Arbetsrapport

R2003:016

Issues affecting the future of ICT

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Januari 2003

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ISSN 1652-0483
Elanders Gotab, Stockholm 2003

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Förord

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Lena Moritz

Enhetschef

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1 Background

In its directives, the Swedish Institute for Growth Policy Studies, ITPS, has been commissioned to ensure that different components of the policy for economic growth are evaluated. In September 2002, ITPS, as part of this general assignment and an explicit assignment from the government, submitted a proposal for the evaluation of the Government's ICT policy.

This document is produced by the IT program on request by ITPS as an input to the continued work on the above-mentioned proposal, lists the general areas and issues which we believe will have impact on the future application and usage of ICT in the Swedish society. It also discusses in which cases the Japanese competence and experiences in these areas are relevant to Sweden, and could serve as valuable input to the continued work on the ICT policy.

It is a difficult task to divide a subject like ICT into distinct areas, and it can be done in many ways. We have selected general rather than specific areas as headings. Some issues, like that of the digital divide, will therefore fall into several areas, as will some technical fields such as those of ITS (Intelligent Transport Systems) and (human interfaces). One might argue that they should have their own areas, but we have opted to include them under the general headings which they affect. We hope that in spite of its insufficiencies, the overview provided in this document might give some inspiration and be adequate as a starting point for discussion. A natural follow-up questions is for example "In what areas can Sweden make a difference?".

A final note on nomenclature: the international telecom union, ITU, recently to use "ICT" (information and communications technology) as denomination for the segment resulting from the convergence of telecom, computer and media technologies, replacing "IT" (information technology) term is not yet applied all through the industry, we have chosen to use in this report.

2 Areas predicted to influence the ICT development

2.1 Hardware and Terminals

2.2 Issues

- Hardware development sets the hard limits for possible ICT evolutions displays, virtually free and unlimited
- PC, PDA or mobile: with regards to personal terminals, are we converging towards a one-type general purpose personal terminal for ubiquitous use, or diverging towards specialized terminals depending on context.

2.3 Relevance of Japan

With regards to network components, the Japanese government has invested substantial funds in R&D on backbone and access-line photonic network technology, as well as Internet node full fibre optic technology, aiming at a nationwide Terabit ultra-high-speed photonic network. A gigabit-per-second class network is already in service connecting some national research institutes.

When it comes to electronics components, Japan, utilising its accumulated semiconductor competence, very early began researching nano-technology. The area is now one of the focus areas in the R&D strategy of the Japanese government.

Due to the increased competition from Korean companies, most Japanese LSI makers have abandoned memory devices and instead focus their R&D on system-on-chip, a crucial technology for designing small terminals or networked home appliances. In Sweden, the Socware project is looking at the same thing.

In a similar way, the Japanese companies who previously worked on LCDs are now giving this area up to their Korean competitors, and instead focus their resources on new types of displays, such as Plasma Display Panels (PDP) and electronic paper. The government has also allocated considerable funds for this in their R&D budget.

When all devices become wireless, the portable energy source, or the battery, becomes a limiting factor with regards to weight, size and time before recharge. Fuel cell development may be the technology to solve these problems, and much research is focusing on this.

Japan has for decades produced and delivered robots to manufacturing plants all over the world. Recently, other types of robots have come into the spotlight, for example entertainment robots such as AIBO and PINO, humanoid robots such as ASIMO, therapeutic robots such as Paro, as well as some emergency rescue robots. The government aims to form a new national robot technologies project soon.

The Japanese world-leading hardware industry has helped create a vital, fast-moving consumer electronics market where all options are available, giving an early indication of user preferences and behavioural patterns.

