provided. Moreover, the process of providing 3G licenses has influenced the way the technology will be rolled out.

This case study investigates the implications of a "beauty-contest" as the method for making available 3G licenses in Sweden. The outline of this report follows. In the next section, background information is provided on the 3G licensing process in Sweden. Section 2 describes the organization and the outcome of the Swedish 3G beauty contest. Sections 3 and 4 present the impact of the licensing process on market dynamics – e.g., the role of cooperation and the changing position of incumbents. Section 5 discusses several issues of importance related to deployment of 3G, including pricing and billing, roaming and terminals. Finally, in Section 6, some questions and issues arising from this study are discussed.

1.1 Country specifications

Sweden has an estimated population of 8,9 million with a growth rate of 0.7 percent. It is has an area of 410,934 square km, giving the country a population density of 22 per square km. Around 87 percent of the population lives in the southern third part of the country. Stockholm is the largest city with a population of 1.6 million followed by Gothenburg (0.8 million), Malmö (0.5 million) and Uppsala (0.187 million).

In 2000, Sweden had a high GDP growth (est. 3,9%): forecasts for 2001 are substantially lower (est. 1,6%), and inflation risk is estimated to be low. Sweden has an industrialized economy, and the open economy depends to a high extent on exports and imports of products and services. The corporate tax rate is 28 percent. Key economic sectors are telecommunications and electronics, wood including paper, timber and pulp, engineering, metals, and chemicals including pharmaceuticals. For a small country, Sweden has a fairly high proportion of large multinational corporations (e.g., Ericsson, ABB, and Electrolux). Around 3000 companies have over 100 employees.

There are 4.1 million households in Sweden with more than two thirds consisting of either one or two persons. 69 percent of households do not have anyone under the age of 18.

1.2 The Swedish telecom and mobile telephony market

Sweden has invested heavily in IT and telecoms and the country is rich in IT clusters, especially in the southern part and along the coast. The government has shown willingness to support the development of IT clusters, investing over 17 billion SEK in 2000 to ensure broadband access in rural areas. Sweden was one of the first deregulated telecom markets: Telia, the former incumbent is partly privatised and is listed on the stock exchange. The regulator PTS (The National Post and Telecom Agency), established in 1993, attempts to increase competition through measures to decrease interconnection charges and facilitate the entry of new actors in the telecommunications market.

Mobile telephony was introduced early in Sweden and today the country has among the highest mobile penetration rates in Europe (around 58% in 2000), along with Finland and Norway. During the development of mobile telephony, several different systems and technologies have been introduced (Mölleryd 1999). In the 1950s, the first automatic mobile system (MTA) was introduced, followed by the MTB in the 1960s and

the start of a private system. The first steps towards a Nordic mobile system were taken in the 1970s with the MTD systems. In the 1980s, NMT 450 was introduced, later followed by NMT900, and the second operator, Comvik, strengthened its position in the market. Originally it was intended that Sweden should have two GSM operators, but a new entrant NordicTel (the firm has since changed its name to Europolitan) demanded a license in 1990 and claimed that the frequency space was sufficient for three networks. At that time Swedish Telecom decided on questions on frequency space and claimed that there were not enough frequencies and that competition in the market was a fact with the two operators Swedish Telecom and Comvik. NordicTel appealed to the government that gave the new operator frequencies for GSM in late 1990. Sweden was then the only European country with three GSM operators (Mölleryd 1999). Later four licenses were allocated for GSM 1800, but Telenordia never started operations and handed back its license.

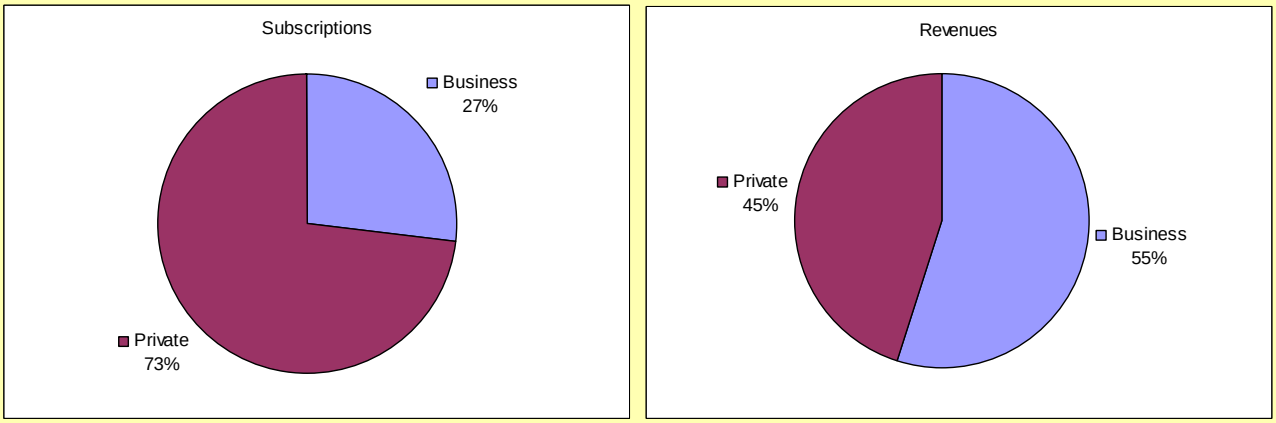
Table 1.1: Yearly sales of mobile telephones in Sweden 1993-2000

Year	NMT 450	NMT 900	GSM	Total
1993	27 000	133 000	44 000	204000
1994	19 000	274 000	367 000	660000
1995	9 000	87 000	764 000	860000
1996	4 000	136 000	925 000	1065000
1997	3 000	44 000	1 200 000	1247000
1998	2 000	2000	1 550 000	1554000
1999	5000		1 647 000	1652000
2000*	1000		2 100 000	2 100000

Source: Europolitan, Netcom and Telia

During 2000, the number of mobile subscriptions in Sweden increased by 1 212 000 from 5 126 000 to 6 338 000 (PTS, 2001a). This corresponds to an annual growth rate of 24%. It represents a fairly impressive growth in view of the already high penetration level in the country (growth in 1999 was 25%). Telia dominates the market with a market share of 51%, followed by Tele2 with 33% and Europolitan with 16%. GSM is the dominant form of mobile telephony. The number of private subscriptions was in 2000 around 4.6 million, which corresponds to 73% of all subscriptions (PTS 2000). Almost 60% of these private subscriptions were based on pre-paid cards. The total turnover for mobile communication services increased from SEK 12.7 billion for 1999 to SEK 14.4 billion for 2000. The average revenue per subscriber has fallen during 1995-2000 from 3569 SEK to 2511 SEK per year. Europolitan (3850 SEK) earns more than twice as much per subscriber compared with Tele2/Comviq (1752 SEK). The former incumbent Telia earns 2679 SEK on average per subscriber in its GSM network (PTS, 2001a, pp. 40-41). Europolitan's high revenue per subscriber depends on its high percentage of business customers that on average have much higher bills than private customers, see Figure 1.1.

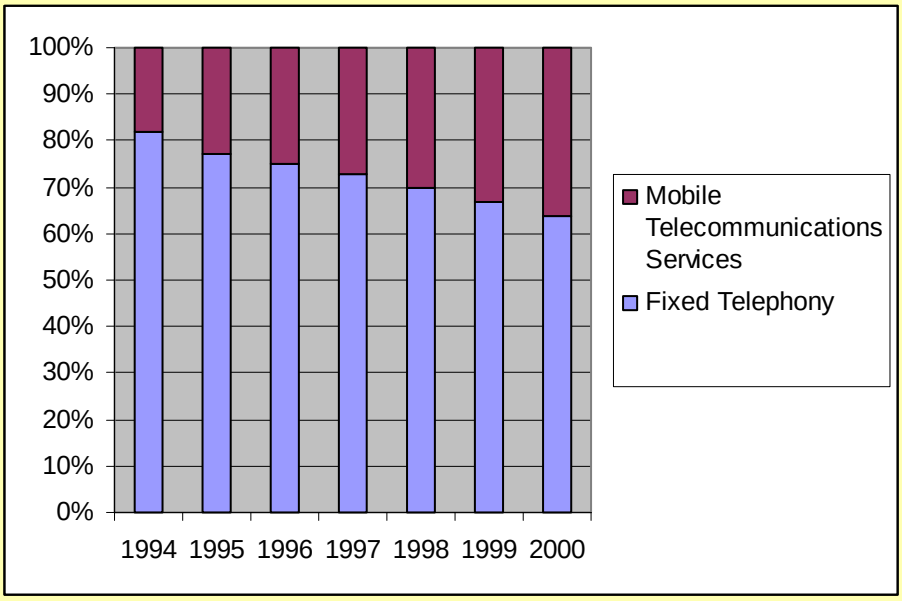
Figure 1.1: Distribution between private and business customers 2000



Source: National Post & Telecommunications Agency 2001

The increasing importance of mobile telephony is also evident if we look at its contribution to the turnover of telecommunication operators in Sweden. Its share of revenue has nearly doubled in percentage terms from 1994 to 2000, see figure 1.2.

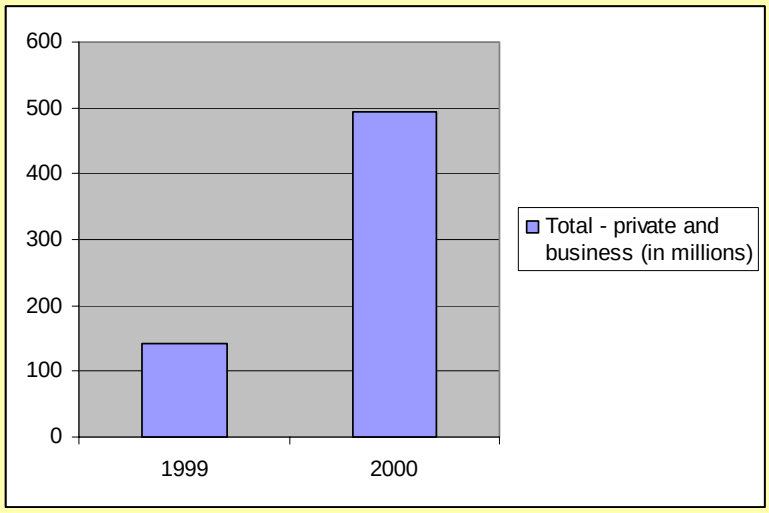
Figure 1.2: Distribution of turnover between fixed and mobile telecommunication services 1994-2000



Source: National Post & Telecommunications Agency 2001

The use of SMS accelerated during 2000. The number of SMS messages increased from 1999 to 2000 from 141 million to 494 million messages sent from mobile phones. PTS wrote: "…both the large number of SMS messages which are sent between subscribers and the relatively high price for sending SMS has been actively debated in the media…as a consequence of this, the development of the economic importance of the service SMS has really taken off for mobile telephones. (PTS 2001, p. 27)

Figure 1.3: Distribution of SMS sent from mobile phones 1999 and 2000



Source: National Post & Telecommunications Agency 2001

A first important step towards the introduction of mobile data services and 3G was the introduction of GPRS. All three GSM operators have upgraded their networks to support GPRS. Only one operator, Europolitan, had started to offer GPRS-based services to customers at the end of 2000. There exists only a few models of GPRS telephones in the market, but it was estimated that the market for these phones and services would start to take off during the second half of 2001. PTS' comments on this were: "A delay with GPRS means that the window of opportunity will probably be closed, this is so because GPRS is viewed by

many as a forerunner to the third generation mobile telephony UMTS, which is expected to break through into the market in only a few years" (PTS 2000, p. 29).

