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**SHAPING THE FUTURE MOBILE INFORMATION  
SOCIETY:**

**THE CASE OF JAPAN**

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## **Executive Summary**

### **Introduction**

Japan boasts the highest percentage of mobile Internet users as a proportion of total mobile users. It was one of the first countries to launch third-generation mobile services in October 2001 and the first country to launch commercial services based on the W-CDMA standard. As such, the country's position as a world leader in ICTs and particularly in mobile communications is widely acknowledged.

### **History of mobile market and regulatory policy**

Japan's mobile service began, like many other countries, with car phones, which were introduced by Nippon Telegraph and Telephone (NTT) in 1979.

In 1985, NTT, which had been a public corporation since 1952, was privatized. This marked the start of competition in Japan's telecommunication market.

In 1987, NTT began offering portable mobile phone services. At the same time, the new entrants, IDO (current KDDI) and Cellular Phone Group (current KDDI and Okinawa Cellular) were established. In 1991, NTT separated its mobile phone business, and NTT DoCoMo was established as a subsidiary.

Deregulation accelerated the growth of mobile services in the 1990s. In 1994, customer ownership of mobile handsets was introduced. In 1996, the MPT deregulated its procedure for amending mobile phone call charges from permission to simple notification.

In June 2000, third-generation IMT-2000 operators were chosen through a comparative selection process. The three incumbent operators, i.e. NTT DoCoMo Group, IDO and Cellular Group (current KDDI) and J-Phone Group (current Vodafone), applied, and obtained the three available licenses. The number of third-generation IMT-2000 subscribers has been increasing steadily and reached more than 13 million by the end of 2003.

In 2003, the Diet passed the amended Telecommunications Business Law to implement a drastic reform of telecommunication field;

- i) abolition of distinction between Type I telecommunications business operators that install their own circuit facilities and Type II telecommunications business operators that don't
- ii) abolition of permission system for market entry with regard to Type I telecommunications business, etc.

### **Mobile applications and contents**

A wide variety of applications and contents are provided in the mobile communications market in Japan.

In February 1999, NTT DoCoMo launched its Internet connection service, "i-mode". The main services are e-mail, information services and applications such as Internet banking and ticket reservation. At the end of December 2003, about 85% of mobile phone subscribers in Japan were using some kind of Internet browsing service.

In January 2001, the first java-enabled handsets which allow the subscriber to download and run small Java applets, such as games and stock quotes, were launched. By the end of October 2003, the users of this application had grown to 20.7 million.

The primary use, however, of the mobile Internet in Japan is for e-mail: over 83 percent of mobile subscribers use the mobile Internet for sending and receiving e-mail.

In addition to this, audio services, such as "Chaku-Melo" and "Chaku-Uta", which allow users to download a melody file or ringing tunes file, and video services, such as moviemail, which attach a short movie to a mobile e-mail, are provided in Japan. Handsets with a built-in analog TV tuner and equipped with GPS sensors are also provided.

### **Policies and applications for realizing the "ubiquitous network society"**

"Ubiquitous networks" are networks that can be accessed by anyone and anything via a wide variety of mechanisms or access methods, and this without limitations of time or space.

The MPHPT established a national vision for realizing the “ubiquitous network society” and is encouraging the government, the private sector and academia to work together in research and development (R&D). In particular, they are focusing on three specific R&D projects;

1. Microchip networking technologies
2. Ubiquitous network authentication and agent technologies
3. Ubiquitous network control and management technologies

The relevant fields are numerous: ubiquitous networks will affect the environment, distribution, road traffic, robots, home information, etc. The MPHPT estimates the total value of ubiquitous industries and market will grow to 84.3 trillion yen (774.5 billion USD) in 2010.

Japan is one of the most advanced countries in terms of car navigation system, an example of a practical ubiquitous application, and the total sales of car navigation systems reached 11’476’000 in March 2003. At the government level, the MPHPT and other ministries are promoting the Vehicle Information and Communication System (VICS) project, which provides and collects various types of information from and to vehicles, through the national infrastructure. The total accumulated number of VICS units reached 7’783’528 at the end of September 2003.

While e-ticketing services via PC or mobile handset have been popular, the launch of the trial service of mobile phones with integrated circuit cards will enable mobile phone users to utilize their mobile phones as tickets or cash for services such as public transport, concert tickets etc.

### **Radio policy for realizing the ubiquitous network society**

One of the key challenges for the development of the ubiquitous network society in Japan, as in many countries, is the efficient use of spectrum. The MPHPT has established the mid-to-long term vision for Japan’s radio policy, and subsequently published the “spectrum open policy”. The policy includes the following solutions:

1. Dynamic review of frequency allocation (spectrum refarming policy)
2. Introduction of compensation scheme for rapid frequency refarming
3. Partial introduction of a registration scheme with simplified process

### **The problems resulting from mobile applications use and their solutions**

With the increased use of mobile applications, various negative influences resulting from the use of mobile applications have arisen. The issues such as the increase in unsolicited e-mail message (spam mail), crime linked to Internet dating and flirting services, and the issue of new mobile etiquette have arisen.

In Japan, the government and the mobile operators are working in tandem to address these problems. The government established the “Law on Regulation of Transmission of Specified Electric Mail” and other laws and regulations. The operators introduced self restriction. The issue of privacy protection linked to the use of the Internet has arisen. In order to raise awareness of this issue, the MPHPT has created a web site entitled “MPHPT Information Security Site for citizens” and alerts the problems resulting from the use of Internet services.

### **Health, safety and environment**

Japan has contributed to the research on the effect of radio waves on human health, such as those emanating from mobile towers or mobile phones. The MPT issued the “Radio Radiation Protection Guidelines for Human Exposure to Electromagnetic Fields”, that are on par with the values released by the International Commission on Non-Ionizing Radiation Protection (ICNIRP), an organization collaborating with the WHO. In June 2002, the local absorption value applicable to mobile phones and other radio communication devices used close to human heads became mandatory.

Concerning the effects on the discarding of old mobile phones to the environment, most mobile phone operators have recycle program, offering incentives to users that return their old mobile phones.

### **Conclusion**

In this case study, the current situation of the mobile information society of Japan, one of the most advanced nations of mobile communication will be reviewed. This case study provides an excellent source for considering regulatory policies and business development plans toward the realization of the mobile information society in every country in the world.

## Table of Contents

1	Introduction .....	7
1.1	Why Japan .....	7
1.2	Scope and outline of report.....	7
2	About Japan: An overview .....	7
2.1	Geography and demographics .....	7
2.1.1	Human development.....	8
2.2	Political economy .....	8
2.3	ICT sector overview .....	9
2.3.1	Basic indicators.....	9
2.3.2	Market structure and network deployment .....	10
2.4	ICT regulation and policy .....	11
2.4.1	History .....	11
2.4.2	Legislative Framework .....	12
2.4.3	The e-Japan strategy I.....	13
2.4.4	The e-Japan strategy II .....	14
3	Keitai musings: Characteristics of the Japanese mobile market.....	15
3.1	Introducing mobile mania in Japan .....	15
3.2	High-speed mobile.....	16
3.2.1	Fixed wireless and converged services.....	18
3.3	Mobile Internet and multimedia .....	20
3.4	New applications, services and terminals.....	23
3.4.1	Audio and video.....	23
3.4.2	Location based services .....	25
3.4.3	Gaming services .....	27
3.4.4	New terminals and handsets .....	27
3.5	Market peculiarities .....	30
4	The path to Japan's "ubiquitous network society" .....	31
4.1	National vision.....	31
4.1.1	Microchip networking rechnologies .....	32
4.2	Development of practical ubiquitous applications .....	33
4.2.1	In-vehicular systems .....	33
4.2.2	Towards the multimedia home .....	35
4.2.3	Vending and ticketing.....	36
4.2.4	The mobile enterprise .....	38
4.2.5	Cards, codes and chips.....	40
4.3	Key challenges.....	42
4.3.1	Radio policy.....	42
4.3.2	Broadcasting policy .....	44
5	Living in the mobile information society, Japan-style .....	45
5.1	Peculiarities .....	45
5.1.1	Selected demographics and patterns of use .....	48
5.2	A question of content.....	52
5.3	Privacy protection and data integrity.....	54
5.4	Health, safety and environment .....	54
5.5	Youths and the mobile phone .....	55
5.6	Managing mobile use and the new mobile etiquette .....	56
6	Conclusion.....	57

# **1 Introduction**

2002 marked an important turning point in the history of information and communication technologies: the total number of mobile subscribers overtook the number of fixed lines on a global scale. Moreover, with the advent of personalized and always-on communications, the impact of technology on the socio-economic landscape is becoming more and more significant. The widespread use of mobile phones has affected the way in which humans learn, interact, and socialize. Yet we are only witnessing the early beginnings of this social transformation.

## **1.1 Why Japan**

Japan boasts the highest percentage of mobile Internet users as a proportion of total mobile users. It was one of the first countries to launch third-generation mobile services in October 2001 and the first country to launch commercial services based on the W-CDMA standard. In 2002, Japan's mobile subscribers outnumbered its fixed-line subscribers in 2002<sup>1</sup>. The country's position as a world leader in ICTs and particularly in mobile communications is widely acknowledged. As such, Japan presents a important case to study in more depth, with a view to gaining a better grasp of its vision of the future mobile information society.

## **1.2 Scope and outline of report**

This report aims to outline the vision of the future mobile information society in Japan. Chapter two provides an introduction to the country, followed by an overview of the ICT sector and institutional framework. Chapter three sets out the main characteristics of the Japanese mobile market, and describes some of the new applications and services. Chapter four looks at the country's road to ubiquitous wireless communications and chapter five focuses on the social and human factors raised by an increasingly mobile society.

# **2 About Japan: An overview**

## **2.1 Geography and demographics**

The Japanese archipelago lies not far off the eastern coast of the world's largest continent, Asia. This chain of islands, of which four distinguish themselves as the main ones, is home to some 127 million people, equivalent to almost half the population of the United States. Its land mass is 377'835 square kilometres, 71 per cent of which is mountainous. It is half again the size of the United Kingdom, but only one-ninth the size of the Indian subcontinent. The national territory is divided into eight or nine geographical regions. These regions are categorized mainly by their economic and human characteristics. The Kanto region, Kinki region and Tokai account for over 60 per cent of the total population. Apart from fishing (Japan accounts for 15 per cent of the world's catch), the country is lacking in natural resources. This is in sharp contrast to its huge economy, which is among the world's largest. Its rate of urbanization is high, as 80 per cent of its population now lives in crowded urban areas, a factor not be neglected in accounting for the considerable success of mobile communications in Japan. The national currency is the Japanese Yen (JPY). One language is spoken throughout the land even though two systems of writing prevail. They are: *Kanji*, written in the manner of Chinese hieroglyphics (3'000 symbols are in daily use) and the phonetic *Kana* (each with a 46-character set). Standard Japanese word-processors recognize up to 6'000 *Kanji* characters.

**Figure 1.1: Geographical regions and population distribution in Japan**



Source: The Kinki region is also known as Kansai.

The Hokuriku region is the northern part of the Chubu region and Tokai region is the southern part of the Chubu region.

**Table 1.1 Basic social and economic indicators for Japan**

	1996	1997	1998	1999	2000	2001	2002
Population (thousands)	125'864	126'166	126'490	126'500	126'920	127'291	127'435
Urban population (in per cent)	78.26	78.42	79.00	79.00	78.70	79.00.	n.a.
Gross Domestic Product (GDP) (JPY Billion)	500'310	509'645	498'499	511'837	513'534	503'594	500'529
GDP Per Capita (US\$)	36'541	34'203	31'179	35'478	37'544	32'553	31'324
Average Annual Exchange Rate Per US\$	108.78	120.99	130.91	113.91	107.77	121.53	125.39

Source: ITU World Telecommunication Indicators Database, International Monetary Fund.

### 2.1.1 Human development

Japan ranks ninth among the 174 countries that make up the United Nations Development Programme<sup>2</sup> 2003 Human Development Index and is placed in the “high” human development group. In this respect, it ranks ahead of France, Switzerland and Hong Kong China, but behind Canada, the United States and the Netherlands. Table 1.1 provides some relevant social and economic indicators for the country.