As a consequence, we especially recommend monitoring the following areas in Japan:

- Opto-electronics technology
- Nano-technology
- System-on-chip technology
- Battery and fuel cell technology
- Display technology
- Robotics
- Terminals for fixed and mobile use
- Connected, digital home appliances
- User behaviour and preferences with regards to terminals

3 System Software and Computing

3.1 Issues

- How can we generate the computing power needed to solve large-scale and data intensive problems, for example gene analysis?
- In order to realize the ubiquitously networked society, things around us need to have intelligence. Embedded systems have in many applications already replaced traditional mechanical controls. In order to connect them and make them able to communicate with each other, the control software will be crucial.
- User interfaces for input and output will become increasingly important as the terminals become smaller and ubiquitous, and more packed with functions. design will also be crucial in order to make the technology accessible for all consumer groups.

3.2 Relevance of Japan

Grid computing enables sharing of power and resources of many computers, distributed and connected with networks. This has been suggested as a solution for high performance computing, and the Japanese government has allocated 365 million SEK (5 billion JPY) for R&D in this area for the next fiscal year. It is the largest budget amount among seven projects named Focus 21, expected to create new future markets where Japan can take a leading position.

The open software architecture TRON is used in more than 50 percent of appliances using embedded real-time operating systems produced in Japan. The TRON industry group has formed a new framework and a new development platform in the field to prepare for the emerging ubiquitous networks society.

The Japanese government recognises that while the required IT infrastructure now largely is in place, IT usage is still not at top global level (Japan is nation number 11 in the recently released list by IDC). Emphasis is therefore put not only on training the users, but also on developing user interfaces that make the technology accessible for all.

As a consequence, we especially recommend monitoring the following areas in Japan:

- Grid computing
- Embedded systems and its development tools
- Human user interface development

4 Networks

4.1 Issues

How can the high-speed backbone network be realised?

What access network will become dominant in what context?

How make access available and affordable for everyone?

- Fixed: VoIP, broadband (DSL, CATV, FTTH), facilities networks, ITS…
- Mobile: 2G, 2.5G, 3G, 4G, W-LAN (Spectrum issues!)
- Ubiquitous: RFID tags, peer-to-peer, home networks for health, security, remote control…

4.2 Relevance of Japan

The Japanese government has formulated very ambitious goals for their high-speed backbone network, and are investing considerable research funding and prestige to realise it. Regarding the access network, the broadband connection fees in Japan on the fixed side are now the lowest in the world, due to a fierce price war.

This in connection with an early introduction of 3G, has made Japan one of the few (the only?) market in the world where consumers already have access to most available network types, including both major types of 3G networks, several networks of hot spots, as well as commercial VoIP. Here we will get the first hints as to whether the unregulated quasi-mobile W-LAN technologies can give the established industry and their investments in 3G a run for their money.

With 3G already in commercial service by the 3 national mobile carriers, the many world-leading Japanese ICT companies, such as NEC, DoCoMo, Hitachi and Mitsubishi, are focusing their mobile telecom research on 4G.

Japan with its challenging traffic situation, has also focused much attention and resources on developing a nationwide intelligent transport system (ITS). The owners of the approximately five million VICS systems can, in addition to receiving near-real time traffic information, also receive a variety of on-demand information. Research is also made in the areas of safety, traffic management, and emergency vehicle support. Will this become an alternative or a complement to the traditional mobile networks?

Because of the imminent crisis due to lack of IP addresses allocated for Asia, Japan is a driver of the transition to IPv6. This new standard will in addition to a virtually limitless supply of addresses, necessary for the emergence of ubiquitous networks, also offer higher security, better quality and the ability to transmit in real-time.

As a consequence, we especially recommend monitoring the following areas in Japan, with regards to regulation, standardization, technical solutions, deployment, usage and pricing:

- High-speed backbone network
- W-LAN

- 3G
- VoIP
- Broadband access
- ITS
- IPv6
- 4G
- Ubiquitous networks

5 Contents, applications and services

5.1 Issues

In a world where ICT is ubiquitous, how can it be used to improve and enrich our lives? What will we be able to do, where, when, using what and to what price?

