

## 8. Policy Implications for the Future of the Sectoral System

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### 1. INTRODUCTION

Policy implications for the Internet and mobile telecommunications will be discussed in this chapter. They are mainly based upon analyses in previous chapters, but also reflect the general policy implications of the systems of innovation approach briefly presented in chapter 1.

As mentioned in chapter 1 (section 2.2), institutional rules may be created, redesigned or abolished. Institutions that can be influenced by public agencies are public policy instruments. Similarly, institutions that are influenced by firms are firm strategy instruments. Further, organizations may be phased out, redesigned or created. If policy makers do this, these changes are also policy instruments. If firm managers do it they are firm strategy instruments.

### 2. FIXED INTERNET

Although several important inventions that served as bases for the development of the Internet did not emerge in the US – e.g., HTML and HTTP – the Internet developed commercially *first and fastest* in the US. The Internet was commercialized and diffused on a large scale in the US before anywhere else.

The US government was extremely important in the very early stages of the development of fixed data communications, when the sectoral system of innovation of fixed data communication was fragile and not well established. Government agencies were essential as financiers of research developing fixed data communications and they initiated public technology procurement of system elements. Other agencies required that organizations receiving public funding use the TCP/IP data communications protocol, which contributed to its diffusion and dominance. The state also increased dynamism in the telecommunications sector by pursuing deregulation.

State agencies were, however, ineffective in creating standards for the Internet in the US. This was instead a rather spontaneous process where private firms had great influence. The idea of 'open standards' or 'compatibility of standards' appears to have been the characteristic US strategy.

The relations among various organizations were crucial for the development of innovations in the sectoral system of innovation. These included the relations between public and private organizations – as in public research funding and in public technology procurement. Relations among different private organizations were also important, both in terms of competition and collaboration.

Early development and diffusion of the Internet in the US – with government support – gave that country's Internet equipment producers a 'headstart'. This is an important explanatory factor behind the fact that US Internet equipment-producing firms, such as Cisco, are still dominant globally. It is obviously very important for firm competitiveness in high-tech areas to be early movers in the sector and to be close to customers in these early stages.

### 3. MOBILE TELECOMMUNICATIONS

State-controlled organizations were very important in creating the first successful mobile telecommunications standard in Europe. Public telecommunications monopolies in the Nordic countries created the NMT 450 mobile telecommunications standard in collaboration with firms. The PTOs pushed the technical development of the standard and pulled national equipment-producing firms along their trajectory. They placed orders to firms and partly used the instrument of public technology procurement to create incentives for firms to develop equipment for NMT 450. NMT 450 provided the cradle for the development of mobile telecommunications in Europe. *Deregulation* of the telecommunications sector was also important in some European countries, such as Sweden and the UK. However, liberalization was not a key factor in Sweden's success with NMT and GSM. At most it aided the diffusion process that was already under way at the time of deregulation which began in 1993.

Relations among organizations were important in the process just described. So were relations between various kinds of institutions – like NMT 450 – and the firms and other organizations involved. Relations between operators – who were the main standard creators – and equipment producers were indispensable in making European equipment producers leaders at the global level. For firms like Nokia and Ericsson it was also important that mobile telecommunications got a 'headstart' in the Nordic countries and grew rapidly.

Most second-generation standards were developed with the potential to become de facto world standards through international adoption. The European GSM standard – which developed out of the NMT standard – more than fulfilled the expectation of wide international diffusion. Initially conceived as a pan-European standard, it became a world standard. No other second-generation standard achieved this. Deregulated operators (like Swedish Televerket/Telia) as well as firms (such as Ericsson and Nokia) were very active in the consortium that supported the development of the GSM standard. Hence, the close relations between users and producers continued. Over the long term, however, these close relations gradually became looser. The GSM success could not be ascribed only to the strategies of a few innovative organizations, but also to the collaborations of a variety of different organizations: PTOs, standard-setting organizations and research organizations as well as equipment producers.

The European Commission also had a leading role in the development of GSM. The EU was pushing one standard and it was developed *ex ante*. This was also a standard that was technologically advanced, operated well and therefore diffused rapidly outside Europe. In contrast, the US digital standards diffused internationally only to a limited extent and the single Japanese standard not at all. The European Commission pushed liberalization and competition in the (mobile) telecommunications sector.<sup>1</sup> But it did so within one single standard and did not care about letting standards compete – as in the US standards policy. The standard pushed by the EU was secured to serve all EU members, while the US digital standards were not completely compatible with one another. What the EU did across 13 European countries, the US did not manage to do for one (although large) country.