## 2.2 Political economy

Japan is universally regarded as one of the world’s leading industrial nations. Significant government-industry collaboration, rapid technological innovation and a strong work ethic have sustained the economy at its present high level.

One of the most remarkable characteristics of the economic scene is the “*keiretsu*”, or tightly-knit groups consisting of manufacturers, suppliers and distributors. Much of the labour force enjoys lifetime employment and in general there is a high degree of staff loyalty. The use of robotic technology and



telecommunications are important factors contributing to its economic strength. In fact, Japan possesses 410,000 of the world's 720,000 “working robots”.

Historically, the economy suffered greatly as a result of the Second World War, particularly due to destruction of infrastructure, severe food shortages and high inflation. Various social reforms were carried out after the war in order to establish a basic framework for economic recovery and development. The process of liberalization began with the break-up of the “*zaibatsu*”, or large business trusts. For instance, postwar demilitarization and the prohibition of rearmament are written into a new constitution, and Japan now spends as little as 1 per cent of its total gross domestic product (GDP) on defense.

In the latter half of the twentieth century, overall economic growth in Japan was phenomenal. In the 1960s, for instance, the annual growth rate averaged close to 11 per cent. This was far above the growth rates for the Federal Republic of Germany at 4.6 per cent and for the United States at 4.3 per cent during the same period. This growth was spurred by large investments from the private sector in infrastructure and equipment, and by the increased capital spending and the introduction of new technology.

There was a significant slowdown between 1992-95, largely due to the after-effects of increased investment during the late 1980s, and constrictive domestic policies intended to wring out speculative excesses from the stock and real estate markets. Since then, periods of growth have been frequently interspersed with stagnation. Growth picked up in 1996 following the introduction of stimulating fiscal and monetary policies coupled with low inflation. Again, in 1997-98, Japan's economy took a downward turn. After the bursting of the IT bubble in 2000, Japan has once again plunged into a severe recession. The slowdown in the economy has been partially attributed to high unemployment rates, and low consumer confidence. The economy picked up somewhat in second and third quarter of 2002, but lost this momentum near the end of the year. There was renewed hope in 2003 however, when GDP figures confirmed a brighter trend, with a rise in investment and stock prices, and a slight decrease in unemployment

## **2.3 ICT sector overview**

### **2.3.1 Basic indicators**

Basic telecommunication indicators for Japan are set out in Table 1.1. Over the past few years, overall telephone density in Japan has been increasing at a rapid rate. However, like in many industrialized economies, the growth of fixed lines has been tapering off. In 2000, mobile lines outnumbered fixed lines in Japan. The penetration of PCs continues to rise, and the rate of but the rate of 41.8 per cent at the end of 2002 has just about reached the average of high-income countries<sup>3</sup>. The Japanese information and communication industry expanded from JPY 79 trillion (USD 732 billion) to JPY 123 trillion (USD 1'141 billion) from 1995 to 2001.

**Table 2.1 Basic telecommunication indicators for Japan**

	1995	1996	1997	1998	1999	2000	2001	2002
<b>Main telephone lines (000s)*</b>	62'292	64'037	65'735	67'488	70'530	74'343	76'000	71'149
<b>Main lines per 100 inhabitants*</b>	49.61	50.88	52.10	53.35	55.75	58.58	59.71	55.79
<b>Mobile phone subscribers, cellular and PHS (000s)</b>	11'712	26'906	38'254	47'308	56'846	66'784	74,819	79'081
<b>Mobile phone subscribers per 100 inhabitants</b>	9.33	21.38	30.32	37.43	44.88	52.62	58.76	63.61
<b>Mobile Lines as % of Fixed Lines</b>	18.8%	42.0%	58.2%	70.1%	80.6%	87.0%	98.0%	111.1%
<b>Number of personal computers per 100 inhabitants</b>	12.03	16.21	20.21	23.72	28.69	31.51	34.87	41.80

Source: ITU World Telecommunication Indicators Database.

### 2.3.2 Market structure and network deployment

In April 1985, Nippon Telegraph and Telephone (NTT), which had been a public corporation since 1952, was privatized. This marked the start of competition in Japan's telecommunication market. Statistics show that there were about 400 Type I operators that own their circuits and over 10'000 Type II operators that don't own their circuits, at the end of 2002. The market size has also expanded from JPY 100 billion (USD 0.8 billion) in 1995 to JPY 168 billion (USD 1.4 billion) in 2002<sup>4</sup>.

NTT was restructured to the holding company and its subsidiaries in 1999. This NTT group has two regional telecom subsidiaries, NTT East and West. They dominate the local voice-call market (over 90 per cent of market share). Another subsidiary, NTT Communications, owns long-distance and international networks. Some other subsidiaries, such as NTT-ME, also offer telecommunication services such as ISP service. Three operators — KDD (mainly international telecommunication), DDI group (long-distance and mobile) and IDO (mobile) — merged into KDDI in 1999. This is the second largest telecommunication group in Japan. The third largest is the Japan Telecom group. In 1999, Vodafone obtained over half of its stocks and since then, Ripplewood has controlled this group.

In the fixed line market, other than above-mentioned three groups, ten telecommunication subsidiaries of ten regional electric power companies own their nationwide networks. Their telecommunication networks are along electric power lines. In Japan, most CATV operators' service areas are only small areas. About 290 CATV operators offer telecom services. Most of their services are Internet access service. For the most part, Japan's Internet services market has been largely unregulated. T

At the end of 2002, there were 69.4 million Internet users in Japan. The development and take-up of broadband Internet access has grown rapidly, with some 19 million Internet users benefiting from high-speed access through technologies such as digital subscriber line (DSL ), fibre to the home (FTTH), cable modem, and fixed wireless access (FWA ) and UWB (ultra wide band).

The first digital broadcasting (DB) services in Japan started in June 1996 with the launch of communication satellite DB. In July 1998, digital broadcasting became available in some areas with cable television. In December 2000, broadcasting satellite DB started. In December 2003, terrestrial digital television was launched in three major regions. A complete shift from analog to digital broadcasting is planned for 2011, with the exception for terrestrial radio broadcasting.

In the mobile market, NTT's subsidiary NTT DoCoMo group owns about 60 per cent of the market share. KDDI (KDDI has Tu-Ka group that offer mobile service in three main regions) and J-Phone that is Vodafone's subsidiary are other players in this market. They offer nationwide mobile services. NTT DoCoMo, J-Phone and the Tu-Ka group adopted the Personal Digital Cellular (PDC) system—Japan's original 2G phone system. KDDI initially adopted this system too, but later replaced it by the cdmaOne system and terminated the PDC service in March 2003. These operators offer mobile Internet services based on these technologies, but with some differences (see details in the Annex A). In October 2001, DoCoMo launched its 3G service "FOMA (Freedom of Mobile Access)" based on W-CDMA system, on a fully commercialized basis. KDDI followed launching its 3G service in April 2002. It adopted cdma2000 1x that has upper-compatibility as its 3G system. J-Phone, which uses the W-CDMA system, launched 3G services in December 2002. J-phone officially changed its name to Vodafone in September 2003.

An alternative to PDC is the personal handyphone system (PHS) launched in 1995. NTT DoCoMo, DDI Pocket (a subsidiary of KDDI) and the ASTEL group offer nationwide PHS services. With the drop-off in the market share since 1997 due to competition from mobile, the operators have switched their attention to PHS data services. The PDC system allows for a much higher maximum transmission speed (128 kbit/s), compared with other 2G mobile systems.

Like in many other countries around the world, since early 2002, wireless LAN (WLAN) hotspots, primarily based on the IEEE 802.11 family of standards (e.g. Wireless Fidelity or 802.11b), have emerged in restaurants, cafés and convenience stores as well as airports and train stations all over large metropolitan cities in Japan.

## **2.4 ICT regulation and policy**

### **2.4.1 History**

A Ministry of Communications was established soon after the introduction of telephone services, in 1890. It remained in place until the end of the Second World War, when it was split into the Ministry of Telecommunications and the Ministry of Posts. In 1952, the Ministry of Telecommunications became a public corporation and Nippon Telegraph and Telephone (NTT) was born. It was to be the monopoly domestic operator. At the same time, the Ministry of Posts became the Ministry of Posts and Telecommunications (MPT) responsible for the regulation of the telecommunication market. In the same year, the KDD Corporation Law of 1952 was enacted, establishing Kokusai Denshin Denwa (KDD) as the international operator. NTT was the primary regulator, responsible for the setting of technical standards, the development of telecommunication regulation, and for policy-making in conjunction with the Japanese parliament (the Diet). NTT already controlled an R and D system in collaboration with the large equipment manufacturers, such as Fujitsu, NEC, Hitachi and Oki Electric.

While substantial network development had been achieved, NTT was nevertheless perceived as being out of touch with user needs. Consequently, in 1970, the MPT set up a number of study groups to consider reforms to telecommunication policy. These study groups, made up of about 100 younger MPT staff, examined the possibility of reorganizing the NTT, and openly questioning its monopoly status. The report, released in June 1971, recommended the "reorganization" of NTT and the liberalization of value-added services. These reforms were not adopted until 1985, fifteen years later. And despite NTT's role as primary regulator, the involvement of the MPT in regulatory reform in the 1970s sealed MPT's future role as the telecommunications regulatory authority for Japan.

With respect to value-added networks, by the end of the 1970s, the Ministry of International Trade and Industry (MITI) and the MPT were in competition with each other. As the regulator for the computer and IT industry, the MITI was pushing for the liberalization of value-added services, whereas the MPT was of the view that all new entrants, including value-added service providers, should be subject to MPT regulation (for the purposes of ensuring consumer protection). Finally it was decided to liberalize value-added networks for small and medium-sized enterprises under the MPT's framework. At the same time, telecommunication reform got under way in Japan.

Significant reform in telecommunications occurred in the 1980s, as the United States began liberalizing its telecommunications market and started the process leading to the break-up of AT&T. In Japan, the Second

Provisional Council on Administrative Reform (*Rincho*) announced a proposal in 1982 to introduce competition in all sectors of telecommunication services, as well as to privatize and “reorganize” NTT. Approval was given to separate telecommunication services on the basis of installation of circuit-switched facilities, rather service types. Under this scheme, Type I service providers (those owning their own facilities or infrastructure) would require permits from the MPT. Special Type II service providers (those not owning infrastructure but with a large user base) would need to register with the Ministry. Basic Type II service providers (confined to operation in limited areas) need to merely register. The licensing regime in Japan is just under revision (see below).

On 1 April 1985, three reform laws came into effect: the Telecommunications Business Law, the NTT Law, and the Background Law for the Telecommunications Law. Open tendering for NTT stock began in October 1986, when the government issued the first block of 200’000 shares. Complete privatization did not take place and the government still holds a substantial share in NTT.

The reforms of 1985 placed regulatory power firmly in the hands of the MPT, e.g. the authority over price and service regulation (the Diet’s original domain) and technical regulation (NTT’s original domain). The MPT also increased its role in telecommunication policy, and research and development. It even began exerting its authority over competition issues, for instance selecting new entrants (new common carriers – NCCs) in the 1980s and 90s. A large number of companies entered the market, and by 1996, 124 Type I and 3134 Type II carriers were offering services.

In the 1990s, the MPT evolved its regulatory framework significantly to adapt to technological innovation and changing market dynamics. It started with the liberalization of the cable TV market in the early 1990s. In 1996, the MPT embarked upon a deregulation process, which included, *inter alia*, a new regime for end-to-end interconnection with NTT (known as “ko-sen-ko” interconnection) and a relaxation of foreign ownership restrictions. Once the privatization process had begun, the MPT was able to focus more effectively on developing policies for information and communications technologies (ICT) in Japan. The MPT and two other ministries were merged into the Ministry of Public Management, Home Affairs, Post and Telecommunications (MPHPT) in the administrative reform of central government in January 2001.

#### **2.4.2 Legislative Framework**

In April 1985, NTT (until then a public corporation) was privatized and the Japanese telecommunication market was opened to new entrants. This was a turning point for the Japanese telecommunications industry, as up until that point, NTT held an unchallenged monopoly. At the same time, the *Telecommunications Business Law* (hereinafter referred to as the “TBL”) was established to regulate telecommunication companies. Businesses offer telecommunication services are required to either to obtain permission, or to register/to notify the Ministry of their intention, depending on their type of operation.