- What services will be offered for leisure and business users respectively
- What information and news based services will be offered; what form will communication and social services take
- What services should be commercial and which public (information, education, health related services…)

5.2 Relevance of Japan

Japan has succeeded with what no other market has, namely to offer attractive, affordable, abundant mobile contents for the consumers, and to create a vital and profitable industry segment. It will be interesting to see if this will help the 3G market take off, and if the experiences will be relevant in the business segment as well as in the future ubiquitous ICT-society.

As a consequence, we especially recommend monitoring the following areas in Japan:

- P2P applications, MMSmusic, images and video
- Location based services
- E- and m-commerce
- 3G “killer” applications

6 Business models

6.1 Issues

During the first century of telecom, the business model was simple: an operator like Televerket sold voice communication, and the subscriber paid for time and distance. With the emergence of e-mail, the web, mobile Internet, digital contents, e-commerce, etc, the business landscape changed completely. Contents became digital, distance lost its relevance, the role of the incumbent organisations changed and new players appeared: payment providers, information brokers, contents providers, web hotels, ISPs…

The challenge, not yet overcome in Europe, is how to create a business model which makes the new industry viable for all necessary players, and makes the pricing models and commercial relationships comprehensible to the consumers.

6.2 Relevance of Japan

By focusing on evolution instead of revolution, and ensuring that both partners and users where with them every step of the way, the Japanese operators introduced the most successful business model for mobile internet and contents so far: the i-mode model. The same industry is now trying to repeat the success with W-LAN and 3G.

We recommend monitoring, among others, the following interesting areas:

- Profit-sharing models: access providers <---> contents providers
- Digital contents: delivery, protection and payment models
- Wireless LAN - business roles and models: Who owns the network, the contents, the customers?
- The changing role of the convenience store network (in Sweden: gasoline stations?) as provider of services, terminals and outlets
- The emerging agents for brokerage of services, information and payment: who do they charge, how much and for what
- New ways to target and charge: ad-based services, push services, location based services…
- E-wallet: using the mobile phone for POS payments

7 Usage

7.1 Issues

ICT has the potential to influence all aspects of our lives. Tele-working could potentially affect our professional identities, the balance between our work and family life, how we live as well as the demands put on public infrastructure. Communication services such as SMS, chat and online communities are already affecting the way especially young people socialise. E-commerce is influencing how we shop as well as the demands put on merchants. The Internet is also affecting the very nervous system of our society: the way citizens can influence and participate in the political work.

How and for what is it desirable that the society, the industry and the citizens use ICT? How do we get there?

Is there undesirable, non-beneficial ICT usage?

- How to build competence, and educate the users
- How to build trust and acceptance
- How to bridge the digital divide

7.2 Relevance of Japan

Japan is lagging behind Sweden in general ICT use, both in the private and industrial sector. However, due to a powerful push from the industry and the government, the mobile and fixed infrastructure is now to a large degree in place, and the Japanese private consumers have access to an almost complete range of choices when it comes to services, networks and terminals. What services will they choose to access, in what context and using what?

Japan is facing similar problems as Sweden when it comes to overcoming a geographic and demographic digital divide due to an ageing society and disproportionately under-populated areas. The area of education and trust is also a shared concern.

As a consequence, we especially recommend monitoring the following areas in Japan:

- Measures and support by the national and local government to bridge the digital divide and raise ICT competence within the framework of the e-Japan strategy
- Development in human interface design and similar in order to support universal usability
- User behaviour and preferences with regard to what, when and how

8 Security

8.1 Issues

Payment, authentication, integrity and privacy are all issues that have to be solved to create the consumer trust necessary to enable e-commerce, e-government, e-health and all the other e-babies to take off for real.

Companies on their side need to control access and protect their innovations and assets, which are to an increasing degree in a digital format and therefore can be copied and transferred to any corner of the world in a matter of seconds.

IPR issues as well as how to regulate and control misuse and criminal use of the internet are issues that have to be addressed on a national as well as international level.