It proved to be a major policy mistake to have several standards in the US. This can be considered a serious policy failure for the US as well as a great success for the EU. The reasons for this are that it led to a slower diffusion of mobile telecommunications in the US than in Europe and that the strongest equipment producers emerged in Europe.

The US policy was calculated and consistent. The FCC was against *ex ante* standardization – which was preferred by ETSI – and advocated an open network architecture.<sup>2</sup> Arguments were that the open architecture was important for the creation of the Internet and that closing it could block further innovation. The FCC was passive in relation to the European invitation to participate in *ex ante* standardization in wireless services. The FCC also later blocked the route towards 3G convergence in the form of W-CDMA as a

<sup>1</sup> In 1996 the Commission decided that mobile services must be competitive, with multiple GSM licences in each member state.

<sup>2</sup> The FCC preferred market- and user-driven *ex post* standards.

global standard (supported by ETSI). This all happened in the latter half of the 1990s. One interpretation of this is that the FCC was tied by the fact that US participants in the 3G race represented different technological alternatives, and therefore the FCC remained 'neutral' in the standardization process. At the same time there is the line of thought that suggests 'the regulation of the new information infrastructure has gravitated toward a clearer recognition of market driven standards. As the world of mobile telecommunications and computer communication (The Internet) collide, the clear trend is for direct regulation to withdraw from the market' (Glimstedt 2001: 52).

Firms such as Ericsson and Nokia are also moving away from their original idea of a singular standard for 3G services and towards the position that the new mobile telecommunications services should be based on several different but compatible standards: 'a family of standards'. This is similar to the idea of open architecture in relation to the Internet which advocates that 'network architecture should be as open as possible, allowing user-led innovation and new combinations of radical technologies' (Glimstedt 2001: 52). At the same time, however, as we saw in Chapter 1 (section 4.3.2.2.B), the most important US mobile telecommunications access providers have, during the first years of the millennium, transferred to GSM. If the reason is to facilitate the transfer to W-CDMA, then *ex ante* standardization seems to be winning the game anyway. This may be because market sizes and economies of scale created by *ex ante* standardization lead actors into the dominant trajectory in the evolutionary process of standard creation.<sup>3</sup>

The promotion of one single standard was of great importance for European dominance in the production of equipment for the mobile telecommunications industry; for example, it allowed economies of scale to be exploited. The fact that the relations between users and producers were close also proved very important, primarily for the producers. The way GSM developed increased the leadership position of Nokia and Ericsson. This is all the more notable in light of the lack of European success – and US–Asian dominance – in most other ICT sectors. The mobile telecommunications market was growing rapidly and was a major job creator in Europe, until recently.

Europe has emerged as a clear leader in mobile telecommunications due to its success in defining good standards in mobile communications. Ericsson's and Nokia's dominance among equipment producers in mobile telecommunications is often traced to the early success of the NMT standard, and GSM is similarly regarded as the means by which early Nordic success was generalized to other EU countries in the second generation of mobile communications.

<sup>3</sup> In Chapter 1 it was argued that there has been an evolutionary process from NMT 450 over GSM to W-CDMA.

One reason for the relatively poor international performance of US-based second-generation mobile standards was the 'division' of the market between standards, none of which could match the subscriber base of GSM. These developments are considered to account for the subsequent loss of market share by US equipment manufacturers to European rivals during the second generation of mobile telecommunications. The slower transfer from first- to second-generation standards in the US was due to regulatory decisions that stressed the necessity of achieving 'backwards compatibility' with the existing analogue standards, rather than compatible digital standards. Decisions with regard to charges were another factor contributing to the low subscriber penetration rates; often the receiver has to pay for all or part of a mobile phone call.

The current 'crisis' of Ericsson is mainly caused by a drastic decrease in demand because of the slowdown in the international business cycle, and thereby in telecommunications system investments. It serves to conceal the fact that Ericsson is still dominant in base stations and switches (and has even conquered market shares), while Nokia strongly dominates global handset production.

In the 1990s we have experienced a convergence between traditional telecommunications, the Internet and mobile telecommunications. This has also been accompanied by a wave of mergers and acquisitions (and strategic alliances), both among equipment producers and among operators. A strategic decision for the equipment producers is whether they should select voice as their main business area and thus go for the growing mobile phone markets; concentrate on the rapidly growing Internet equipment market; or go for mobile Internet?