2 Introduction to the Swedish 3G Case

2.1 Summary of the Swedish Beauty Contest: Main Steps in the Process

On 12 May 2000, PTS issued an invitation to all interested parties with guidelines for applicants to provide network capacity for UMTS mobile telecommunications services in Sweden (and in some cases in accordance with the GSM standard). Four licenses were to be issued for up to 31 December 2015. The selection of the applicants would be based on a "beauty contest" using two steps. Sweden was not the first European country to select future UMTS operators. At this time, some European countries had already carried out their UMTS license selection process.

The Swedish legislators had given the PTS a high degree of freedom in deciding on how to formulate an invitation to all interested parties to build a telecommunication network in case the frequency space was not sufficient to give everyone a permit to develop such a business. The reason for this was that the politicians believed that the government should be flexible to allow market forces to direct the development of new services and forms of communication. The PTS decision to use a beauty contest was a legal interpretation of Swedish law. The license process should be issued based on *grounds of fact*; determined in relation to the aims that the telecommunication laws were intended to support. Selection criteria determined in other ways than the intended goals of the laws, like an auction or a lottery, were not considered to be grounds of fact.[1]

Another important reason for using a beauty contest was that rapid development of 3G could be an essential part of the development of Sweden as an IT nation. Therefore, the PTS focused on two main criteria when choosing operators — namely rapid rollout and nation-wide coverage. PTS wrote in press release after the decision to use a beauty contest: "In contrast to many other European countries, Sweden and the other Nordic countries do not hold auctions to award mobile telephony licenses. Swedish law stipulates that licenses must be allocated based on specific criteria. This is to the advantage of operators and consumers alike, because operators do not have to pay the state expensive fees for licenses."[2]

The contest was organized in the following way:

The applicants should submit their applications no later than 1 September 2000. At that date, they should have paid the application fee of 100000 SEK (approximately 10000 USD). The applicants were responsible for all costs of the preparation and submission of the application. It was not possible for the applicant to add information after the application period. The PTS could request further information from the applicant after the application date.

The initial administration fees paid by applicants did not cover the costs for the PTS of organizing the beauty contest. The preparation process consumed around 2 man-years from PTS. From September 2000 to December 2000, PTS had 8 persons working full-time on the process and also hired a couple of consultants.[3]

If two or more applicants were considered to be closely related they could only get one license. A license comprising GSM activities would not be granted to an applicant that already operates with a GSM license in Sweden. Therefore, the applicants were asked to describe their ownership structures in order to enable PTS to assess whether any applicant was closely related or not to another applicant. As a rule of thumb, a business that had 20 % or more of all shares in an applying company was considered to be closely related to that company.

The guidelines described that the selection process would be carried out in two steps. In an initial consideration, an evaluation was made of whether the applicants had fulfilled the preconditions for the establishment of a network in accordance with the plans presented in the application. The guidelines stated

[1] PTS (2001b). The regulation of the Swedish Telecommunication sector is principally codified in three different legal documents: Telelagen (Telecommunication Act), Teleförordning (Telecommunication Ordinance) and Förordning med instruktion för Post- och telestyrelsen (Ordinance with instructions for the PTS).

[2] PTS (2000a)

[3] Interview with Hans Brändström and Lars-Erik Axelsson, PTS, 2000-06-08

explicitly: “Only applicants that satisfy the requirements of the initial considerations will advance to the detailed consideration.” This meant that all the applicants could have passed this first step if they had shown that they fulfilled this criteria. In the initial considerations, the following aspects evaluated:

Financial capacity: The applicant shall be able to demonstrate that it has enough capital at its disposal to establish the promised network.

Technical feasibility: The applicant shall demonstrate the network’s reliability, availability, voice quality and other used quality parameters.

Commercial feasibility: Is a demand that the applicant presented a documented business and market plan with investment plans and financial projections that showed the costs, revenues and resources required to provide the services.

Appropriate expertise and experience concerned that the applicant should demonstrate that it had access to appropriate expertise and experience to construct a mobile telecommunications network.

If a firm or a consortium passed the initial considerations, it was further evaluated in a detailed consideration. In this step, the future operators’ commitments were compared as regards:

1. Commitments concerning coverage in relation to surface area and population.
2. Commitments concerning the development rate (rollout speed) for the networks.

According to the guidance for applicants:

“PTS will, by the license conditions, impose a requirement that the license holders shall ensure at every phase that at least 30% of the population coverage promised takes place through establishment of its own radio infrastructure. For other parts of the population, the license holders have the possibility of satisfying the coverage requirements by national roaming. However, this does not affect the license holder’s obligation to ensure that network capacity of high quality is held available in accordance with the license conditions. A license holder that cannot satisfy the license conditions through national roaming is thus obliged to establish its own access network to satisfy its obligations.”[4]

All masts in the network could be shared with other operators.

The applicants could count their own scores in the detailed consideration. It was considered to be important by the PTS that the applicants themselves could see how well they scored.

2.2 The competitors

Ten participants competed in the beauty contest: Broadwave Communications AB, Europolitan AB, HI3G Access AB, Mobility4Sweden AB, Orange Sweden AB, Reach Out Mobile AB, Tele 2 AB, Telenordia Mobil AB, Telia AB, and Tenora Networks AB. Seven of the competitors were consortia mounted for the 3G beauty contest and three were the leading mobile telephone operators in the Swedish market: Europolitan, Tele2 and Telia.

In nearly all the consortia, one or more firms had a strong presence in the European or global mobile telecommunications market. In the Orange consortium, Orange was a partner; in HI3G, Hutchison was a partner; in Reach Out Mobile, Sonera and Telefónica were partners; in Mobility4Sweden, Deutsche Telekom was a partner; and in Telenordia, both BT and Telenor were partners. Broadwave and Tenora Networks were the only participants in the beauty contest that lacked a major international or national mobile telecommunication player.

In no case did PTS find an ownership relationship between two competing applicants.

In the evaluation of the applicants’ coverage estimates the PTS required that: “An area shall be deemed to be covered where the field strength, measured on the pilot signal from the base station, outdoors at a height of 1.7 m, is equal to or exceeds 58dB_V/m/5MHz.”[5] The PTS did not want to use base stations as the selection criterion per se because such a criterion would lack support in the goals of the telecommunications law.

[4] PTS, (2000b), p.12

[5] Ibid. p.12

Furthermore, it was considered unwise because such a criterion can counteract the technical development and de facto result in a negative direction of the technical development. “Base stations are no ends in themselves…”[6]

All competitors presented plans that, in their own evaluations, gave a good area and population coverage. The base stations necessary to build the cell structure defined area and population coverage and transmission speeds. To some extent the choices of network architecture made by the applicants gave them higher or lower returns in terms of coverage and transmission speed. For example, this is why in Table 2.1; Telia’s 4100 base stations can cover a bigger area than, for example, HI3G’s 20184 base stations. Investment costs were lowest for Telia with 6.8 billion SEK and highest for HI3G with 36.9 billion SEK. In the case of two applicants – Broadwave and Telia - the PTS estimates of the area coverage were significantly smaller than the applicants’ calculations.[7]

Table 2.1: Some key figures for the competitors in the Swedish beauty contest[8]

Name of Consortium or Operator	Number of Base stations phase 1	Estimated costs	Area coverage and share of population in phase 1	Rollout speed – start etc	Participating firms
Broadwave Communications AB	4700 at the end of 2003	14.7 billion SEK	32750 square km 81 %	September 2002 90 % at end of phase 3	Tele1 Europe AB Western Wireless International 2G/3P Group You Communication Rix Telecom
Europolitan AB	20000 at the end of 2003	27.5 billion SEK	165 259 square km 100 %	January 2001 100 % at end of phase 1	
HI3G Access AB	20184 at the end of 2003	36.9 billion SEK	224 724 square km 100 %	January 2002 100 % at end of phase 1	Investor (40 %) Hutchison (60%)
Mobility4Sweden AB	8760 at the end of 2003	15.3 billion SEK	395 520 square km 100 %	January 2002 100 % at end of phase 1	T-Mobil International AG Utfors AB ABB
Orange Sweden AB	8635 at the end of 2003	19.7 billion SEK	364 528 square km 100 %	August 2001 100 % at end of phase 1	Orange PCS Bredband Mobil AB Skanska AB NTL Ltd Schibsted
Reach Out Mobile AB	5238 at the end of 2003	15.8 billion SEK	259 944 square km 100 %	April 2001 100 % at end of phase 1	Sonera (45%) Industri Kapital (35%) Telefónica (20%)
Tele 2 AB	10186 at the end of 2003	17.7 billion SEK	112 666 square km 100 %	October 2001 100 % at end of phase 1	
Telenordia Mobil AB	7200 at the end of 2003	14.0 billion SEK	181 346 square km 98 %	January 2002 98 % at end of phase 1	BT (90%0 Telenor (10%)
Telia AB	4100 at the end of 2003	6.8 billion SEK	308 661 square km 100 %	January 2002 100 % at end of phase 1	
Tenora Networks AB	7550 at the end of 2003	11.2 billion SEK	290 038 square km 100 %	January 2002 100 % at end of phase 1	Ratos (25%) Nomura (55.1%) Teracom (19.9%)

Source : Sweden 3G Case Study

[6] PTS (2001b)

[7] PTS (2000d)

[8] The table is based on PTS (2000d)

According to the PTS, four competitors failed in technical feasibility and one failed in financial capacity. Two of the applicants failed miserably: Broadwave and Tenora Networks. Broadwave could, according to the PTS, only cover 6538 square km with their 4700 base stations and not the 32750 described in their application. The consortium also was found lacking in their financial capacity, business plan and expertise. Tenora Networks couldn't demonstrate that it had the necessary financial capacity. In addition, the quality of the network (1 hour unplanned failure per day), PTS considered created problems for the business plan. The PTS also stated that Tenora hadn't demonstrated how it would get the needed equipment for the network.