The TBL classifies telecommunications businesses into Type I and Type II businesses. The latter are divided into General Type II and Special Type II businesses. Operators that install their own circuit facilities are classified as Type I businesses and others as Type II businesses. The rationale behind this classification stems from the important role played by Type I operators, typically large telephone companies, who are responsible for providing basic infrastructure indispensable to people’s lives and overall socio-economic activity. They are therefore subject to more stringent regulations. On the other hand, Type II operators, that do not install their own circuit facilities, are small value-added service providers with less direct influence on socio-economic activities. The “mobile virtual network operator” model stems from this distinction. MVNO’s in Japan include Japan Communications Inc, NTT Communications, as well manufacturers Sony and Fujitsu.

However, over the last few years, the market has evolved. There are a number of small operators in the Type I category, such as CATV, W-LAN and CBD (central business district). Similarly, large-scale Type II enterprises have emerged, such as Internet, IP-telephony, and ADSL providers. These operators compete in the same market. If an operator owns circuit facilities, no matter how small, it is classified as Type I and is subject to more stringent regulation. The Government deemed that the distinction between Type I and Type II businesses was therefore in need of revision. On 17 March 2003, the Cabinet submitted a bill to the Parliament (Diet) to amend TBL. The main amendments were as follows:

1. Abolition of the distinction between Type I and Type II telecommunications business;
2. Abolition of permission system for market entry with regard to Type I telecommunications business;
3. Abolition of permission system for suspension and discontinuance of business with regard to Type I telecommunications business;
4. Abolition of tariff regulations for non-dominant operators;
5. Abolition of ex-ante regulations with regard to interconnection such as prior notification of interconnection agreement for non-dominant operators;
6. Maintenance of asymmetrical regulations for dominant operators.

Table 2.1 compares the current and revised framework under the Business Law, notably with respect to the first, second and fourth points above. The aim of the revised legislation is to enable all operators to develop business models swiftly, capitalizing on emerging business opportunities to meet the needs of users in a timely manner. In so doing, it is hoped that user-centric business models and consumer protection will be promoted and enhanced.

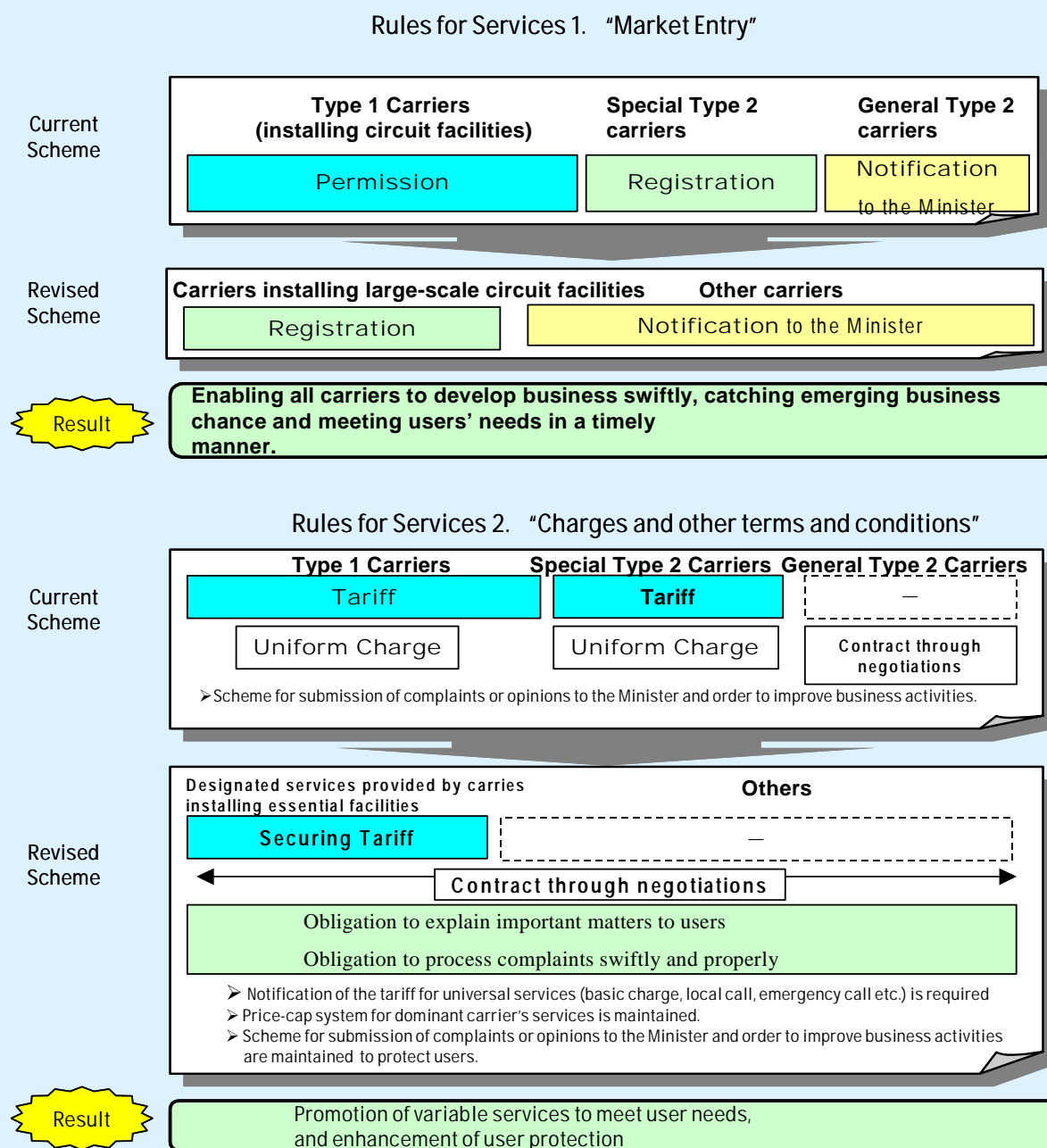
### **2.4.3 The e-Japan strategy I**

Like many other industrialized countries, Japan is facing a number of challenges, including environmental concerns, a rapidly ageing population, falling birthrates, and expanded urban development. The introduction and rapid diffusion of information and communication technology is seen to be an essential factor in overcoming these challenges. However, up until 2000, there was no national policy on IT, in contrast to other countries in Europe and Asia. In this context, in January 2001, the government put forward “e-Japan Strategy”, with the main objective of making Japan the most advanced IT nation in the world within five years (2005). The Strategy consists primarily the “e-Japan Priority Policy Programs” and “FY2002 Programs”. In order to enable a rapid and focused policy implementation related to establishing advanced information society, a Cabinet-level IT Strategy Headquarters <sup>5</sup> (led by the Japanese Prime Minister) was established, to enforce the Basic Law on the Formation of an Advanced Information and Telecommunications Network Society (commonly referred to as “IT Basic Law”) of January 2001<sup>6</sup>. The Headquarters announced the “e-Japan Strategy” in January 2001<sup>7</sup> and revealed in March 2001 the “e-Japan Priority Policy Programme”<sup>8</sup> with a view to clarify specific action plans. This programme, to be reviewed every year, sets out five policy areas for the country to concentrate on:

- (1) Infrastructure;
- (2) Human resources;
- (3) E-commerce;
- (4) E-government;
- (5) Network security.

In terms of infrastructure development, the programme clearly states that, “the private sector is to play a leading role in the area of IT”. Although initiative was to be taken by the private sector, the government was to take concrete action in promoting an environment conducive to innovation and investment, through mechanisms such as effective IT policies, tax incentives and deregulation. Among the 220 projects to be implemented by the end of the financial year 2001 (March 2002), 103 had been completed as scheduled. The headquarters reviewed it in June 2002 to include 318 projects.

**Figure 2.1: Principal amendments to “Telecommunication Business Law” (2003)**



Source: MPHPT.

#### 2.4.4 The e-Japan strategy II

In line with the e-Japan strategy, the goal of providing high-speed Internet access for 30 million households and ultra high-speed access for 10 million households is being reached. Furthermore, the country’s monthly broadband consumer prices are the lowest in the world<sup>9</sup>. In 2003, the IT Strategy Headquarters adopted the second phase of the IT strategy, “e-Japan Strategy II”, with a target date of 2006. The second stage shifts its focus from infrastructure to user adoption, and aims to create a “society that is fully energetic and lets people lead secure lives as well as enjoy new sensations and unprecedented convenience”. The strategy cites four strategic ideas for realizing such a society: structural reform, new value creation, individual perspective and new international relationships. On this basis, seven areas were designated for the promotion of IT use: medical care, food, living, small business financing, intellectuality, employment/work, and government services. The e-Japan strategy II also includes specific infrastructure targets, as did the first phase.

### 3 Keitai musings: Characteristics of the Japanese mobile market

#### 3.1 Introducing mobile mania in Japan

Japan's mobile journey began, like in many other countries, with car phones, which were introduced by the NTT in 1979. In April 1987, NTT (privatized in 1985) began offering portable mobile phone services under an analogue "HiCap" system that it had developed. At the same time, NCC (New Common Carriers), IDO and Cellular Phone Group were established. IDO was a subsidiary of the long-distance fixed line operator Nihon Kosoku Tushin, and Cellular Phone Group was a subsidiary of long-distance fixed line operator DDI. IDO started its service from December 1988 in Kanto and Tokai region. Cellular Phone Group operators launched their service in other regions. At that time, two mobile operators (NTT and IDO or Cellular Phone Group operator) offered mobile services in each region. Roaming between operators was not an obligation and depended on negotiations between them. In August 1991, with a view to ensuring fair competition in the mobile market, NTT separated its mobile phone business, and NTT DoCoMo was established as a subsidiary.

Digital mobile phone services in the 800 MHz frequency band were launched in 1993. Operators adopted the PDC (Personal Digital Cellular) system developed by NTT DoCoMo. In April 1994, the 1.5GHz frequency band was also opened up for mobile services. DoCoMo now uses this band in the Kanto, Tokai and Kinki regions, where population density is very high. In these areas, two additional mobile operators (Digital Phone Group of Japan Telecom and Tu-ka Group of Nissan) also entered the market in April 1994. In other regions, Japan Telecom and Nissan Motors jointly established one operator (Digital Tu-ka Group).

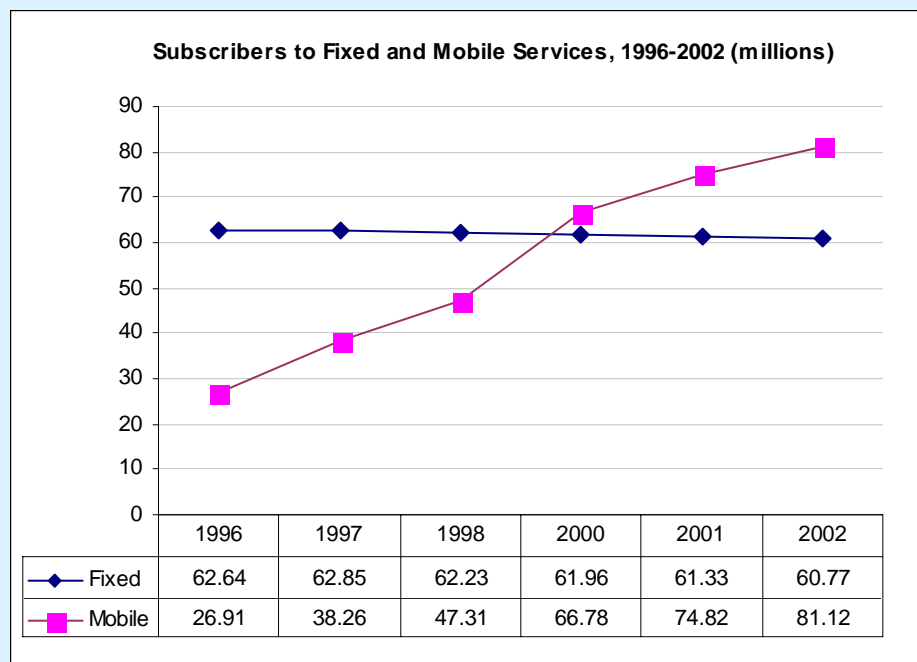
In July 1995, a new mobile phone system by the name of personal handyphone system (PHS) was launched. Three groups of PHS operators (NTT Personal, DDI Pocket, and ASTEL Group) launched their services simultaneously in each region. PHS had the advantage of low cost, long battery life and relatively fast data transmission rate (64 kbit/s compared to PDC's 9.6 kbit/s). However, it was primarily a cordless phone and thus had limited coverage. Although the early adoption rate for PHS was higher than for cellular mobile or PDC, its subscriptions declined, and now account for a fraction of the total mobile market. Over the last few years, the strategy of PHS operators has shifted to focusing on wireless PC data access (see Section 3.2.1).