8.2 Relevance of Japan

When it comes to computer security, Japan has traditionally focused on the "hard" issues. It has been discussed to introduce PKI (Public Key Infrastructure) and other technologies on a nationwide scale as a tool to improve e-security especially in the area of e-government.

When it comes to authentication, integrity and privacy however, the discussions have just started in Japan due to the recently introduced nation-wide system for personal identification numbers, aiming to enable the first online governmental databases, and Japan can therefore be considered as lagging after Sweden in these areas.

Conversely, due to their leading position in the mobile internet area, Japan has been confronted with some of its dark sides before any other country, including a proliferating and sometimes violent date-against-payment market, and rampaging mobile scams and spams, and the legislative bodies and the operators have taken a number of measures to combat this.

As a consequence, we especially recommend monitoring the following areas in Japan:

- Encryption and hardware technologies, including smart cards, and its implementation
- Legislative and technical measures to combat mobile based scams, spams and crime

9 Health issues (usage related)

9.1 Issues

How does the ever-present and overlapping radiation from masts and terminals, around us, in our homes and carried on our bodies, affect us physically? What about the chemicals emitted from the electronics? Some say that electromagnetic fields are this generation's smoking issue, where we are still at the stage of believing it to be harmless.

9.2 Relevance of Japan

In Japan these issues have not been widely discussed or researched, and Sweden can therefore be considered as having come further than Japan. However, if any problems are discovered, the Japanese world leading hardware industry will of course be faced with the consequences, and trying to find the solutions.

We recommend general monitoring of the area.

10 Policies

10.1 Issues

What can and should the government do to support and enable use of ICT in a beneficial way, for the growth of the economy and the improvement of life quality for the citizens?

- What are the objectives of the policies, how are they realised and how are they evaluated?
- E-government: G2B, G2C, inG… How shall it be designed, realised, regulated and maintained?
- What part of the spectrum should be regulated? How? Should the policy be based on commons instead of ownerships, and the spectrum regulated with technology instead of laws?
- Should BB (FTTH?) be provided like a facility, and only the provision of services market driven? Maybe the network should be stupid with intelligence only at the edge?
- Should a volks-3G mobile be offered, much like the tax-free PCs for the homes which made the Internet take off in Sweden?
- What services should be public?
- Should the state support 3G and the established industry, or let the unregulated W-LAN technology have a stab at the market?
- Should VoIP be supported and regulated as a commercial service, competing with traditional telephone services?
- How solve issues around roaming, antenna sites, competition, etc?

10.2 Relevance of Japan

Japan is the second largest economy in the world, with large funds invested into research and development. Since several years, the Japanese government has identified ICT as a means to create growth in the economy, and year 2001 the e-Japan strategy was established with the explicit goal to make Japan the world's leading ICT nation by year 2005.

As a consequence, we recommend monitoring the e-Japan strategy and programs, their focuses, objectives, applications, and evaluations.

11 List of abbreviations used

2G	Second generation mobile network (digital)
3G	Third generation mobile network (broadband)
4G	Fourth generation mobile network
ADSL	Asymmetric digital subscriber line (a DSL technology)
BB	Broadband
CATV	Cable TV
DSL	Digital subscriber line (fixed broadband access over wire)
e-commerce	Electronic commerce
FTTH	Fibre to the home (fixed broadband access offered over optical fibre)
G2B	Government to business
G2C	Government to consumers
HCI	Human computer interface
ICT	Information and communications technology
inG	In-government, within the government
IPR	Intellectual property rights
IPv6	Internet Protocol version 6
ISP	Internet service provider
IT	Information technology
ITPS	Swedish Institute for Growth Policy Studies
ITS	Intelligent transport system
m-commerce	Electronic commerce via mobile phones
MMS	Media messaging service (sending video, sound and images over mobile)
P2P	Peer-to-peer (networks or applications from user to user)
POS	Point of sales (sales outlet for physical goods)
VoIP	Voice over IP (voice telephony over the Internet)
W-LAN	Wireless LAN (mobile broadband access offered in a limited area)

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