The Mobility4Sweden consortium made a mistake in their financial capacity consideration. The consortium forgot to show how the participants should finance the operation after the initial funding had disappeared after losses in the first years of operation.

Reach Out Mobile AB was excluded because the consortium a) failed to convince the PTS that the members could create a good enough project organization and b) network had too low transmission speeds (64 kbit/sec.) in rural areas.

The most surprising result of the first step was that Sweden's former telecommunication monopolist was excluded. Telia failed because the former incumbent was unsuccessful in achieving the signal level required by PTS in the network. One important reason for this was that Telia committed itself to building only 4100 base stations. PTS wrote in its decision that Telia would need to construct three times more base stations in the countryside than in its application to fulfil the PTS demands for coverage. Telia's area coverage was found to be lower by PTS than Telia's estimates (291278 square km compared with 308661 square km). More damaging was that the low number of base stations in PTS opinion gave too low of transmission speeds (32 kbit/sec) compared with the business model Telia presented. For example, videoconferencing was deemed impossible by PTS in more than half of Telia's proposed UMTS network. In consequence the PTS concluded "The feasibility of the business plan is in this respect inadequate."[9]

Five consortia passed the criteria in phase one: Europolitan, HI3G, Orange, Tele2 and Telenordia.

In phase two the applicants were evaluated as regards area and population coverage as well as rollout speed. One point was awarded for every complete 10,000 number of inhabitants in Sweden provided with coverage. One point was awarded for every complete 30 square km in Sweden that provided with coverage. However, the surface area could account to a maximum of 20% of the number of points for population coverage.[10] All five competitors in phase two got maximum points for area coverage. Telenordia had promised a population coverage of 98 % at the end of 2003. The other four competitors promised that nearly 100 % of the population should have access to UMTS at the end of 2003. Therefore Europolitan, HI3G, Orange and Tele2 got the four licenses. These four operators got the highest possible number of points, 3977, while Telenordia got 3940. The promises from the operators in their applications thereafter were part of the license conditions.

PTS will continue to monitor the development of the 3G networks. Three important deadlines are at the end of 2003, 2006 and 2009. In reality, the only important control date will be December 2003 or January 2004, since the four winners have promised to complete their networks at that date. If they haven't performed in accordance with their commitments, the PTS may order the license holder, subject to a default fine, to comply with the license conditions. Under certain circumstances, PTS can also revoke the license.

2.3 Trial Processes

After the PTS presented its selection of the four winners, the decision was contested in court — most importantly by Reach Out Mobile, Telia and Telenordia.

Reach Out Mobile's principal complaint was that it was wrong to reject the consortium's application because of possible problems in the project organization and the building of the network since any license holder would face the same problems.

[9] PTS (2000c)

[10] PTS (2000b)

The basic argument used against the PTS decision by Telia and Telenordia was a discussion about the number of base stations needed to get good area and population coverage and sufficient transmission speeds.[11]

Telia requested the county administrative court: a) that, in case the court didn't issue a UMTS-license to Telia, it should set aside the decision by PTS and return the matter to the PTS for a new evaluation. b) Telia further claimed that the PTS had wrongfully designed the procedure as if it was a question of public purchasing (offentlig upphandling) and, because of this, conducted a number of formal and material mistakes. Telia also demanded an inhibition of the contested decision.[12]

Telenordia also requested the court that it should change the decision by PTS and give Telenordia a license. If the court denied this request, then Telenordia requested that the court should return the matter to PTS for a new evaluation. Telenordia asserted that Orange could not achieve the area coverage it had promised with the network presented in its application and that PTS in its evaluation hadn't correctly combined the statistical office's (SCB) statistical material and applicants' coverage maps.[13]

The winning applicants also hired legal advisors to represent them in court in case the court proceedings would create problems for them. An important reason for this was that PTS had issued all the licenses in one decision. This meant that if the court accepted the claims by Reach Out Mobile, Telia and Telenordia, all licenses could be revoked – even the license given to the best applicant.

The county administrative court decided in June 2001 that the PTS decision was correct and rejected most of the complaints, although it gave some criticism. Two criticisms were: 1) The court noted that the contest between the applying companies, allowed by the telecommunications law, contains particular rules of procedure with deviation from the constitutional law's instructions that should have been formulated in law or regulation.[14] 2) The court found that the method used by the PTS to compare the applicants' maps with the statistical office's map seems "unscientific" but that the procedure in this particular case was conducted in an acceptable way.[15]

After the decision by the court, Telia and Telenordia have stated that they will not contest the court ruling.

2.4 Summary of the Swedish Beauty Contest: Discussions of Pros and Cons of Beauty Contest versus Auctions from a Swedish Perspective

An important reason for using a beauty contest was that a rapid development of 3G was regarded to be an essential part of the development of Sweden as an IT nation. The minister Mona Sahlin has on many occasions stated that it was urgent to have a rapid construction of UMTS and that it was important that the new technology should benefit all of the population.[16] The second paragraph in the telecommunication law stresses that the law aims at individuals and that public agencies should get access to effective telecommunications services at the lowest possible socio-economic cost. In accordance with these and other policy ambitions, the PTS focused on two main criteria when choosing operators: namely quick rollout and nation-wide coverage. One reason for this is that the infrastructure is important not only for telecom firms but also for other industries in general. From the PTS point of view it was regarded as positive that it got more far-reaching promises for fast rollout and coverage than it had expected. The result is that Sweden will develop its 3G infrastructure at the fastest rollout pace and highest coverage level in Europe.[17]

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[11] Telia (2001) and Telenordia Mobil (2001)

[12] Telia (2001) and Länsrätten (2001) p. 29

[13] Länsrätten (2001) p. 51, 54 and 113. T

[14] Länsrätten (2001) p. 83

[15] Länsrätten (2001) p. 114

[16] PTS (2001b)

[17] Interview with Hans Brändström and Lars-Erik Axelsson, PTS, 2000-06-08

An important factor facilitating a fast rollout was the right given to companies to share infrastructure. The idea is that the core networks – in the bigger cities and other commercially attractive regions - will provide for competition necessary to get competitive prices that will apply to the rest of the market.

One problem with a beauty contest is that the decision can be challenged. Whatever decision made it could have been appealed. As mentioned before, the decision by PTS was contested in court by some of the applicants that didn't get a license. The two most difficult cases for the PTS were the demands by Telia and Telenordia. The problem with Telia was that the operator was the dominant player in the Swedish market and had a strong reputation in the mobile telecommunications industry. Telenordia's appeal was potentially difficult because the firm suggested that another interpretation could be made of its tender compared with the winning consortia.

The danger from PTS' point of view with its contested decision was that the launch of 3G networks would be delayed. Appeals against the decision were considered by PTS to be probable but it was impossible by Swedish law to put a disclaimer not allowing the applicants to challenge decisions. The potentially negative impact on a rapid rollout was mitigated when the county court rapidly rejected a demand from Telia on inhibition.

One particular problem concerned the transparency of the consultants' work in developing the guidelines. In the trial process, the operators claimed that all information (even hand written notes) used in the process of setting the evaluation criteria should have been made public.

The evaluation process was more difficult than had been predicted. PTS needed a thorough evaluation of each application. The final documentation handed to PTS consisted of approximately 1000 pages per applicant.

2.5 Rationale behind the Final Choice of Operators

Two applicants failed in the selection process because they made many mistakes in their applications due to the fact that they had insufficient experience of mobile telecommunications operations. Among the experienced and financially strong competitors, technical feasibility and willingness to invest became the two most important factors.

Reach Out Mobile and Telia were not willing to commit themselves to build networks with a high quality. Reach Out Mobile was not able to present a credible enough project organization and had too low of transmission speeds. Telia had both a too low signal level and too low transmission speeds. Mobility4Sweden did not demonstrate how it planned to finance the operation in the longer run.

Interestingly the PTS didn't consider the following issues as being problematic:

a) Rapid rollout speed. For example, Europolitan and HI3G planned to build 700 base stations a month.

b) High investment costs related to revenue. HI3g planned to spend 36.9 billion SEK — more than five times more than Telia; the most successful Swedish mobile telecommunication operator.

c) Sites for base stations. For example, HI3G and Orange had no prior presence in the Swedish mobile telecommunications market meaning that they had to find new sites for all their base stations.

Another problematic feature of the selection process was that the four winners all got the maximum score in the detailed consideration. What would have happened if five or more applicants had scored the maximum points? Telenordia was only marginally more cautious and lost. Telia, could probably have afforded a more committed bid but didn't.

It was not number of base stations *per se* in the final analysis that selected the winners. It is important to note that the conclusive factor excluding Telia and Reach Out Mobile was not area coverage but rather network quality.

In conclusion, we can state that in a strategic theoretical sense, the PTS rewarded tough committed players that made promises for the future.

2.6 Economic Consequences: Initial Investment Expenses

One important economic consequence of the PTS' decision was that the firms and consortia winning the licenses started to discuss how to cooperate in the building of the networks. Tele2 made an agreement with Telia. The other three actors: Europolitan, HI3G and Orange started to negotiate future cooperation.

Because of the strong position of Telia and Tele2 the competition authority is looking into this agreement. Also, Europolitan and HI3G have requested the competition authority to accept their cooperation initiatives.

3 Market Dynamics: 3G and the Impact on Market Behaviour

3.1 An Increased Interest in Cooperation and Alliances

With 3G, the number of mobile network operators in Sweden increased, from three GSM to four 3G operators, five in total**.** With four operators building four separate systems with national coverage including rural areas, talks of cooperation between operators to share costs appeared early in the licensing process. Towards the end of 2000, both before and during the licensing process, the role of the National Post & Telecom Agency (PTS) in this matter was discussed. In the application process, some operators (mainly the new entrants) argued that PTS should actively force 3G operators, through regulations, to cooperate in the construction and/or operation of various parts of the new systems. Some feared that such cooperation would not take place if there was no PTS intervention. At the same time, it was expected that in the general era of deregulation of the telecommunication industry in Europe, it should not be expected that PTS would engage in such interventions. The requirements defined by PTS was that each licensed operator should cover 30 percent of the population with its own radio infrastructure. PTS had not defined requirements concerning cooperation between operators.[18]

Different areas for cooperation were discussed in the pre-licensing phase, including the sharing of radio masts, parts of radio equipment, the localisation of the radio base stations, and coordination of the construction processes during the coming years. As an example, a radio base station in a rural area was estimated to cost around 1-1,5 million SEK with the major parts coming from land costs, electricity, the construction of the actual building, and fibre optic connections.