The mid-1990s were crucial for the development of mobile communications in Japan. Take the example of the pager. At first its only function was to alert the user to a transmission with a ringing bell. Not unlike the mobile phone, its first use was limited to businesses. This situation was radically altered, however, with the introduction of the "display pager". This pager displayed the caller's number. This was quickly adopted as an important means of communication between high school students, who then used the pager code to exchange messages. Although the number of mobile phone subscribers in 1992 was about 1 million, the number of pager subscribers was 7 million. The PHS was then developed and these three products competed fiercely for market share.

Deregulation accelerated the growth of mobile services in the 1990s. In April 1994, customer ownership of handsets was introduced. Within this system, handsets could be sold to individual customers, rather than making them available on a rental basis. In December 1996, MPT deregulated its procedure for amending mobile phone call charges from permission to simple notification. As a result, mobile operators could reduce their call charges more easily and efficiently. As a result, PDC operators abolished the use of connection fees and reduced their per-minute tariffs. They also introduced attractive handsets and customized tariff packages. This further led to phenomenal growth in new mobile subscriptions<sup>10</sup>. When the cellular mobile phone (known as "keitai" in Japanese) was first launched, its main users were business professionals, and it was considered a luxury item.<sup>11</sup> Today, however, the number of mobile subscribers (both cellular subscribers and PHS) has outnumbered the number of fixed-line subscribers (including ISDN) in 2000 (See Figure 3.1). Cellular mobile subscribers overtook fixed line subscribers in 2002. In terms of overall mobile subscribers, Japan has the third largest mobile population, and ranks only after China and the United States (Figure 3.2, left chart). In terms of mobile subscribers as a percentage of total population, the country also ranks in the top 10 list for the Asia-Pacific region (Figure 3.2, right chart). There are currently three main operators on the market providing mobile services: KDDI, NTT DoCoMo and Vodafone (previously J-Phone).

**Figure 3.1: Mobile overtakes fixed in Japan**

*Transitions in the number of subscribers to fixed and mobile communications from 1996 to 2002*

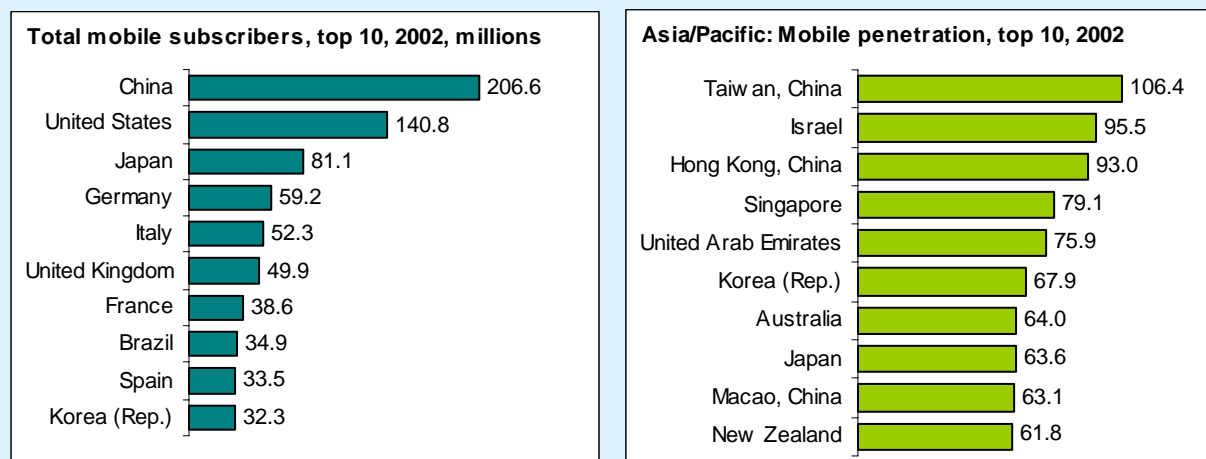


*Note:* The data above refers to the end of the fiscal year (i.e. 2002 refers to March 2003), and mobile subscribers include subscribers to the PHS system.

*Source:* MPHPT

**Figure 3.2: Japan in Top 10 (2002)**

*Leader countries in terms of total mobile subscribers and Asia-Pacific leaders in mobile penetration*



*Source:* ITU World Telecommunication Indicators Database.

### 3.2 High-speed mobile

The policies on the introduction of higher-speed third-generation IMT-2000 services were finalized by the MPHPT in March 2000. They fixed the number of operators to three per region. New as well as incumbent operators were eligible for the licences, with the exception of fixed regional operators. The main reason behind the limitation on the number of licenses was the shortage of frequencies. The regulator had a total of 60 Mhz available for 3G services (uplink and downlink). This meant that in order to allocate a minimum of



2X20 Mhz blocks of spectrum, only 3 licenses could be awarded. Owing to the shortage of frequencies experienced due to the unexpected growth in the number of 2G subscribers, the regulator was cautious in the allocation of 3G spectrum.

Operators were required to cover 50 per cent of the population in the first five years. The policies favoured applicants with know-how of IMT-2000 technologies and systems. 3G operators were chosen through a comparative selection process, and operators were free to decide on the radio interface they wished to use, between Wideband CDMA and CDMA 2000 (see Table 3.1). The 40-day application period began in April 2000 and licenses were allocated in June 2000. Only the three incumbent operators, i.e. NTT DoCoMo Group, IDO and Cellular Group (KDDI), and J-Phone Group, applied, and obtained, the three available licenses in each region.

NTT DoCoMo was the first operator to launch 3G services in Japan, under the brand name “FOMA”, or “Freedom of Mobile Multimedia Access”, and based on the ITU standard W-CDMA (Wideband CDMA). The full-scale commercial launch of FOMA was initially scheduled for 30 May 2001. Although DoCoMo postponed the launch until 1 October 2001, it was one of the first operators to launch a 3G commercial service. In the first days of FOMA, DoCoMo was hoping to sign up 150,000 users by the end of 2001. However, due to the limited service coverage at the time of launch, the fact that the W-CDMA system does not have backward compatibility with its 2G service based on the personal digital cellular (PDC) system, relatively short battery life and lack of killer applications (the highly publicised video-phone capability was not a resounding success), it took another year to reach 152’000 subscribers (by the end of 2002). In early 2003, DoCoMo introduced new W-CDMA handsets, which have a battery life three times longer than previous handsets.

DoCoMo was not the only operator to suffer delays. J-Phone initially announced a delay of six months to June 2002, and full commercial deployment of its W-CDMA network occurred as late as December 2002. KDDI launched its CDMA 20001x service in April 2002, and introduced its packet service CDMA 2000 1x EV-DO on 28 November 2003, under the brand name “WIN”.<sup>12</sup> WIN will enable data transmission rates of up to 2.4 Mbit/s, and enhance delivery times for traditional mobile Internet services (e.g. Ezweb, EZMovie and EZ Chaku Uta). KDDI also plans to introduce a new series of services for the EV-DO network, including EZChannel, which will automatically distribute various multimedia programmes, and Live Camera, which will allow for the delivery of video content in real-time. In order to encourage take-up and allow for the increased data traffic, the operator will be introducing a flat-rate fee (EZ Flat), the first of its kind in Japan. Users will be able to benefit from unlimited use of EZWeb services, including e-mail, for a fixed monthly charge of 4’200 yen (USD 39.10).

**Table 3.1 IMT-2000 Systems in Japan**

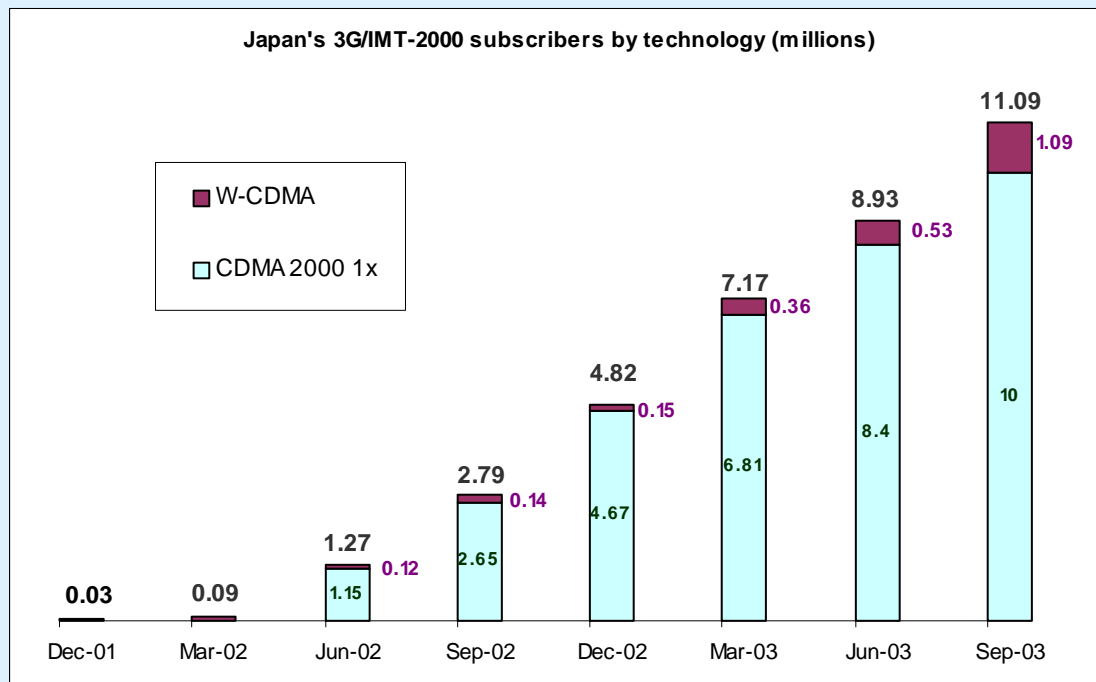
		<b>CDMA 2000 1x EV-DO</b>	<b>CDMA2000 1x</b>	<b>W-CDMA</b>
<b>Spectrum occupancy</b>		1.48 MHz	1.48 MHz	5 MHz
<b>Services</b>		Data only	Voice and Data	Voice and Data
<b>Connection mode</b>		Packet only	Circuit and Packet	Circuit and Packet
<b>Maximum data rate per user</b>	<b>F/L</b>	2.4 Mbit/s	153.6 kbit/s	384 kbit/s and up to 2 Mbit/s
	<b>R/L</b>	153.6 kbit/s	64 kbit/s (153.6 kbit/s)	64 kbit/s and up to 384 kbit/s
<b>Sector rthroughput (F/L)</b>		Approx. 600 Kbit/s	Approx 220 kbit/s	Approx 1000 kbit/s

Source: MPHPT and operator data.

KDDI now boasts the highest number of 3G subscribers: in December 2003, there were 11.8 million CDMA2000 1x subscribers. Not surprisingly, KDDI has now discontinued the sale of its 2G handsets in March 2003. NTT DoCoMo passed the one million mark in September 2003<sup>13</sup>, while J-Phone had had approximately 90'000 subscribers 9 months after initial launch (see Figure 3.3). At the end of January 2004, DoCoMo's 3G service surpassed the two million mark, ahead of targets.<sup>14</sup>

**Figure 3.3: IMT-2000 in Japan**

*Proportion of IMT-2000 subscribers by technology*



Source: MPHPT.