#### 4. THE SECTORAL SYSTEM'S FUTURE IN EUROPE, THE US AND JAPAN

It is clear that Europe has had the initiative in mobile voice telephony. Whether this will continue during the third-generation UMTS standard is unclear. NTT DoCoMo's I-Mode now has 31 million subscribers and DoCoMo was also the first operator to enter 3G in October 2001. This means that the focus of the centre of experimentation may have moved from Europe to Japan. This can spur equipment producers since user/producer interaction has earlier proved to be important. In the US, some operators have transferred to GSM and they will be more standardized in 3G than they were in 2G. However, the US is a slow starter in third-generation mobile telecommunications (with regard to WLANs, see below). Although Europe will probably

enter 3G earlier than the US, it is doing so at a slower pace than Japan. This might partly be because of the very high prices European operators had to pay in some countries for a 3G licence, i.e., it might partly be a consequence of public policy.

Currently 3G is developing quite slowly. However, telecommunications operators' revenue was growing by 10 per cent per year in 2001 and the immediately preceding years. This indicates that telecommunications operators are not subject to a structural crisis, but have been hit by the downturn of the business cycle during 2000 and 2001 – which is expected to take off again in 2002 or early 2003.

The most important obstacles to the diffusion of 3G are, in the short run, the availability of handsets and in the longer run the supply of attractive content suited for mobile Internet. This points to the crucial role of demand in the emergence of new sectoral systems. As far as equipment is concerned, the policy instrument of public technology procurement was used both with regard to the Internet (US) and mobile telecommunications (Scandinavia). When it comes to content in 3G mobile Internet, most of the demand has to be provided by final consumers – firms and individuals – outside the public sphere to the largest extent. The success of I-Mode in Japan indicates that this will happen,<sup>4</sup> but access providers and content providers will have to be innovative not only with regard to access and content proper, but also when it comes to charging systems and other innovations in the field of management and administration. It is also a matter of developing niche strategies adapted to the new medium: movies will never be watched best on a mobile phone!

Fixed Internet diffusion is proceeding and now about 70 per cent of households have access in the US. In other countries the degree of diffusion varies widely. The dominance of US equipment producers which was established early in the history of fixed Internet is likely to remain stable for some time. At the same time this sector may be entering a more mature stage of development – with slower growth and smaller profits.

If WLAN becomes a serious competitor or an alternative to third-generation mobile telecommunications, i.e., if the development is jumping the 3G 'step' and goes directly into 4G, this will probably benefit the US. The reasons are that 3G will not be implemented there in the near future, that there are already a number of WLAN installations and that the US is very strong in PCs and Palmtops. There seems to be a possibility for leapfrogging here. If WLAN (802.11) proves to be extremely successful, the Europeans and the Japanese may be left out.

<sup>4</sup> But the slow diffusion of WAP and GPRS in Europe and the US points in the opposite direction.

## 5. THE THREE MOST IMPORTANT POLICY ISSUES

Here follows a summary of the three most important policy issues with regard to fixed Internet and mobile telecommunications. They are presented in telegraphic form, and in no particular order.

*The role of institutions has been crucial for policy.* Standards have played a major role in innovation and the success of European mobile telecommunications, both in terms of diffusion of use and with regard to the success of equipment-producing companies. Deregulation has also played a role for the diffusion of the Internet and mobile telecommunications. Other important institutions are the structure and level of tariffs. Some institutions are national, some are sectoral and others are firm specific. An important firm strategy objective has been to influence institutions to the firm's benefit.

*The relations between different organizations and between institutions and organizations are crucial for the functioning and performance of (sectoral) systems of innovation.* Examples are the relations between private and public organizations in the form of research funding, standard setting or public technology procurement. Relations between different kinds of firms and other private organizations are also important, e.g., collaboration between users and producers. Organizations provoke institutional changes, and when the new institutions come into effect, they may greatly influence the same or other organizations.

*It is of paramount importance that public policy intervention occurs early in the development of the sectoral system.* Public technology procurement was crucial for the very early development of the Internet in the US and formulation of standards was crucial for the very early development of mobile telecommunications in the Nordic countries. This proved to be very important also for equipment producers in these fields. It is in the very early stage in the development of a sectoral system of innovation that uncertainty and risks are largest and private actors and markets therefore operate least efficiently and dynamically.<sup>5</sup> Therefore policy intervention in these nascent stages often means the difference between success and failure. Hence, policy resources – which are always scarce – should mainly be allocated to the very early stages of the development of new sectoral systems of innovation or new product areas.

<sup>5</sup> That public policy intervention in the field of innovation should be practised only in situations where private firms and markets fail to spontaneously achieve the wanted results is argued in Edquist (2001a; 2001b). This means that public policy action should not replace or duplicate markets and private actors.

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