Such cooperation initiatives were not new to most of the operators taking part in the 3G licensing process. Some joint investments between operators had already been done in the process of expanding 2G GSM-based systems in the rural areas of Sweden. For example, renting the antenna masts of other operators was common in 2G systems. The big established operators like Telia Mobile, which had made considerable investments in expanding 2G systems in rural areas, were somewhat more reluctant in the early phases of the 3G process to discuss such cooperation initiatives.[19]

During and after the licensing process, discussions of cooperation and speculations about upcoming alliances between operators intensified. These processes dominated the six months following the announcement of the results of the beauty contest. The major alliances formed between the four licensed operators (and with Telia who didn't receive a license), during the six months after the beauty contest, can be summed up in the following four steps:

December 2000:

PTS announces the four winners of the beauty contest; Tele2, Orange, HI3G, and Europolitan-Vodaphone

Early January 2001:

Tele2 and Telia (incumbent without a license) announce the first alliance concerning the construction of a 3G network (later named Svenska UMTS AB)

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18 "- We are pushing this issue in other ways, said the Information Manager of PTS, Katarina Kämpe. We are pushing the operators to sell capacity to other operators, and it is one step in this direction. Roaming is another way to share the systems.." (Interview, Vision, 16 Nov 2000).

19 "- We have already taken some major investments when we expanded the GSM nets into the rural areas. Comviq and Europolitan (the two other 2G operators) have not done that to the same extent. Therefore, we are in a better position and can show a lower cost for our system…" (Interview, Vision, 16 Nov 2000).

Late January 2001:

HI3G and Europolitan announce that an agreement has been signed to cooperate on the construction of 3G networks (later named 3G Infrastructure Services AB)

May 2001:

It is announced that Orange will also be part of HI3G's and Europolitan's 3G alliance.

3.2 Restructuring Before and During the Licensing Process

During the pre-licensing phase, discussions of cooperation and speculation about upcoming alliances between operators intensified. However, cooperation and alliances has been part of the preparations and planning for mobile Internet even before the distribution of 3G licenses had been determined. It involved not only the operators, but also the new mobile virtual network operators, the new content providers and portals, and also the system suppliers, dominated in Sweden by Ericsson. Some of the cooperation and alliances formed were related to 2G systems but also involved preparations for 3G.

Before the 3G licenses were distributed in December, operators presented several cooperation initiatives that would facilitate a rapid construction of new 3G networks. As an example, Orange outlined two major obstacles to rapid construction of 3G networks in Sweden; first, the supply of sites and infrastructure equipment, and second, the supply of terminals. The solution presented by Orange in the first case was cooperation with the building constructor Skanska. In the second case, the solution of Orange was cooperation with, as an example, Ericsson, Nokia and Alcatel.

The big Swedish operators were involved early on in major 3G cooperation initiatives. For example, Telia's R&D cooperation with Oracle had been initiated in 1996 and served to develop new data services for mobile phones. One result was the launch of a new portal/virtual operator Halebop[20] in preparation for the availability of GPRS and 3G. Halebop was purchased by Telia in August 2001 from the company Drutt — it is now owned by Telia and Oracle. Another Swedish 2G operators, Europolitan, was the first to launch a GPRS service in November 2000. This was a result of Europolitan's cooperation with Motorola, the only company that had GPRS terminals available in the Swedish market at that time.

In the pre-3G phase, global actors of non-Swedish origin had already entered the Swedish market - mainly the Stockholm region - and contributed to restructuring the Swedish industry for mobile Internet. For example, Siemens established Mobile Solutions in Sweden in order to establish alliances and/or acquire new companies involved in the development of solutions for 3G (e.g., location-based). Sun Microsystems, Intervowen, Cisco, Nortel and many other foreign companies have been doing the same.

During the finalisation of the beauty contest, there was increased speculation in the Swedish media concerning the future market behaviour of the eventually selected operators. These speculations were linked to the many concerns expressed about high costs involved in deploying 3G. Uncertainty about future 3G services and the unclear role of technologies complementary to or competing with 3G were discussed (e.g., W-LAN). Questions were also raised about the future role of MVNOs in the Swedish market; actors which came not only from the telecommunication sector but also from the more distant industrial and business areas (retailing, banking, energy sector, etc.). Through alliances, backing by the EU, national deregulation programs as well as other efforts to open networks to competition, MVNOs were expected to rapidly establish positions in the new 3G networks in Sweden. On the whole, media coverage in Sweden of the 3G licensing process, both before and after the beauty contest, was very intense.

3.3 Ericsson's Important Position in the Swedish 3G System

The equipment supplier Ericsson also announced a number of strategic cooperative initiatives during the months preceding the finalisation of the Swedish beauty contest.[21] For example, in November 2000, Ericsson announced strategic cooperation with the Japanese image processing company Canon on the

[20] http://www.halebop.com

[21] Being a global company, most of these announced cooperative initiatives were not confined to Ericsson's Swedish market, but nevertheless had an indirect effect on the Swedish situation for 3G. This due to Ericsson's importance to the Swedish economy in general.)

development of wireless technologies for Canon's cameras and Ericsson's mobile telephones. Due to Ericsson's well-known problems with the production and sales of mobile telephones, there was further speculation about potential alliances appearing towards the end of 2000. One of Ericsson's strongest alliance partners to emerge was Sony. An agreement concerning the costly and important construction of a large number of 3G base stations had earlier also been signed with the Swedish building constructor giant NCC (SvD 15 Jan 2001). In January 2001, Ericsson announced even more profound changes. The company presented a new production strategy where it would outsource most of its mobile phone production to the manufacturer Flextronic[22]. Another impressive global joint venture, between Ericsson and Sony, received much media attention in April 2001. The deal was expected to have a major affect on Ericsson's and therefore Sweden's future position in mobile technology, including 3G. The deal was also expected to have dramatic effects on the market behaviour of the other global 3G terminal suppliers (Finanstidningen 20 April 2001).[23]

3.4 December 2000: The Announcement of the 3G Winners

As the 16th of December 2000 approached and with it the announcement of the four successful 3G licensees, it became clear that most operators and other companies involved in the application process had back-up plans that would be activated as soon as any announcement was made. It was generally expected to be the start of the formation of a new set of alliances and cooperation across existing 3G constellations, including the entry of various content providers into these existing 3G constellations. The most attractive cooperation partners were considered to be large operators with large established customer bases in 2G (Telia, Tele2 and Europolitan), large powerful content providers (Schibsted, Rix Telecom), infrastructure owners (Teracom, Utfors) as well as large construction companies (Skanska, NCC, ABB). Along with Orange and Tele2, who earlier had stated an interest in further alliances, Telia also stated in the media interest in establishing cooperative ventures (Vision 14 Dec 2000).

When the announcement was made that Tele2, Europolitan, Orange and HI3G were the beauty contest winners, the fallout effect of the largest Swedish operator, Telia, not receiving a license overshadowed almost all other discussions. However, discussions concerning structural changes and consolidation of the whole 3G industry intensified.

Europolitan immediately signed preliminary agreements with two major system suppliers, Ericsson and Nokia, in order to guarantee a rapid construction of the new 3G systems. The company also predicted that several new operator cooperative arrangements would emerge, to be able to cover the rural areas, e.g., in northern Sweden.

The Swedish beauty contest result affected other actors in a broader sense. To everyone's surprise, Telia had acquired a license in Norway but not in Sweden. With this surprising result, Tele2 immediately became the only operator that could present a truly Nordic position in 3G (with 3G licenses in Sweden, Finland and Norway).

3.5 After the Beauty Contest: How Should the Network Be Financed?

The media immediately began to question the financial budgets and market estimations that had been made in the 3G beauty contest applications. Sweden's largest daily business paper, Dagens Industri, in late December questioned the cost estimates of one of the newcomers HI3G (Dagens Industri, 28 Dec 2000). It was argued that in the worst case, HI3G would have to finance and build their 3G system completely on their own, without the support of any partner. However, it was widely expected that all four groups of operators would need to engage in various cooperative initiatives (not only financial) to be able to fulfil promises made in their applications. There were early speculations (Dagens Industri, 18 Dec 2000) that Telia, which had been left without a license, would be a suitable partner for HI3G. In further speculation on how Telia should develop a new strategy and gain a stronghold in 3G in Sweden, two newcomers without

[22] http://www.flextronics.com

[23] American Spectrasite and German Infineon were other alliance partners presented during this period. Ericsson also continued to create agreements with other terminal manufacturers, e.g. Matsushita (Panasonic) in order to secure that other terminals would function together with Ericsson's new systems and products for 3G. Later, Matsushita established the same type of alliance with network manufacturers Nortel and Lucent.

any prior position in mobile telephony in Sweden – namely HI3G and Orange - were frequently cited as partner candidates. A major argument for this was that both newcomers would need an established incumbent operator to be able to cope with the heavy financial investments necessary to build up the new systems.

In the media there also emerged an intense debate about the pros and cons of various alternatives to 3G technology including wireless LAN solutions, upgraded EDGE and GPRS systems, Bluetooth, etc. For Telia, the option to become a MVNO was suggested as an alternative (Vision, 18 Dec 2000). Discussions in Swedish media about the advantages of WLANs intensified within the first months after the beauty contest. Through its separate venture, Homerun, Telia already dominated the WLAN market development, with over 90 so-called "hot zones" with local networks. However, there was increased competition from new operators using this technology (e.g., the Scandic Hotel chain). Telia's strategy was to try to link up these and other competing or complementary WLANs operators. Meanwhile, other independent groups driving the development of WLANs as a complementary or competing technology to 3G have been established (e.g., Electrosmog).

3.6 New Attractive Partners For 3G Operators: Companies Controlling the Infrastructures

One of the major bottlenecks for the new 3G operators was the access to a large number of sites for radio antennas and base stations. Firms controlling existing infrastructure immediately became interesting partners for the new 3G operators (especially for HI3G and Orange with no history in earlier generations of mobile telephony in Sweden). Tele2 already had about 1300 radio masts to bring to the new joint Tele2/Telia company. Europolitan could leverage the infrastructure of its existing Swedish GSM network. For HI3G and Orange, companies like the state-owned Teracom, controlling around 1000 high radio masts, became interesting partners.

Apart from the negotiations with large actors like Teracom who covered both urban and rural areas, the 3G operators also had to begin negotiations with a large number of local municipalities. The access to a large number of local sites for base stations would prove to be one of the most important and difficult problems to solve. It was clearly in the municipalities' interest to minimize the number of base stations and any negative effects on the environment. Therefore, many municipalities were reluctant to give operators the rights to construct radio masts until they had a much clearer picture of the emerging cooperation between operators.

3.7 The First Cooperative Ventures Are Established

Immediately after PTS' announcement of the winners, a set of strategic alliances and cooperation agreements were made between companies directly or indirectly involved in the 3G business. In December 2000, one of the 3G operators, Europolitan, announced a new cooperative venture related to service provisioning. Glocalnet, a service provider in fixed telephony and the Internet, aimed to use Europolitan's established position in mobile telephony to broaden its range of services to customers, particularly with regard to the mobile Internet business. Glocalnet had been part of one of the groups applying for a 3G license (Tenora). For Europolitan, the deal meant that the company would get paid for some of the infrastructure investments and it also offered a way to reach new groups of customers. Shortly thereafter, Europolitan also closed a service provider deal with ICA, Sweden's largest food distribution and retail chain.