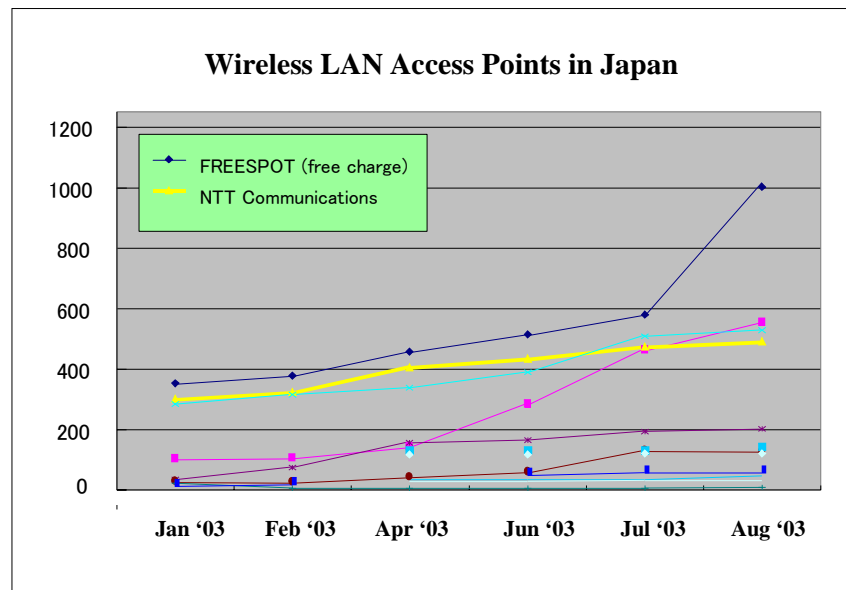
### 3.2.1 Fixed wireless and converged services

High-speed Internet access services, such as wireless LAN (local area network) were launched in 2002 in Japan. However, it seemed challenging task to develop a sound business model, attracting a large number of paying users. Much media attention was paid to the launch of the first commercial wireless LAN service called Mobile Internet Services (MIS) in April 2002, but service was suspended in December after only garnering around 1'300 subscribers in eight months.

NTT Communications launched in May 2002 its commercial wireless LAN service, branded "hotspot", and based on a combination of IEEE 802.11a and IEEE 802.11b specifications, NTT currently offers 600 access points in Japan, 450 of which are based in Tokyo. NTT plans to reach the 1'500-mark by March 2004. Out of the 13 cities that have more than 1 million people, 9 cities are covered by NTT's service. There are also several wireless LAN access points offered free of charge by a number of providers. Still, "Freespot", which offers access points free of charge, has the largest number of access points in Japan (see Figure 3.4).

**Figure 3.4: Wireless LAN services**

*Access Points in Japan: Freespot, NTT Communications and others*



Source: NTT Communications.

Nonetheless, other types of fixed wireless access services are being launched. And given possible transmission speeds of up to 11 Mbit/s, they are seen by some to threaten third-generation mobile services, which have only managed a maximum of 384 kbit/s to date. Table 3.2 shows the various fixed wireless access systems in Japan.

**Table 3.2: Wireless access in Japan**

Frequency band	Examples of use	Transmission distance	Maximum Transmission speed	Licence for radio station
2.4GHz	(1) Wireless LAN in the office (2) FWA (in hot spots and to buildings) (3) Home network	Around 5km	54 Mbit/s	Not necessary
5GHz	FWA (in hot spots and to buildings)	Around 300m	54 Mbit/s	Necessary
5.2GHz (Indoor only)	(1) Wireless LAN in the office (2) FWA (indoor hot spots) (3) Home network	Around 3km	54 Mbit/s	Not necessary
22/26/38GHz	FWA (for businesses)	Around 4km	10Mbit/s (P-MP) 156Mbit/s (P-P)	Necessary
25/27GHz	(1) FWA (in hot spots and to buildings) (2) Relay line to access points (3) Wireless LAN in the office (4) Home network	Around 100m	100Mbit/s 400Mbit/s (Short distance)	Not necessary

Note: P-P: refers to a system in which one radio station communicates with another radio subscriber station.

P-MP: refers to a system in which one base station communicates with more than one subscriber station.

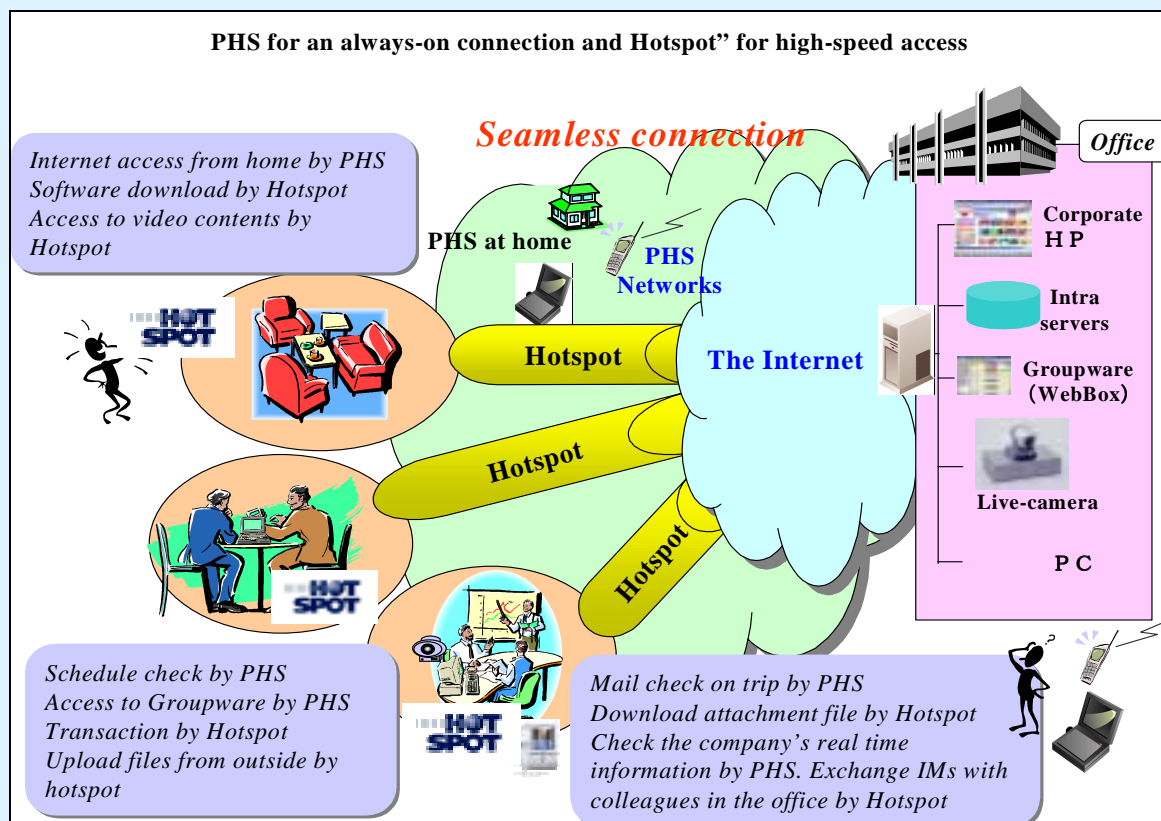
Source: MPHPT.

A handful of companies are planning to offer wireless IP phone service for personal digital assistants (PDAs) and WLAN service providers are hoping this will get them out of their current business plan conundrum, but it remains to be seen whether they will be successful. .

The lack of profitability of WLAN services is likely to persist for some time to come, and for this reason, a number of providers are exploring options to combine or integrate WLAN services with other types of services, notably NTT Communications and NTT DoCoMo.

NTT Communications also provides a PHS and WLAN combined “nomadic Internet Access” (see Figure 3.5). This allows users to use PHS for an always-on data connection and W-LAN for high-speed stationary access .

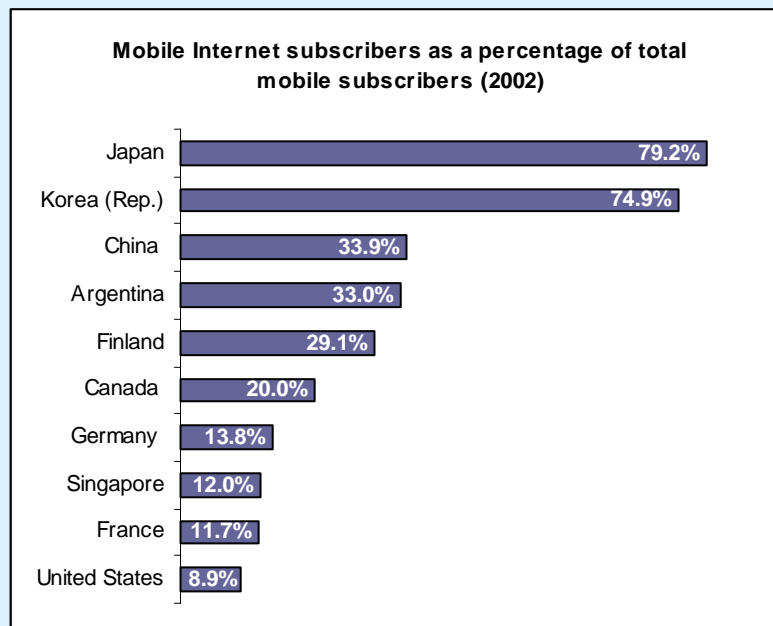
### Figure 3.5. PHS and WLAN nomadic Internet access



### 3.3 Mobile Internet and multimedia

percentage) of mobile Internet users in the world (Figure 3.6). In terms of devices connected to the Internet, mobile phones now outnumber personal computers.

**Figure 3.6: Mobile Internet access in selected countries**



*Note:* For Japan, the figure includes paying subscribers, whereas in other cases (e.g. Korea), numbers may actually be lower, as those with Internet-enabled handsets may not necessary be subscribed to a particular service or using particular service.

*Source:* MPHPT compiled from *3G Mobile*.

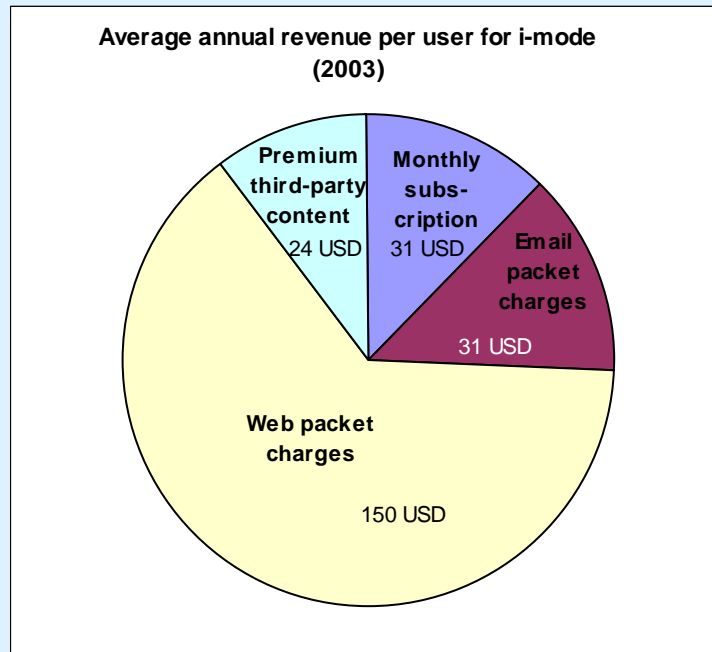
NTT DoCoMo launched its Internet connection service, 'i-mode', in February 1999. i-mode subscribers can connect to the Internet through special designated handsets. The main services are e-mail, information services and applications such as Internet banking and ticket reservation. Other mobile operators also began competitive Internet connection services in 1999 (KDDI group launched Ezweb and the J-Phone group launched "J-Sky"). In September 2003, there were 78.6 million cellular mobile subscribers in Japan, of which 84 per cent were using some kind of Internet browsing service. By far, the most popular service remains NTT DoCoMo's i-mode. Mobile Internet services are offered both on the PDC and PHS platform.