In January 2001, negotiations among the four 3G operators as well as operators outside the winning group intensified. While Orange was negotiating both within and outside the group, Europolitan was said to be primarily seeking cooperation within the group.[24]

On the 8th of January 2001, the first major cooperation deal was announced. Telia, the dominating GSM operator without a 3G license, announced they were closing a deal with Tele2, one of the four winners (as well as one of Telia's major competitors in the GSM market). A new joint company was to be formed (later named Svenska UMTS AB), where Tele2 and Telia would each own 50 percent. There were further

[24] As stated by Orange's manager of strategy and information in January 2001 concerning the many negotiations initiated: "…The most important thing for us right now is to get an overview of what parts of the system that we are going to build on our own. It is clear that we are going to be solely responsible for the major urban regions, but what it's going to be like in the more rural regions is still an open question. However, we expect this to be all settled within the next two to three months." (Ekonomi24, 4 Jan 2001).

negotiations to expand the cooperation to include the Norwegian market. In general, this deal was considered a major threat to the three other 3G operators, especially HI3G and Orange who had no prior position in the Swedish telecoms market. The Swedish media at this time expressed uncertainties about the reactions of PTS and several other agencies, such as the Swedish Competition Authority, as the licensed 3G operator would be responsible for 70 percent of customers. Two other factors were generally considered in a negative light. The planned 3G system would use Telia's and Tele2's GSM networks, which were built around different supplier technologies. In the case of Telia, this was mainly Ericsson and Nokia, while Tele2 had deals with Siemens and Motorola. Secondly, the joint organisation would inherit a very large customer base (a possible cause for objection by the Swedish Competition Authority). Finally, revisions in the original plans for Tele2's 3G system might have had to be made.

The regulator PTS reactions to the Swedish media's focus on the Telia-Tele2 deal was an announcement that stated that Tele2 formally owned the license and would be responsible for the 3G network but this would not hinder Tele2 from putting the venture into a separate company. Later, Swedish media also reported an increased interest by European Commission concerning the effects on competition of the new emerging deals between operators.

3.8 January 2001: The Second Major Cooperation Deal Is Announced

In late January 2001, a second major cooperation deal was announced. Europolitan and HI3G announced they were going to collaborate on the construction of new 3G infrastructure networks — principally in the rural areas outside Stockholm, Gothenburg and Malmö. The plan was to collaborate on infrastructure covering roughly 70 percent of the population. Europolitan would, on their side, continue the focus on six chosen regions for the continued development of GPRS services. The two companies planned to cooperate on the construction and maintenance of 3G network but keep separate the development and distribution of customer services. Interestingly, in the beauty contest, Europolitan and HI3G had been the two companies promising the highest levels of investment (26.3 and 36.9 billion SEK, and 20 000 and 20 814 radio base stations respectively).

Speculations about what cooperation strategy that the fourth 3G operator, Orange, would reveal intensified. In late January, it was rumoured that Orange had approached the Finnish operator Sonera, the Dutch operator KPN, and the Spanish operator Telefonica for a joint cooperation in Spain — which might also open cooperation between the companies in Sweden. It was also reported that one of the applicants without a license, the Norwegian operator Telenor, was interested in gaining a partner in the Swedish market.

3.9 New Deals Between System Suppliers and 3G Operators

Complementing the deals between operators, there was interest in the development of relationships between operators and infrastructure suppliers. While Ericsson had dominated the market for mobile infrastructure systems globally, the competition in the Swedish and generally Nordic markets was tougher. It was widely acknowledged that Ericsson's former dominant position in Sweden was no longer so self-evident. In March 2001, Nokia was announced as Telia's supplier of systems in Finland, Norway and Denmark. As a complementary system supplier to Nokia, Telia had also selected Siemens. This was considered in the media to be a major setback for Ericsson. However, it was also acknowledged that this was to be expected as Ericsson had already closed deals with most of the major competitors of Telia in the Nordic countries (e.g., with Sonera in Finland and with Telenor in Norway). Later, in June 2001, Ericsson also signed a new deal with the HI3G group, to supply the 3G systems in Sweden. The fight between system suppliers in the Swedish market, mainly between Ericsson and Nokia, was also affected by the fact that both the suppliers and most of the four 3G groups were part of global consortia.[25] There were also tensions reported between operators like Telia and the major system and terminal suppliers, Nokia and Ericsson. For example, Telia blamed most of the delay concerning the launch of GPRS on the latter. Interestingly, the emergence of 3G became an important force in dissolving some of the old established structures of the Swedish telecom industry.

[25] Thus, during the period both Ericsson and Nokia announced global deals with e.g. Orange and Hutchinson. In April 2001, Nokia had announced in total around 20 new supplier deals for 3G while Ericsson was able to show 28 new contracts. These global deals would also partly affect the cooperation between the suppliers and the 3G operators in Sweden.

Eventually, Ericsson would supply major parts of Telia's and Tele2's system. A few weeks after this announcement, HI3G announced that this consortium had also chosen Ericsson as the main supplier and cooperation partner involving 3G terminals and various content. In August 2001 Europolitan gave Nokia the larger part of an order for 3G systems with Ericsson getting a smaller portion. In September 2001, Europolitan estimated the infrastructure costs for building their 3G network would be 10 billion SEK (Dagens industri 2001-09-11).

The Hutchinson Whampoa Group announced that Ericsson's competitor, Motorola, would become a major partner globally for the supply of new multimedia terminals.

3.10 New Alliances Involving Content Providers and Mobile Portals

In Sweden, many mobile virtual operators had been dissatisfied with the high commissions paid to operators — sometimes up to 60-70 percent of total sales. This compares with operators such as NTT Docomo charging as little as 9 percent (Vision 15 Feb 2001). More new alliances were formed involving established operators and system suppliers, although content providers did not seem to be satisfied with their existing and emerging cooperative ventures related to 3G services. Among the over 300 3G companies established in Sweden 2000-2001, of which content providers had the strongest position, the need to engage in cooperative initiatives to secure a stable, future market position was widely acknowledged. In many cases, these initiatives were local — e.g., set up between some of the over 200 3G companies that had been established in the Stockholm region or between the cluster of companies emerging in the Gothenburg region.

In the old structure, system suppliers and operators had completely dominated the value chain. With the emergence of 3G in Sweden, it was widely foreseen in the Swedish media that system suppliers, operators, content providers and 3G portals would emerge as the dominant constellation of actors in the value chain. Not surprisingly, the established operators were striving to take control of several parts of the new 3G value chain (e.g., by developing 3G portals) to defend their positions. It was also expected that the new emerging MVNOs might be able to establish strong positions.

3.11 Spring 2001: Negotiations on Cooperation Continue

In April 2001, only Orange was still without an alliance partner. However, Orange, as well as the other operators continued to negotiate. The media widely reported on the failure of Orange to establish the necessary cooperation initiatives as well as on internal tensions between companies in the Orange group, which included France Telecom, Bredbandsbolaget, Skanska and Schibsted. It was also reported that the Orange Group and Skanska were engaged in tough negotiations on how the new 3G network should be built as well as how large a part Skanska would receive of the construction contracts in Sweden. In May 2001, it was reported that Orange was involved in deep negotiations with one of the two existing cooperative initiatives, namely Europolitan-HI3G. The latter were reported to be open to letting in a third partner in the construction of their 3G network.

Important partners in this phase of negotiations were the three major building constructors in Sweden involved in the construction of the 3G infrastructure: Skanska, Peab and NCC. One consequence of their increased involvement in the telecom industry was that all three companies had created separate companies focused on the telecom industry and had begun to acquire telecom companies in preparation for a 3G boom. Some had even stated that there was a new industry convergence between the telecom and construction industry. In May 2001, NCC announced that a major deal with Tele2 had been concluded concerning the first phases in the construction of Telia's and Tele2's new 3G network.

Other important negotiations involving the four operator groups entered extremely critical phases during the spring of 2001. For example, the negotiations with the Swedish associations of local municipalities, Kommunförbundet and state organisation Boverket, concerning the placement of base stations and antennas, were on the verge of breaking down. There was considerable irritation that the operators were not better coordinated in negotiations concerning where base stations should be located. Later, the Swedish Defence Ministry and The Swedish Aviation Administration also became critical in negotiations for the construction and placement of base stations. On a positive note, several of the large energy companies (Vattenfall, Birka Energi) and infrastructure companies (Svenska Kraftnät) had offered to rent out locales connected to their many sites.

The original plans to invest 100 billion SEK in four totally separate 3G networks were rapidly being reformulated. In May 2001, it was even asserted that the "four 3G companies will construct not more than two 3G networks" (Dagens Nyheter 12 May 2001). It was argued that, in fact, 3G Infrastructure Services AB (Europolitan Vodaphone and HI3G, later including Orange) and Svenska UMTS AB (Telia and Tele2) would construct these two networks.

Orange stated that for the company, the cooperation deal that was signed in Sweden in Spring 2001 with Europolitan Vodaphone and Hutchinson/HI3G (also global actors), would function as a test for similar future cooperation in other countries. There was notably increased interest by other countries and in the EC of "the Swedish case" of cooperation between operators. When Germany opened up the possibility of 3G licensee cooperative initiatives, many insights had been gained from the prior six months of deals in Sweden. It has been estimated that in Sweden the original costs of 100 Billion SEK were down to a level of 30 Billion SEK. In June 2001, the media reported on further negotiations between HI3G and Telia-Tele2, and there have been speculation that the remaining "two" 3G networks would eventually become one.

During the Spring, the operators' negotiations with virtual operators intensified. Telia, for example, stated that they could increase their number of virtual partners in their network by approximately four or five during 2001. As an example, foreign virtual operators such as Virgin Mobile were actively seeking partners in Sweden and attracted the attention of the four operators.

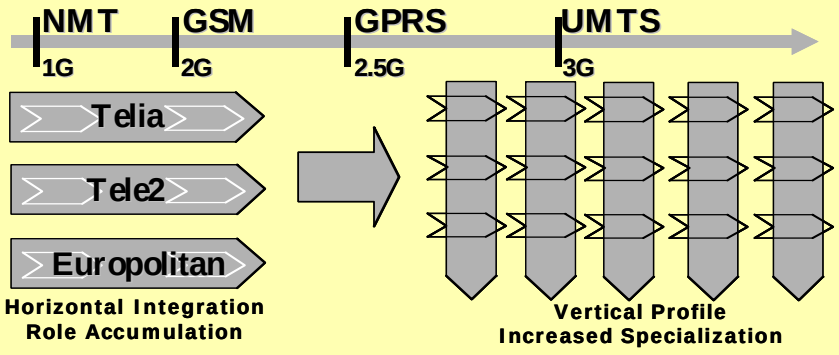
4 Market Dynamics: 3G and the Impact on Market Structure

4.1 General on Market Structure

The use of a beauty contest as the licensing process, the cooperative initiatives in the value chain as well as the media hype discussed in the previous sections represent some of the factors that have influenced the evolution of the mobile market structure. We will analyse these changes from the viewpoint of the players involved, i.e., the incumbent and emerging mobile operators, the system suppliers and the service and application providers. Some general comments on the market dynamics are discussed below before analysing each group in particular.

The traditional industry profile characterized by moderate competition and number of players involved in activities comprising the whole industry's value chain has evolved towards a market where a broader diversity of actors target different segments of the value chain. Furthermore, the convergence of the 2G value chain and the Internet value chain will lead to new roles in an enlarged value chain (Björkdal, J and Byström, A., 2001,).

Figure 4.1: Market Development



Source: Sweden 3G Case Study

The 3G licensing process has played an important role in this particular process. PTS, through the use of the beauty contest, has influenced the evolution according to the process described. During 1999, PTS proposed that the Telecommunications Act should be amended, in particular regarding two aspects, namely *access to*

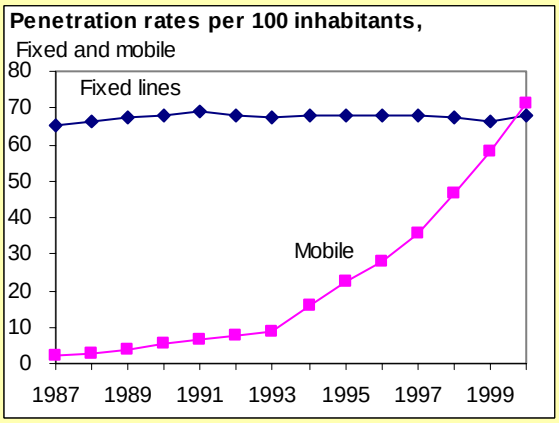
network capacity[26] and *national roaming*[27] to increase competition in the telecommunications field. The Government presented two legislative proposals, based on PTS' recommendations that took effect as of 1 May 2000 and 1 July 2000, respectively. These proposals influenced the design of the 3G beauty contest guidelines.

Furthermore, the guidelines for the applicants, where the selection criteria for granting 3G-licenses were described, clearly stated that PTS considered that as many different operators as possible should be afforded an opportunity to establish networks for mobile services. In order to ensure that licenses were not issued to applicants belonging to the same company or group of companies, the PTS took into account whether the applicants were to be regarded as closely-related – i.e., that had interrelated financial interests or could be consider closely related in other ways (PTS, 2001a).

The process of market enlargement described above can be explained due to the removal of constraints in the mobile industry thanks to the convergence of mobile data and speech traffic. The removal of constraints in an industry through technological innovations often creates increased choice (cf. Normann and Ramírez, 1994) and new opportunities within the industry. Hence, expanded opportunities magnetise new players to the industry that can easily slip into the new market and target the most profitable segments.[28]

As a result of Sweden's high mobile penetration[29] and the regulation characteristics of the mobile market, the interest in entering the Swedish market increased. This was demonstrated by the number of applications presented to PTS for four licenses (10 applicants comprising 19 different companies from 6 different countries).

Figure 4.2: Mobile Penetration Development in Sweden last decade[30]



Source: MobilTeleBranschen

[26] Operators with their own network for mobile telecommunications services are obliged to grant access to network capacity to undertakings that do not have their own networks. Fair market terms shall apply. This obligation only applies to the extent that capacity is available (Report, Applying for UMTS licenses in Sweden, PTS)

[27] Operators with their own network for mobile telecommunications services are obliged to make national roaming available in certain circumstances and at certain times (Report, Applying for UMTS licenses in Sweden, PTS)

[28] This phenomenon is described by some economists as contestability. Contestability is intensified by, for instance, the introduction of new technologies that reduce the minimum required scale to compete in an industry (cf. Clemons 1996)

[29] The parameter total number of subscriptions as proportion of entire population in order to specify the penetration is a commonly used parameter to specify the mobile penetration and would, upon a computation, correspond to approximately 71 % at the end of 2000. The corresponding figure for the preceding year was 58 %. However, it is not possible to compute correctly the penetration of mobile telephone subscriptions on the basis of the above mentioned figure as it is not unusual that a person has several subscriptions – particularly today when pre-paid cards are common and many people have both private and business subscriptions (Report, The Swedish Telecommunications Market 2000, PTS)

[30] MobilTeleBranschen is an independent branch organization for suppliers, distributors and sales organizations of mobile equipment, cf. http://www.mtb.se/

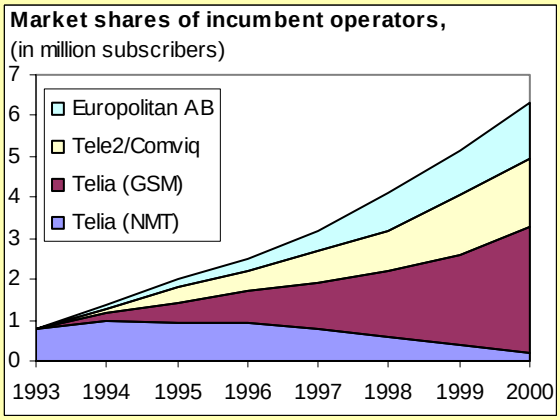
The interest in the Swedish market was confirmed not only by foreign companies but also from companies in other industries. Although all applicants had a background in the telecom industry, constellations with members of other industries were also created. For example, companies from the construction trade such as Skanska or the publishing industry (like Schibsted) were involved in the application process (e.g., through joint ventures).

4.2 3G and the Role of the Incumbent 2G Actors

The phenomenon described above as contestability (cf. Footnote 3) can seriously damage dominant players in an industry represented by incumbent operators. There are three incumbent 2G operators in Sweden: Telia, Tele2/Comviq and Europolitan.[31] The introduction of UMTS will increase the number of players on the Swedish market and the competition will therefore increase. This will affect the dominant operators, Tele2 and Telia that today jointly have over 80% of the Swedish market. However, Europolitan, thanks to its differentiation strategy, even though it currently does not have more than 16% of the market, will not be much affected (Björkdal, J and Byström, A., 2001,).

Two of the three incumbent operators (Tele2 and Europolitan) were each awarded a 3G license and the two remaining licenses were awarded to new entrants, namely Orange Sverige and HI3G.

Figure 4.3: Market shares of incumbent operators



Source: The Swedish Telecommunications Market 2000, PTS

These operators had previously developed different strategies in the 2G mobile market; mainly based on specific ARPU[32], according to the phenomenon of customer-segmentation. For example, Europolitan had developed a differentiation strategy aimed at business users who have a high ARPU. Tele2, on the other hand, has adopted the cost leader strategy on the GSM market. Orange has used a similar strategy as Tele2, but has been more innovative in entering the GSM market in Europe. Finally, HI3G is likely to use a combination of Europolitan's and Tele2's strategy, comparable to Telia's strategy on the GSM market (Financial Analysis of the Swedish 3G licenses 2001). Although the future is uncertain, there are signals that predict similar strategies will be used when entering the UMTS market.

What about Telia then? The fact that Telia, Sweden's oldest and largest telecom operator, did not get a license was totally unexpected. After the decision was made public, Telia did have two options, either to ally with one of the awarded operators or to wait and become a virtual operator. Telia disregarded the second alternative and joined Tele2 in order to build a network together. At the same time, it sought to get a license for itself by unsuccessfully challenging PTS' decision. This is another sign of the dynamics of the UMTS market where roles change rapidly.

[31] Telenordia got a GSM 1800 license to build an own GSM network but did not use it. PTS draw their license back by the end of 1999.

[32] Average Revenue per User

A representative from a large system supplier company in Sweden stated that: "…in the western part of the world, operators are in the middle of the value chain and they control the whole chain, whereas in Japan different roles (and revenues) are shared between different players of the value chain: content, application and operators" (Interview Ericsson 2001-06-07). This development is playing out in Sweden. Although their customer base reinforces the position of the awarded incumbent operators, the market development suggests increased revenue coming from data services rather than from voice services.

Finally, an incumbent operator's main agenda is to become a Nordic 3G-operators with a presence in Sweden, Norway, Denmark and Finland (Computer Sweden 2001-05-23). As a part of their expansion plans, incumbent operators intend to become virtual operators in Nordic countries where they currently lack a presence. For example, Tele2 will enter Denmark as a MVNO. Telia has a European mobile portal that could result in service provision in other European countries (Computer Sweden 2001-05-23). Interestingly, Sonera won a license in Norway but gave it back in August 2001.

Figure 4.4: Mobile operators in the Nordic Countries

	Denmark	*Norway*	*Finland*	*Sweden*
Telenor	X	Incumbent	No Presence	Difficulties to Enter
Telia	Weak Presence	X	X	Incumbent
Tele2	Weak Presence	X	X	Incumbent
Tele Danmark	Incumbent	No Presence	No Presence	No Presence
Sonera	No Presence	(X)	Incumbent	No Presence

Source: Sweden 3G Case Study

4.3 3G and the Emergence of New Actors and System Roles Including Regulatory Treatment

According to the revised Telecommunications Act (1993:597) in proposed legislation, an new obligation would exist for permit holders who operate a telecommunication network to offer network capacity on commercial terms to other operators.[33] Even if this obligation would apply only to the extent that capacity exists, the fact of increasing applications to PTS to become service providers remain. During the year 2000, the Swedish mobile industry had three mobile operators (Telia, Tele2 and Europolitan) and two service providers, Sense Communications AB (started 1999) and Song Networks.[34] During the year 2000, a dozen companies announced they intended to start as service providers. In February 2001, there were around 30 companies already registered as service providers at PTS. (PTS, 2001a)

One of the most interesting aspects with the new mobile service providers of telecommunication services is that they usually have a widely different backgrounds: e.g., in the food industry such as ICA; in the electricity supply industry such as HemEl; or in new services like LunarStorm (a chat site oriented towards youth in their upper teens).

Incumbent operators clearly consider virtual network provision as a strategic path in subsidizing investments in 3G networks (Nyhetsbrevet Telekom, 2001-03-14). For example, Telia has three MVNOs today: Wireless Maingate, Song Networks and Sense Communications (Nyhetsbyrån Direkt, 2001-01-15). Virgin Mobile intends to enter the Swedish market as a virtual operator targeting young teenagers around the beginning of 2002 (Ekonomi24, 2001-05-17).