There are several factors contributing to the success of mobile networks for Internet access in Japan - low PC and Internet penetration are the most important ones. Some analysts point to the large number of long-distance commuters using public transport as a stimulus for growth. The early adopters of mobile services are usually young users, who account for the largest proportion of data traffic. It seems that the Internet and electronic services market in Japan will be spurred by the mobile industry. In fact, the demand for browsing services has been responsible for transforming NTT DoCoMo into the world's largest ISP almost overnight.<sup>17</sup> In 2003, the average annual revenue per i-mode user was USD 236 (see Figure 3.6), most of which stems from packet transmission charges.

One of the major factors influencing mobile Internet access was the introduction of colour display handsets in December 1999. The take-up of services such i-mode increased dramatically due to the availability of information and pictures in colour. And at the end of January 2001, DoCoMo launched the first java-enabled handsets in Japan offering the "i-appli" service. The i-appli service is an enhanced i-mode service and which enables the subscriber to download and run small Java applets. Applet access to information and entertainment falls into two categories: stand-alone applets and agent applets. Stand-alone applets, such as games, can be saved in the handset's memory. Agent applets are used for timely information alerts (such as stock quotes) and therefore need to connect to a server to provide up to date information. The applets are usually around 10 kbytes in size and handsets can save at least five such applets in their memory. Size and applications available in i-appli will be further enhanced with the arrival of 3G. For instance, images are currently based on .GIF format, but 3G will allow viewing and storing in .JPEG format. The 4.5 million

i-appli users in June 2001 have grown to 20.7 million at the end of October 2003. KDDI's "au" group started a similar service on 4 July 2001, soon after J-Phone's service launch on 22 June 2001.

**Figure 3.7: Average annual revenue per user for i-mode (US dollars)**



Source: Analysys consulting, 2003.

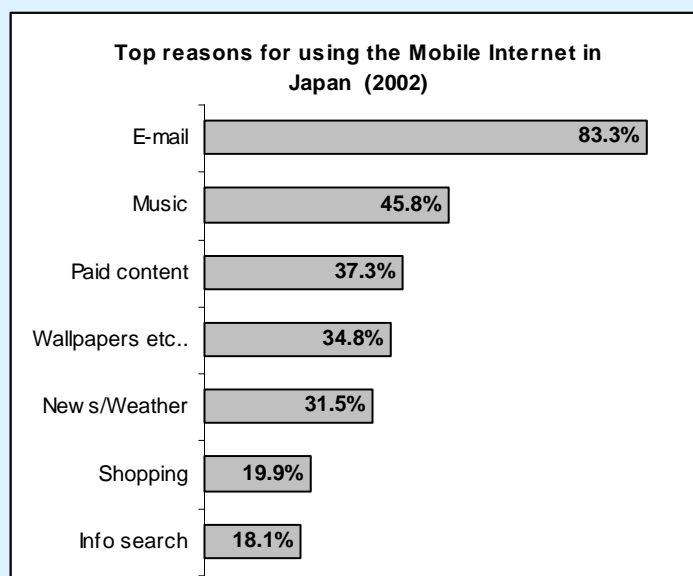
Location-based services in Japan began as early as 1998, when NTT Personal (a subsidiary of NTT) launched its PHS service known as "ima doko" (which literally means "now where"). Ima-doko uses technology that estimates a caller's distance from a wireless transmission tower, sometimes within several hundred meters. It is primarily used to find pets or locate children or the elderly. With this service, if someone carrying an ima-doko PHS phone gets lost or disoriented, a computer map can be used to find the person. The showing his or her location can even be sent to family members, by fax or now, or to their mobile phone.

On 28 June 2001, DoCoMo announced its new location-based service for its i-mode handsets. J-Phone has been offering a similar "J-Sky Station" service since October 2000. DoCoMo's "i-area" service provides weather, dining, traffic and other information for 500 areas in Japan. Information is organized according to the handset's current dialling code. This enables users to find search items about a specific area rapidly. To access the service, users simply go to the i-mode portal site and click "i-area" to view a large menu of i-area information. Since i-mode base stations automatically recognize the handset's area code, users do not need to enter their location. Initially, information services will include the following: weather forecasts, local guides to shops restaurants and hotels, detailed searchable maps, 24-hour traffic updates.

It must be noted, however, that the primary use of mobile Internet in Japan is for e-mail: over 83 per cent of mobile subscribers use the mobile Internet for sending and receiving e-mail (Figure 3.8). This is closely followed by downloading or listening to online music (45.8 per cent), such as ringtones or tunes, and purchasing online content (37.3 per cent). Although video games, ringtones and software are the most popular mobile phone content, this does not differ as widely as one might expect from PC content in Japan, for which software and music are the most popular items (see Figure 3.9). Some of the newer mobile content services discussed in section 3.4 below.

**Figure 3.8: Top reasons for using the mobile Internet in Japan**

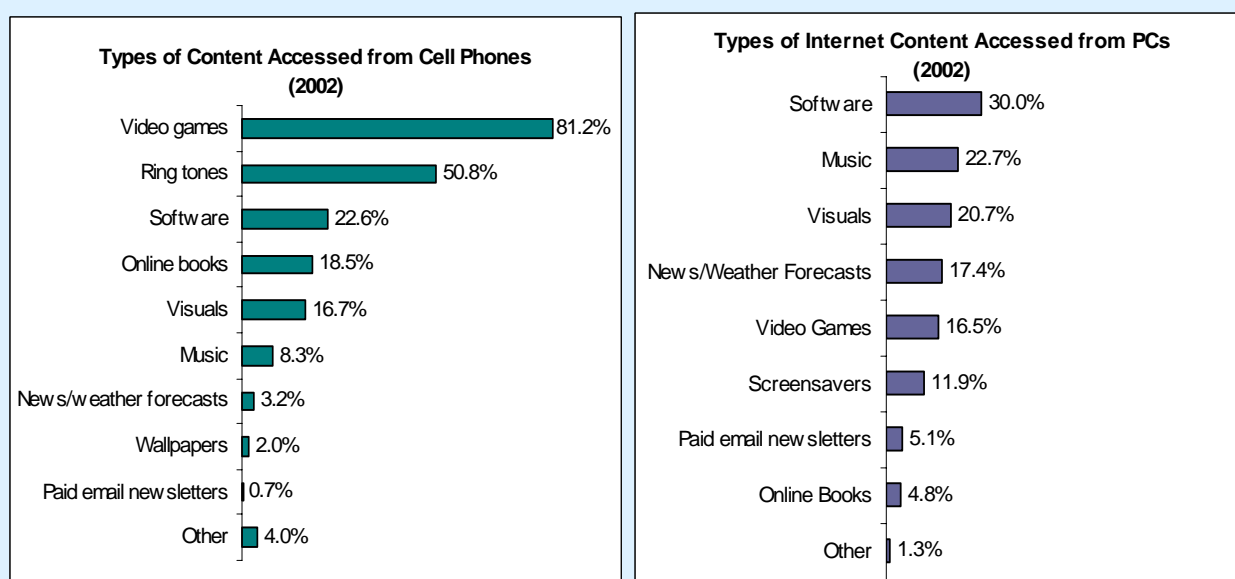
*Reasons for using Internet services over mobile or PHS networks*



*Note:* The survey allowed for multiple answers.

*Source:* MPHPT "Communications Usage Trend Survey", 2002.

**Figure 3.9: Types of content accessed from PCs and mobile phones, excluding e-mail (2002)**



*Note:* The survey allowed for multiple answers.

*Source:* MPHPT "Communications Usage Trend Survey", 2002.

## 3.4 New applications, services and terminals

### 3.4.1 Audio and video

Multimedia services in Japan are steadily gaining in popularity. Early manifestations of audio services started back in late 1990s with the introduction of i-mode and the possibility to download ringing tunes. The Chaku-Melo service was launched by NTT DoCoMo in December 1999. This service allows users to download a melody file by accessing a content provider's website – the melody is then saved on the mobile

handset and users can choose to set it as their melody for incoming calls. The format used for Chaku-Melo is MIDI or Musical Instrument Digital Interface, and thus is a limited and simplified version of the original song. The success of the service was unprecedented. Operators therefore took the decision to offer more enhanced ringing tone services over higher-speed mobile networks. In December 2002, KDDI launched a new downloadable audio service by the name of “Chaku-Uta” (Ringing Tunes) in collaboration with Sony Music Entertainment Inc. Through Chaku-Uta, users can enjoy high-quality audio files of 30 seconds or less in “AMC format”, an mp3-based format encoded in about 24 kbit/s. The cost ranges from JPY 50 to 100 per song. The total cost, including the packet transmission charge, is about JPY 100-200 or under USD 2. In August 2003 alone, there were over seven million Chaku-Uta downloads. With the backdrop of this success, Vodafone began their 3G Chaku-Uta service in December 2003. The important difference between Chaku-Melo (Ringing Tones) and Chaku-Uta, besides the music quality is the structure of the value chain. Record companies that own the delivery right of the recorded source of CD can join the chain in the Chaku-Uta service as the sound sources are supplied by them.

The success of Chaku-Uta is expected to trigger a variety of high quality audio content for mobiles. 3G Chaku-Koe is a similar service, providing voices of people or celebrities as a ringing tone, as is the Karaoke Service, which provides words, melodies and graphical images to mobile handsets. Furthermore, DoCoMo introduced a new service known as “Melody call” in September 2003: this service allows the calling party to enjoy registered melodies as the ring back tone while waiting for the called party to answer. More than 0.5 million subscribers have taken up the service as of November 2003, and users can choose three songs a month (from a total of 1’000 songs) for a fee of JPY 200 per a month.

Since January 2001, audio streaming services have also been provided to mobile handsets, notably through the J-Stream’s Pho-Dio service. J-Stream’s first service transcoded mp3 format content into analog sound with voice quality based on a contract with the content holders, and streamed this material over a circuit switched network at a speed of 9.6 kbit/s. Users have to follow three simple steps:

- (1) Users searches and selects the track by accessing the mobile Internet;
- (2) Server returns the answer “ready” to the user when the track is prepared in the proper format;
- (3) The user then pushes the “play” button and the track is then streamed as a voice signal.

More recently, J-stream launched a digital version of the “pho-dio” service, which provides higher quality and fully digital audio streaming for 3G users.

Another popular video service is movie mail, which is now provided by all Japanese mobile operators, with the exception of TU-KA. Moviemail is a form of multimedia messaging, which attaches a short movie to a mobile e-mail. An example of use is parents sending the greetings of a child to the grandparents, or a business tracking and checking the point of repair in a remote area. The first movie mail service was “Movie ShaMail”, launched by J-Phone in March 2002 for their 2G users. ShaMail enabled transmission of a pre-stored movie of 10 seconds in length. NTT DoCoMo is now also providing high quality movie mail service known as “i-motion mail” over its 3G networks. The mail is in MPEG-4 format, and can be sent to mobile user and PC users and is supported by the latest version of QuickTime 6.3.

3G users can also communicate thorough videophone service: DoCoMo users, for instance, can see real time videos of each other at 64 kbit/s , starting at the price of 14 yen per 30 seconds. Young girls are often seen asking the advice of boyfriends when shopping for clothes. And companies can check on operations outside headquarters. In October 2003, Vodafone (previously J-Phone), introduced a new videophone pricing plan known as “Vodafone Happy Time”, providing a uniform rate of JPY 5 per minute for calls to other J-Phone customers on weekends and national holidays.

DoCoMo provides video conferencing services over mobiles. The “M-stage visual net” is a video conferencing service that can be shared by a total of 8 mobile users. Multimedia streaming services are also available, such as “M-stage-V-live” (NTT DoCoMo) and “EZ-channel” (KDDI). KDDI will start content delivery up for up to 3 MB for their latest CDMA 1x-WIN service, which allows for data transmission rates of up to 2.4 Mbit/s. Subscribers of this service can enjoy news, short educational programmes such as English conversations, short drama and movie clips, including a live-on-demand service.



#### *3.4.1.1 Mobile TV and radio*

Portable TVs and radios have had a long history in Japan. In fact, portable radios have been even more successful than other portable electronic devices such as Walkmans, during travel to or from work. Portable televisions have taken off particularly among baseball, football and horse racing fans not wanting to miss that crucial moment. Furthermore, most car navigation systems include options of TV antenna so to allow passengers to watch TV in the car, while at red lights or parked. Thus, the integration of TV and radio with mobile handsets seems a natural development.

NEC announced the release of Vodafone “V-601N” handset with a built-in analog TV tuner in 2003. The continuous viewing period is limited to one hour, due to battery size, but users can capture up to 9 pictures and record up to 30 seconds of moving pictures in MPEG-4 format from broadcasted TV programmes. The export of this data, however, is not possible. The terminal has an interface for the use of external antennae. While viewing a TV programme, users can access the mobile Internet to download information, relevant to the programming. This kind of interactive collaboration between TV programmes and the Internet is expected to transform the way we watch television in the coming ubiquitous age. Furthermore, many Japanese people simply surf the mobile Internet while watching television, to access different kinds of data. Most of the new2er models of mobile phones can also double as television remote controls.

In terms of radio applications, SANYO plans to release a new handset for KDDI, the “A5503A”, which has an FM radio tuner built-in to it based on BREW. All the domestic radio stations are included in the radio menu and users can tune to these stations quite easily. As programming is received via FM radio, users can use the mobile Internet while listening to the radio. Thus, they can enjoy interactive services provided by most radio stations, including information on the music currently playing, music archives or requests to join a quiz or win a prize. Collaborative radio Internet programming has been rather popular among frequent listeners and this new handset is expected to sell well.

#### **3.4.2 Location based services**

Location based services are very special services in a sense they are not the mobile version of information services of the wired world. Services can be categorized into three types: a) services for the moving user, b) services for moving objects and c) services when both the user and objects are moving.

“Station service” launched by J-Phone in October 2000 is representative of the first category. It allows users to send their location information and receive the location aware information such as weather, local news, restaurants and shopping information by using the information of their current accessed cell.

The “i-area” service was launched by DoCoMo in July 2001 (see Figure 3.10): “i-area” delivers users a broad range of location-specific content. Recognizing 500 different regions, the system pinpoints the location of the subscriber according to their nearest base station and provides them with a content menu specific to that area. The subscriber can view information about restaurants, accommodation in the area, download relevant maps and access local weather reports. “i-area” can list and provide reviews of local restaurants and even offers downloadable discount coupons to users. Downloadable maps help users reach their destinations provide instant and relevant information such as easily recognizable landmarks and icons for banks and convenience stores. Currently, with i-area services for 500 different regions, subscribers can check weather information relating to virtually anywhere in Japan. In addition, a simple search function lets subscribers look for hotels, shops, and restaurants, or search by business name or type.

**Figure 3.10 Location, location, location: i-area**

*Menu and services available through DoCoMo's i-area location-based service*



Source: NTT DoCoMo, <http://www.nttdocomo.com/corebiz/imode/services/iarea.html>.

Vehicle location management systems is a Tybe b) service. In July 2001, DoCoMo Machine Inc., a subsidiary of NTT DoCoMo, launched a vehicle location management service called “DoCo-desu Car?” (meaning “Where is the car?” in Japanese) using a combination of GPS and mobile cell information. An example of this service is the “Nearest Taxi Delivery” service, which, using the location information of a customer, can pinpoint location information of nearby GPS-enabled taxis. Another example is the “Child pick-up” service: as a kindergarten school bus gets closer to the child’s stop, the child’s family receives information of the approximate arrival time of the bus so that they can use time more efficiently.

In the case of type c) services, more dynamic responses are required to the speed of mobility. In the Japanese metropolitan area, railways are complex and owned by a number of different companies with different fare systems. Val Laboratory Corporation developed software by the name of “Ekisupart” (meant to resemble the English word “expert”) for personal computers in 1992, to find out the cheapest or the fastest route to a given destination. In the center of Tokyo, there are sometimes more than five or six routes to any given destination and each route implies a different fare. Ekisupart has been very successful among businesses as a cost and time-saving measure. There are now at least three or four types of software programs for this kind of travel navigator. In 1999 VAL Laboratory began applying their expertise to the mobile Internet.

To provide a higher quality of service based on location, information about the nearest cell is not enough. Until December 2003, KDDI was the only carrier in Japan that releases location-based information based on GPS sensors equipped on handsets. DoCoMo released its GPS-enabled terminal at the end of 2003, two years after KDDI released its first GPS terminal equipped with gpsOne technology, a hybrid method using both GPS and base station information. GpsOne is one solution to the problem that GPS location information

is minimal when users are inside a building or underground. At the end of November 2003, 12 out of the 15 current KDDI handsets with gpsOne technology. The most recent location-based service launched by KDDI is called EZ-naviwalk (November 2003). “EZ-navi-walk” currently runs on 3 terminals (AU 55xx-series): A5501T (Toshiba), A5503SA (Sanyo) and A5502K (Kyocera). This pedestrian service provides equivalent quality to car navigation such as automatic scroll of maps pointing the current position, voice and text guidance. As EZ-naviwalk has implemented BREW technology, a faster update of location information and autonomous navigation are possible. The A5502K handset is even equipped with an electronic compass that adds to the precision of location information by establishing exact direction.

Once the exact location of a user is established, the server provides the following information: a) time and route to the nearest train station, b) train route and time information, where to transfer etc. c) time and route to the destination from the arrival station. In the old version of EZ-navi, terminals needed to transmit and receive information to get the current position – however, the new EZ-naviwalk needs to communicate only once at the beginning to confirm the current position in order to get the necessary map information. Then as the user walks, the map displayed on the terminal scrolls automatically keeping the current position in the center. The right direction is indicated by an arrow and the route information is also given in text and voice, such as “go straight 20 m and turn to the right”. This type of navigation is known as autonomous navigation.

### **3.4.3 Gaming services**

With the introduction of the JAVA application platform on mobile handsets, gaming services, such as DoCoMo’s “i-appli”, started taking off in Japan. It is very common in Japan to find people playing games on their mobile in trains, buses or while waiting for friends. The trend is strong, and irrespective of gender or age.

Portable game machines have a long history of success in Japan: for instance Nintendo’s “Game Watch” in the early 1980s and “Game Boy” in the early 1990s. But gaming services on mobile terminals have now almost entirely replaced those specialized game terminals, particularly given that the limit on file sizes increased with JAVA, together with the size and quality of the LCD screen display. For most gaming services, users pay a subscription cost of 100-300 yen per month.

Available games can be classified into three main categories:

- A. Export from the conventional computer games;
- B. Collaboration with from the conventional computer games,
- C. New games designed for mobile terminals.

Typical examples of Category A games are: Tetris, Role Playing Games, shooting games, sports games. Type B games are those games for which users can continue playing on mobile handsets with exported data from their game machines. The game known as “i-dabisuta” (derby stadium) is a good example of such a game. A race horse training simulation, “i-dabisuta” gamers can play the training phase on their mobile and then continue the race portion of the game on Nintendo-64 terminal. Type C games are mobile versions of Internet collaborative games, where players can share the data together. One example is car-racing game, in which users can access servers to upload their best score and see their ranking. They can also play the race together in real time. Another type of game, “mail games” belongs to the Type C category: in most “mail games”, users can exchange virtual e-mails and experience virtual dating. Three-dimensional games using high quality (QVGA) screen displays have been recently released, as have attachable game controllers, but these are still in the minority.

### **3.4.4 New terminals and handsets**

Recent trends in terminal and handset development can be narrowed down into two main categories. The first relates to collaboration with other audio-visual services. The second is the integration of other portable devices or functions.

Multimedia collaboration is on the rise. The most popular case is that of the export of pictures taken by cameras on mobile terminals. The latest models of ink jet printers have memory card slots for printing

pictures directly without a personal computer. Video playback on mobiles through memory cards taken from video recorders, or recorded video output to an external television, is also possible.

In terms of the second category, the most popular device to integrate into a mobile phone is a digital camera. Most of the current terminals are equipped with digital cameras. The first camera-equipped handset to be launched in Japan was the Sharp terminal for J-Phone, released in December 2001. It had only 0.1 mega pixel quality. But in the last 2 years, together with the success of “Sha-mail” (picture attachment e-mail), the resolution of CCD has been improving at a rapid rate, and some of the latest models now contain 2 mega pixel quality with auto-focus and digital 20X zoom (e.g. D505iS). This brings mobile cameras in line with standard digital cameras. Camera-enabled phones require larger memory capacity, and additional memory is typically obtained through memory sticks or SD cards. In order to protect privacy, handset manufacturers have added a shutter-sound synchronized with the use of the camera (see Section 5.3).

To protect private information in the case of loss or theft, more secure access methods to the mobile phone have also been developed. Fujitsu released a handset F505i for DoCoMo, which introduced in July 2003 a personal identification system based on a fingerprint sensor (see Figure 3.11).

**Figure 3.11: Fingerprints and television go mobile: New handsets**

*DoCoMo and Vodafone bring new features and functionality to the ordinary mobile*



Source: ZDNet, NTT DoCoMo.

Another unique terminal are those supporting voice communication such as a speaker and microphone separate from the main body which has PDA functions, e.g. DoCoMo’s 3G phone by Sharp (SH2101V, shown in Figure 3.11). Though this terminal has not been very successful in the market, there is a potential renewed demand to integrate mobile phone, PDA or PC, especially in Japan where small and light laptops of about 1kg have been very successful. In the business field, it is not surprising to see somebody carrying 4 devices all the time: 2G phone for voice communication and mobile Internet, PHS data card for higher speed, PDA and a portable PC. This terminal targets these types of users. Three-dimensional LCD is also available for those users wishing to play 3D game or view 3D images (see Figure 3.11).

Newer experimental handsets are being developed, such as FeliCa-enabled phones (see Figure 3.12). And in December 2003, the TU-KA group launched a brand new handset, the “TS41”, which is the first handset to be equipped with a “Sonic Speaker”: the TS41 has a mechanism to transmit voice through bone conduction. Bone conduction is a method applied for sound transmission to support devices such as hearing aids for those that are hard of hearing. Therefore this handset has the added benefit of addressing hearing problems, e.g. when the user needs to talk in a very noisy place such as the next to the Jet Engine of the Plane or in a very crowded room (see Figure 3.12). NTT DoCoMo labs is currently working on a handset which would free users from placing anything but a finger in their ear to talk (see Box 3.1).

The Japanese mobile market is expected to start with a bang in 2004. DoCoMo announced its introduction of the 900i series for 3G users, with features as interesting as their latest PDC (2G) 505iS series. Vodafone has already introduced their new handset V801SA for their “Vodafone Global Standard”, which is the first

handset with global “Vodafone live” service capability where it is available (see Figure 3.12). Table 3.2 sets out some milestones in Japanese handset technology.

**Box 3.1. Let your bones do the talking**

*Japanese phone firm NTT DoCoMo has created a wristwatch phone that uses its owner's finger as an earpiece.*

The gadget, dubbed Finger Whisper, uses a wristband to convert the sounds of conversation to vibrations that can be heard when the finger is placed in the ear.. So far NTT has given no date for when a commercial version will go on sale. The wristband for the watchphone is key to the device's many features.

According to reports the Finger Whisper phone is answered by touching forefinger to thumb and then by putting the forefinger in the ear to hear who is ringing. The call is ended by again touching forefinger to thumb.

Some of the latest earpieces for mobile phones also use sound induction via the bones of the skull to let people hear who is talking to them. The sound converting wristband on the watch phone is also fitted with a microphone that the phone owner can talk into. The phone has no keypad but users can make a call by saying out loud the number they want to reach. Voice recognition electronics built in to the wristband decipher what has been said and dial the number. None of the early reports about the phone mention whether it is possible to use the wristphone to send text messages.

Meanwhile, the first “sonic speaker” handset, using bone conduction technology, was commercially released in early 2004 by the TUKA group (See Figure 3.12, b).