[33] The Telecommunications Act (1993:597) - changes has been made in 11, 14, 15 and 63 §§. Also a new paragraph, 23 a §, has been added. (SFS 2000:210). For detailed information see http://www.pts.se

[34] Former Tele1 Europe, started operations in 1999

4.4 3G and the Role of Terminal and System Suppliers

Sweden has been a prominent country in the telecommunications area, primarily as a result of the old, historical collaboration between Ericsson and the incumbent operator Telia. Today, Sweden has one of the most advanced infrastructures for telephony in the world. Due to this importance, Sweden's largest system supplier, Ericsson, has largely played an advisory (if not parental) role for the applicants of 3G licenses — especially the new entrants.[35]

Moreover, system suppliers have had to deal with another big issue after the award of licenses, namely the financing of the roll-out of 3G systems: "Suppliers try to stay out in the same way as operators try to stay out of subsidization but in some cases it is not possible" (Interview, Ericsson 2001-06-07). During the second quarter this year, Ericsson signed eight new 3G contracts, which gives 34 in total. Customer financing of 3G has been limited; only three of all contracts will be subsidized (Nyhetsbyrån Direkt 2001-07-20).

4.5 3G and Entrepreneurship: Startups and the Role of VCs, Survival versus Dismantling Processes

It is often agreed that the combination of access to competent human capital, intensive R&D facilities and venture capital create high technology clusters. Sweden is developing such clusters within the wireless technology and mobile Internet industry, thanks to its long tradition in the telecommunications field. Sweden has been recognized as a *wireless valley* on various occasions, and this has attracted IT and Telecom Companies such as Nokia, Microsoft, Sun Microsystems, Motorola, etc., to establish R&D operations in mobile communications (see Table 4.1 below, Invest in Sweden Agency, ISA). Notable collaboration between large international companies have taken place.[36] There is also wide cooperation between companies and Swedish universities. For example, Hewlett-Packard collaborates with the Swedish Institute of Computer Science (SICS) at the Internet Research Institute (IRI) and Sun Microsystems and Uppsala University have a long tradition of cooperation. Furthermore, a number of new wireless technologies are being developed and tested in Sweden such as GPRS, Bluetooth, etc.

Table 4.1: Foreign investments in wireless communications in Sweden since 1998

- **Accenture** (US): global center for WAP applications and services
- **Cambridge Technology Partners** (US): global wireless competence center
- **Cap Gemini Ernst & Young** (France/US) together with **Cisco** (US): joint competence center for 3G mobile systems
- **Compaq** (US): wireless competence center and e-commerce knowledge center
- **EDS** (US): mobile center of excellence
- **Hewlett Packard** (US): wireless research and a joint project with Ericsson and Telia
- **IBM** (US): wireless Internet center
- **Intel** (US): wireless competence center and e-business solution center
- **Microsoft** (US): acquired Swedish Sendit and created the Mobile Solutions Center and also formed a strategic partnership with Ericsson to develop and market end-to-end solutions for the wireless Internet
- **Motorola** (US): development centers for wireless applications and services
- **Nokia** (Finland): R&D in mobile communication infrastructure
- **Nortel Networks** (Canada): R&D center for datacom, telecom and wireless communications
- **Oracle** (US): center of excellence for wireless product development. Also established a joint-company with Telia for wireless services, Halebop
- **RSA Security** (US): development of secure wireless communications
- **Siemens** (Germany): R&D center for mobile applications
- **Sun Microsystems** (US): wireless center of excellence
- **Sybase** (US): test center for mobile business applications and a strategic alliance with Ericsson around mobile banking solution

Source: Sweden 3G Case Study

[35] Advising mainly based on business information, information on services, infrastructure, etc according to Göran Skytteval at Ericsson (interview 2001-06-07).

[36] Ericsson and Microsoft formed together Microsoft Mobile Internet, EHPT is a joint venture between Hewlett-Packard and Ericsson, Telia Mobile and Oracle owned Halebop that developed a mobile portal.

All of these factors have created an entrepreneurial climate promoting the creation of startups. In Fall 2000, *Brainheart Magazine* studied inventoried 167 Swedish wireless IT companies. The latest Internet version of this magazine listed 522 companies in Spring 2001. These startup companies are found in all market segments – from infrastructure and enabling technologies to wireless applications and services. According to the magazine Vision, there are 300 of these startup companies within the so-called wireless valley in Stockholm — with around 10 billion SEK in venture capital. They represent around 50.000 employees working in the area (Vision 2001-03-15).

A report elaborated at the Center of Information and Communication Research at the Stockholm School of Economics presented an analysis of 39 Swedish Mobile Internet Companies (Kviselius, 2001). According to this report, more than half the companies analysed were created in 1999 or later. An unwillingness to talk about earnings and sales was identified. Only 3 companies (8%) could show positive earnings by those who answered the questionnaire (cf. Figure 4.5 below).

Figure 4.5: Statistical data from 39 Swedish Mobile Internet Companies 2001

Founded before 1998	24%	Net Sales >10MSEK	26%
Founded 1998	16%	Net Sales <10MSEK	8%
Founded 1999	32%	Net Sales n/a	66%
Founded 2000 or later	29%		
		Net Earnings Negative	34%
Seek Capital (Yes)	37%	Net Earnings Positive	8%
Seek Capital (No)	24%	Net Earnings n/a	58%
Seek Capital (n/a)	39%		
		Employees <25	13%
		Employees 25-75	74%
		Employees >75	13%

Source: Sweden 3G Case Study

4.6 Development of 3G Services

According to one of the persons in charge of Ericsson's test lab (Interview, Ericsson 2001-06-07), the main problem when developing services for 3G systems is that application developers ignore the extreme conditions in which applications will perform. The results from testing applications show, in a majority of the cases, that applications taken from PCs or laptops do not perform well when brought to the radio space. Most of the applications are developed for laptops. After failed tests in the radio environment, they typically need to be rewritten.

One of the main experiences from Japan regarding the development of services is the way they add applications on top of voice with useful content. In this way, they can develop business cases for their systems. This combination of voice, applications and content is perceived as the way to deliver solutions (Interview, Ericsson 2001-06-07).

5 Focus: Three 3G Issues; Pricing and Billing, Roaming, and 3G Terminals

5.1 Pricing Issues

General pricing strategies

Packet-based communication offers new opportunities for innovative pricing. The introduction of GPRS and UMTS systems will develop new pricing models. Some incumbent operators are already working on the development of innovative price methods. Telia, for example, has test customers in their GPRS network that test packet-based pricing. According to Kenneth Karlberg of Telia Mobile, the models are not yet fully developed. A key issue is how to offer customers awareness of consumed capacity. Time-based billing is easy to communicate. Everyone has a sort of embedded clock that indicates the amount of time consumed. However, information based pricing is difficult to communicate because the awareness of the amount of sent or received data is considerably more abstract. There are a number of different charging methods and Telia believes a combination of all these will be necessary. The main types of charging considered are:

- Plain Time Subscription (charge based on minutes and seconds)
- Service Subscription (charge per service)
- Service Usage based Subscription (charge for the usage, as number of times of a service)
- Flat Rate Subscription.

Uncertainties and ambiguities about 3G business models and pricing strategies

Discussions in Sweden regarding the future business models, including pricing strategies, for 3G seemed to be characterized by major uncertainties and ambiguities. Although GPRS has been introduced during 2000 (despite lack of terminals), there were few that dared take these experiences as an indication of what might come with 3G. At the same time, due to the huge infrastructure investments planned for 3G, debate concerning new business models to cover these investments became central in the debates following the beauty contest. Various possible options and models have been have been discussed.

While it had taken GSM ten years to become profitable in Sweden, it was argued by some that that was to be expected. It can be argued that, in order to rapidly acquire a large customer base for 3G services, some services (like mobile games) should probably be *free of charge* (e.g., like Microsoft's Hotmail). Some of these free 3G services would be introduced in new virtual 3G communities. [37]

According to Telia, there is to be no subvention of terminals like with 2G. Telia argues that it is time to give the responsibility back to system suppliers. However, there remains uncertainty about how new players would increase their customer base. An example of an innovative subscription scheme with no phone subvention is Telia's Mobitel Plus. The subscription targets young phone customers that use the phone evening and night. The subscription is not restricted to a certain handset and is considered to be an alternative if the subscriber has already a phone or can buy a cheap second-hand terminal.

Charging the content providers and the MVNOs

In Sweden, many mobile virtual operators had been dissatisfied with the high commissions paid to operators — sometimes up to 60-70 percent of total sales. This compares with operators such as NTT Docomo charging as little as 9 percent (Vision 15 Feb 2001). More new alliances were formed involving established operators and system suppliers, although content providers did not seem to be satisfied with their existing and emerging cooperative ventures related to 3G services.

According to MCI WorldCom the costs to become an MVNO are still too high. Charges have been reduced but an incumbent operator prefers to offer lower prices for terminating fees within its own network rather than offering lower interconnect rates to other operators. PTS is working to reduce them (Nyhetsbrevet Telekom, 200103-14).

5.2 Roaming

Before the launch of the 3G licensing process the Swedish government included a new section in the Telecommunication Act: "In certain circumstances and at certain times, operator with their own network for mobile telecommunication services are obliged to make nation-wide roaming available." This amendment was believed to assist operators that entered the market at a later stage than its competitors. (SFS, 1993)

[37] In a major study of the many new mobile internet companies emerging in Sweden during 2000 (Brask and Fredriksson 2000), before the beauty contest, some of the major conclusions made were that: 1) Pricing strategies developed in all types of mobile internet companies were generally very elementary. In no case of the companies studied were there a clear view of the pricing strategy, nor any clear connection between the pricing strategy and the general business model of the company. 2) The turnover was generally too low (or non existent) from which followed that the new companies had difficulties in focusing and stabilising their business models and pricing strategies. 3) Among the major threats described by the new content providers, mobile portals etc. were the polices and strategies of the big mobile operators. The power of the operators and the unbalanced power and relationships was seen as a major threat to the stabilisation of functioning new business and pricing models in the new value chains. 4) Network effects were generally considered important in the business and for the future business models and value creation activities, but few companies had any clear ideas of how these network effects should be realized. 5) New types of 'aggregators' of mobile internet services in relation to the operators were considered important. Several companies were actively trying to develop new business models, aiming for this position in the value chain. MVNOs were considered important in this group of companies.

5.3 Terminals For 3G

The supply situation and distribution for 3G terminals: production and distribution issues

The present debate regarding the supply of 3G terminals represents a vicious cycle concerning both the suppliers and the operators. Operators are afraid of delays in supply of the 3G-terminals, whereas terminal suppliers often claim that delays in the 3G roll-out slow down their investments in terminal development. Motorola announced decreased resource concentration in 3G-terminal development due to ongoing delays in 3G roll-out and doubts increased sales volumes will be felt before 2004 (Nyhetsbyrån Direkt 2001-08-01).

However, some operators have started to sign contracts with suppliers in order to guarantee a supply of terminals when needed. Hutchison Whampoa, part of the HI3G group, one of the licensed operators in Sweden, has chosen NEC Corporation as a terminal supplier. Through the HI3G Group, Hutchison Whampoa is present in Italy, Australia, Switzerland, Sweden and the United Kingdom. According to a press release from the beginning of August 2001, NEC will deliver terminals compatible with 2, 2.5 and 3G-systems.

The development of handsets: design, size, pricing

Japan has been a good example of handset development due to the success of I-Mode. Many western suppliers regard I-mode as a good test market for handset development (Interview, Ericsson 2001-06-07). However, NTT DoCoMo typically used Japanese manufacturers as handset providers.[38] The reason Ericsson entered the Japanese market was that they wanted to learn the *Japanese way*, according to Göran Skyttvall, in charge of Ericsson's entry in Japan: "We learned from PDC and we mostly understood the way I-mode was launched and the market introduced. One of the main points learned at the time was quality. The Japanese have a very strong quality mindset. Their approach to quality is amazing. It takes Western manufacturers four to six different production prototypes before they start production on full-scale. Japanese manufacturers manage to do it right from day one." (Interview, Ericsson 2001-06-07)

According to Håkan Eriksson, chief of Ericsson's technical development department, future terminals will have embedded Internet browsers around 2003-2005 (Computer Sweden 2001-06-08). An important characteristic of future 3G handsets is that they will have to support a number of browsers as I-mode is spreading outside of Japan. There are two dominating standards, namely WAP and cHTML[39]. "Key operators require terminal suppliers to deliver handsets with dual browsers (cHTML and WAP). Due to alliances with NTT DoCoMo, we will see more of this kind of requirements in the future." (Interview Ericsson 2001-06-07)

Regarding the cost of the new phones, one must bear in mind that all new phones are subsidized in Japan. The price range of a new phone is 40-50.000 yen, approximately 400$ USD. The production cost for an I-mode phone is somewhere around 30.000 yen (300$ USD). There are no fixed price levels for a 3G handset but according to Göran Skyttvall the cost will be around 400$ USD.

The subsidization of phones is a large cost for operators. Due to depreciation, the Network Cost is at the same level as the subsidization of phones. This is why operators try to stop the subsidization of handsets, but this is difficult (Interview, Ericsson 2001-06-07).

Another important aspect of the handsets relates to hardware and the use of colour screens in the I-mode handsets. The way Japanese content providers standardize video and messaging has had a tremendous effect. Perhaps even more important is user-friendliness and simplicity. I-Mode terminals are mainly used with just one button and user customized menus.

Regulatory framework concerning the production of handsets

The R&TTE-directive (Directive 1999/5/EC) of the European Parliament and of the Council of 9 March 1999 on radio equipment and telecommunications terminal equipment provides the general regulatory framework concerning the manufacture of radio terminals. 3G-terminals are considered under this section.

[38] There were 15 Japanese suppliers plus Nokia, Motorola and Ericsson

[39] Compact Hypertext Markup Language (cHTML)

However 3G terminals in Sweden have not been subject to any special regulation yet, according to Åke Karlsson working at PTS's Technical Department, within terminal & radio equipment regulation (Interview, PTS 2001-08-09). The European Commission has assigned ETSI to develop future standards that will regulate 3G-terminal manufacturing. These standards can be found in ETSI EN:301:908-1.[40] Paragraphs one to ten describe the standards related to spectrum efficiency. These standards will be *harmonized standards*, (i.e., non-compulsory).

The work to develop standards is in progress. They are now subject to *public enquiry* until the end of August 2001. Voting will take place after revising documents according to the comments gathered in the enquiry phase. In Sweden, PTS will follow these standards in order to decide about the general regulations for handset manufacturing. These standards will be considered as regulatory, but not compulsory for manufacturers.

6 Questions and Issues

This section includes questions and issues that have emerged during the preparation of the report. It does not offer answers or solutions. Rather it tries to highlight problems, formulate questions and describe issues that appear to have been important with regards to the licensing process.

6.1 The Boundaries of Regulatory Intervention?

In the intense debates and discussions connected to the beauty contest process, the role of and the extension of PTS' regulatory interventions came in focus in different phases of the process. The official approach of PTS throughout the process was that its role was only to allocate the licenses according to the detailed specifications set up beforehand, concerning the rate of development, coverage from population and geographical viewpoints, including financial, technical and commercial feasibility.

However, when licenses were awarded, PTS was drawn into discussions of if and how the license holders emerging cooperative ventures should be regulated. Thus, although PTS stated that its own role was clear in this respect, there emerged considerable ambiguities (in the media, for example) as to whose responsibility it was to regulate an increasing number of ventures between the operators after the licenses had been awarded. Operators successively extended their cooperation starting with base station placement to cooperation on major infrastructure to cooperation involving various services. PTS clearly stated that questions concerning issues such as service cooperation between operators (and potential abuse of dominant power) were really the responsibility of the Swedish Competition Authority or consumer issues authorities. Although PTS argued that it would only follow-up separately the commitments made by the four operators, according to time frames and other criteria defined, it was generally questioned and debated whether the new cooperative structures would lead to new sets of conditions.

6.2 National Regulations In an Increasingly Internationalising Telecom Context?

One issue raised by the Swedish 3G case concerns the effects on national regulators' roles and power in a situation of increasingly internationalised telecom companies, growing through international M&As or connected through global strategic alliances. Orange, for example, openly stated that the cooperation deal signed in Sweden with Europolitan Vodaphone and Hutchinson/HI3G, also global actors, would function as a test for similar cooperation in other countries in the future. Secondly, regulations on an international level (e.g.. in EU) were not completely separated from the regulator's activities on a national level. It was also noted an increasing interest in other countries and in EU of "the Swedish case" of cooperation between operators. Thirdly, the Swedish 3G case indicates that although the choice of auctions or beauty contests for the distribution of licenses are different in countries, there are signs that countries resemble each other in their processes. One important question is, of course, what are the effects of increased internationalisation on regulators' local power and intervention policies.

[40] Electromagnetic compatibility and Radio spectrum Matters (ERM); Base Stations (BS) and User Equipment (UE) for IMT-2000 3G cellular networks; Part 1: Harmonized standard for IMT-2000, introduction and common requirements, covering essential requirements of article 3.2 of the R&TTE Directive (source http://webapp.etsi.org/action/PE/PE20010824/PE20010824.htm)

6.3 Regulatory Issues on Convergence?

The opportunity of combining speech and data transmission in the same network leads to a broader value chain and enlarged market with increased number of players as discussed. The convergence of a number of different communication industries to deliver mobile services is a fact. Content providers, telecom operators, datacom system suppliers, etc., are joining to build tomorrow's infrastructure for next generation mobile communications. Datacom companies try to enter this market to become service providers or application developers. However, these industries, often have radically different backgrounds regarding the extent of regulation, competition, number of players in the market, etc. Therefore, one important issue for regulators within the industry has to do with to what extent regulations will be accepted by actors with different regulatory experiences (e.g., the datacom industry). Policy makers should therefore, consider the extent that, with convergence, whether this will lead to an increased or decreased regulated market.

6.4 Contestability Dilemma

The entrance of new players due to the enlargement of the mobile industry is another issue that has been identified in this report. This issue, i.e., the entrance of new players, involves regulators to a large extent due to the possibility of inherent contestability within the industry. Contestability implies that new entrants such as VNO enter the market to target the most profitable segments of the industry. This process represent a threat for incumbent operators that have often carried out large investment efforts to build infrastructure needed to provide services. The issue we would like to raise here is the importance of a balance between network capacity offered at commercial prices and the survival of network owners to secure the future development of the market.

6.5 Vicious Circle

The launch of mobile technology standards has traditionally been delayed. Increased risk and disagreement between network providers and terminal suppliers has been one reason. Mobile systems have been ready but not the terminals or vice versa. Examples from NMT, GSM and WAP and GPRS illustrate this fact. Terminal suppliers wait until there is a system and operators delay the commercial launch of the networks because of the lack of terminals. There seems to be a form of inertia within a market that makes it difficult to introduce new standards. An important issue to consider is how this inertia can be mitigated to provide more dynamics in the industry.

6.6 Auction or Beauty Contest?

Today it is still too early to know if a beauty contest provides for a better development of a 3G network than an auction. The cost structures of the two competing ways of selecting license holders are dramatically different. An auction costs more money to organise for the state than a beauty contest. The Swedish beauty contest didn't demand much more than 10 man years. An auction directly forces the license winners to pay a fee to the state. The beauty contest also results in big costs for the winners. They have to start build the network at a speed that is determined by their commitment in the contest.

One thing is clear. Sweden wanted to continue to be an advanced IT nation and the outcome of the beauty contest will support that position. Sweden will not only get national coverage of a 384 kbit/sec UMTS networks, the country is receiving large investments in complementary and/or competing technologies like GPRS and WLAN. Commercial actors investing in these technologies are looking for either synergies with 3G (e.g., Europolitan) or trying to build a market that will be big enough to also support alternative technologies (e.g., WLAN network operators).

Annex 1: Sources

News articles covering the period before, during and after the beauty contest 2000-11-01 to 2001-09-11 collected from e.g.:

Dagens Nyheter

Svenska Dagbladet

Vision

Computor Sweden

Dagens Industri

Ekonomi24

Direkt

Finanstidningen

Telecom and 3G reports from:

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The Swedish Consumer Agency (Konsumentverket)

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SFS, 1993, Telelag (1193:597) (ändring införd t.o.m. SFS 2000:166)

Telia, 2001, Till Länsrätten i Stockholms län 2001-01-08. Överklagande

Telenordia Mobil AB, 2001, Till Länsrätten i Stockholms län. Överklagande

Annex 2: List of Interviews

Lars Erik Axelsson, Economist, PTS, 2001-06-08

Hans Brändström, Head of Division for Mobile Telecommunications, PTS, 2001-06-08

Åke Karlsson; Responsible at the Technical Department – radio equipment at PTS; Telephone interview 2001-08-09

Kenneth Karlberg, VD Telia Mobile, 2001-08-13

Göran Skyttvall; Director Terminals & Applications 2G&3G LME Ericsson (ERA); Interview 2001-06-07

Helena Strömbäck, Ministry of Industry, Head of Section for IT, Research and Development, 2001-06-07

Annex 3: Links to Web Sources

National Post and Telecom Agency (PTS)

www.pts.se

The Swedish Competition Authority (Konkurrensverket)

www.kkv.se/indexns.html

The Swedish Consumer Agency (Konsumentverket)

www.kov.se

Ministry of Industry

www.naring.regeringen.se/index.htm