*Source: BBC News, <http://news.bbc.co.uk/2/hi/technology/3246433.stm>.*

**Figure 3.12: Additional new handsets: from bus tickets to bone conductors**

*Docomo's Felica handset, Tu-Ka's bone conductor handset and Vodafone's global Internet handset*



(a) DoCoMo SO504iC

FeliCa built-in handset  
(Trial only)



(b) TU-KA TS41

First “Sonic Speaker” handset  
with Bone Conduction technology



(c) Vodafone V801SA

3G/GSM Dual Band  
with global Internet service

*Source: Impress Web and IT media Web.*

**Table 3.2: History of mobile terminals, handsets and related products**

Year	Mobile terminal and handset	Related products
1999	i-mode service launched (DoCoMo 501i series) First color LCD handset (DoCoMo 502i)	
2000		
2001	i-appli service launched (DoCoMo 503i series) Camera equipped terminal (J-SH04)	PlayStation 2(SONY) Launch of L-mode (NTT)
2002	3D display ( DoCoMo SH251iS)	
2003	Fingerprint identification (DoCoMo F505i) 256KB Java application support (Vodafone J-SH53) Built-in FM radio tuner ( AU ) Built-in TV tuner ( Vodafone V-N601) 2 mega pixel CCD camera FeliCa build-in (SO504iC) Bone Conduction (TU-KA TS41) GSM and 3G Dual band (Vodafone V-801SA)	Digital Camera 5 mega pixel CCD PSX (Playstation X) Digital terrestrial broadcasting

Source: Waseda University.

### 3.5 Market peculiarities

One of the most distinguishing aspects of the Japanese mobile industry is that it is operator-led. Equipment manufacturers and operators work in closely-knit groups and supply the market with handsets and portable devices in a coordinated effort. The mobile operator retains ownership of the handset. As such, the operator's brand is dominant rather than that of the manufacturer. The Japanese subscriber must first select the service provider and then choose his or her mobile device. The subscriber's choice of handset is thus limited to those on offer and branded by the service provider selected. This differs remarkably from the European case, where the handset brand rests firmly with manufacturers such as Nokia and Ericsson, as does the responsibility for research and development.<sup>18</sup> By contrast, Japanese mobile operators play a leading role in research and development activities. The Yokosuka Research Park (YRP), just outside Tokyo, is well-renowned and houses one of the largest R&D centres in the world for 3G technologies. The close relationship between manufacturers and operators in Japan accounts in part for the sophistication and availability of handset technology and the take-up of value-added services. This relationship must be fostered in order to ensure further innovation and service take-up.

Another peculiarity of the Japanese mobile market is the agreement that was struck early on between content providers and operators. In principle, the mobile operator bills for content, retains a commission, and passes on the majority of the content fees to the content provider, which amounts to about 90 per cent. However, none of the revenues from the traffic that content sites generate is passed on the content providers. In addition, in many cases, a price cap has been introduced for content subscription charges. Many content providers and analysts argue that call charges should be included in any revenue-sharing for mobile content. One mechanism to address the perceived imbalance is to introduce flat-rate billing for data traffic charges. If operators bring down connectivity costs for data traffic, users will most likely increase their use of content sites. Thus, proportionately, in such a case, there will be a drop in traffic charges but a corresponding increase in content charges. However, such a system is more feasible for packet-based services.

KDDI will be introducing flat-rate billing in November 2003, for all users subscribed to its CDMA 2000 1x EV-DO (WIN). It remains to be seen whether the issue of revenue-sharing between mobile operators and content providers will be subject to renewed negotiation.

## 4 The path to Japan's "ubiquitous network society"

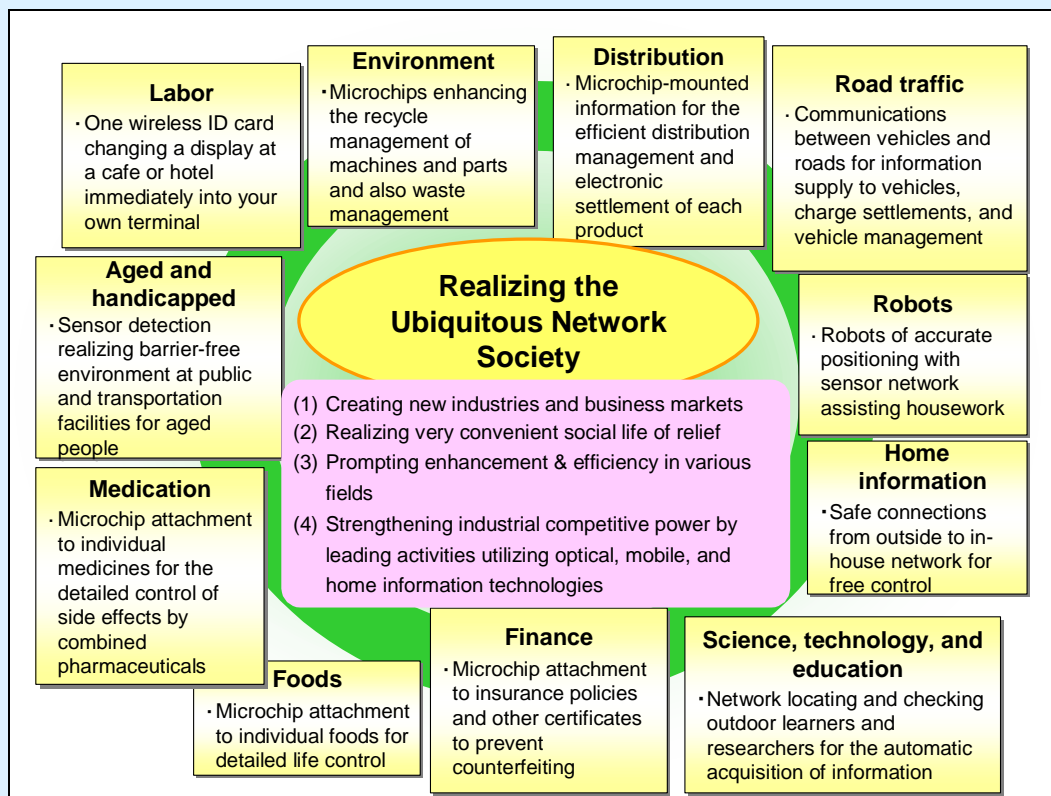
It can be said that there are different ways to characterize the "ubiquitous" network society. At its origins, the word "ubiquitous" is derived from the Latin "*ubique*", meaning that which exists everywhere. In the context of information and communication technologies, ubiquitous "networks" are those networks that can be accessed by anyone and anything via a wide variety of mechanisms or access methods, and this without limitations of time or space. However, there can be different approaches to fostering such a society, the concept of "ubiquity" being a relatively broad one. This is no different in Japan. For Sony, ubiquity manifests itself through integrated circuit cards communicating with all kinds of devices. On the other hand, for Toyota, ubiquity may come in the shape of car navigation services. The YRP Ubiquitous Networking Laboratory may consider that ubiquity can be achieved through the use of tiny chips and special communicators. On a national level, however, the Japanese approach is a unified one. This chapter describes that vision, outlines current research and development (R&D) initiatives and zooms in on five important practical manifestations of the ubiquitous network society.

### 4.1 National vision

For the Government, ubiquity relates to the extension and expansion of wireless technologies, that is to say a shift away from the mobile device itself, to a greater consideration of the interaction between handsets and other devices and networks. The relevant fields are numerous: ubiquitous networks will affect the environment, distribution, road traffic, robots, home information, finance, foods, medication, the elderly and the handicapped, labour, science, technology and education (see Figure 4.1). The Government estimates the total value of ubiquitous industries and market to be of the order of JPY 30.3 trillion in 2005 (USD 278.4 billion), growing to JPY 84.3 trillion (USD 774.5 billion) in 2010 (see Figure 4.2).

**Figure 4.1 Ubiquitous network application fields**

*The various field of application for ubiquitous networking technologies*

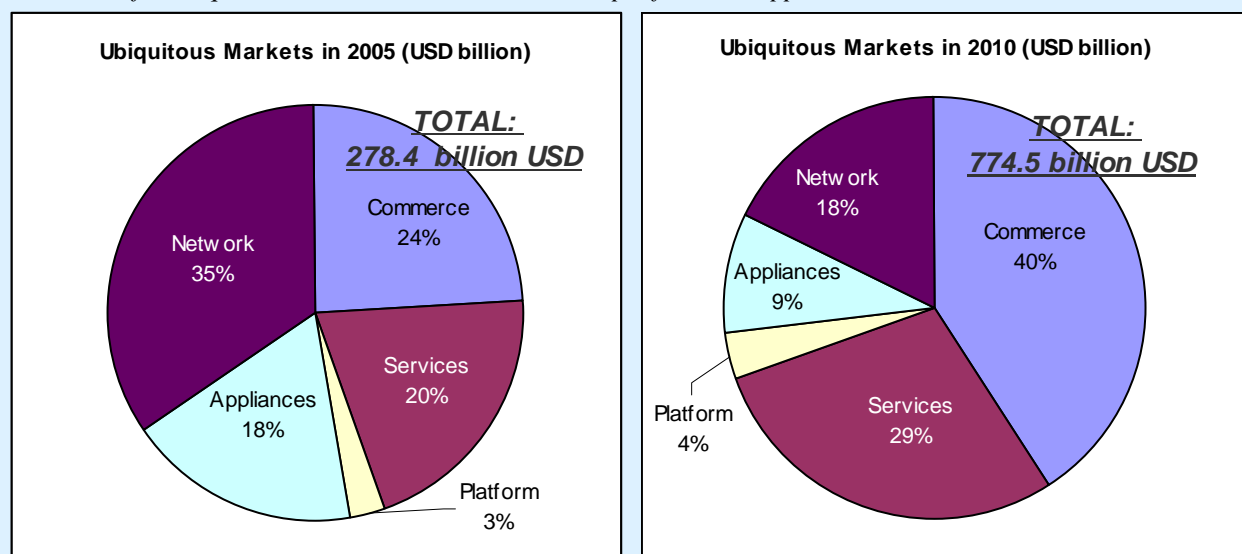


Source: MPHPT.



**Figure 4.2. From 2005 to 2010: The scale of the ubiquitous network society**

*Market size for ubiquitous commerce, services, network, platform and appliances*



Source: MPHPT.

Established in July 2003, the e-Japan strategy II, as outlined above, declares “the realization of a society that offers energy, security, emotion, and convenience” as its basic underlying principle, and priority is given to the individual perspective and the development of new international relations.

The MPHPT is encouraging the government, the private sector and academia, to work together to develop initiatives that leverage Japan’s strengths. In particular, they are focusing on three specific R&D projects:

1. Microchip networking technologies;
2. Ubiquitous network authentication and agent technologies;
3. Ubiquitous network control and management technologies;

The first of these projects is described in greater detail below.

#### 4.1.1 Microchip networking technologies

This MPHPT project explores network technologies that facilitate the regulation and control of billions of sundry items with embedded microchips that can be as small as a particle of dust. The e-Japan Strategy II states clearly that there is a need to make early efforts to address R&D and verification experiences for the advanced use of electronic tags. In this context, Japan’s Ubiquitous Networking Forum and YRP Ubiquitous Networking Laboratory are key examples of trilateral initiatives involving the private sector, the public sector and academia.

At the moment, electronic tags are being used as an alternative to barcodes, and mainly for the purposes of physical distribution management. In the ubiquitous information society, however, these tags will open up

In April 2003, the MPHPT created a “Study Group on Advanced Electronic Tag Applications in the Ubiquitous Networking Age”. Since then, the group has been attempting to develop specific measures to promote the advanced use of electronic tags that are seen to be relevant in a number of fields, such as health care and education. In August 2003, the Study group issued its interim report. The report proposes advanced usage models for electronic tags in 18 different application fields. The following frequencies are currently assigned to electronic tags in Japan: 135 kHz, 13.56 MHz and 2.4 GHz. The Study Group agreed that additional frequency bands are required to stimulate the use of electronic tags, and recommended the assignment of the 950 MHz band for this purpose. The interim report also proposes the following measures for promotion;

- Implementation of verification experiments involving users;



- Promotion of advanced use of electronic tags using enhanced business methods;
- Preparation and use of test beds to enable verification experiments;
- Promotion of standardization in collaboration with European, United States, and Asian countries.

Current initiatives and trials are discussed below in section 4.2.5.

## **4.2 Development of practical ubiquitous applications**

### **4.2.1 In-vehicular systems**

This section examines in-vehicular services in Japan that are offered over mobile networks. Japan is one of the most advanced countries in terms of car navigation systems, and the total sales of car navigation systems reached 11'476'000 in March 2003, according to a white paper released by the Ministry of Land, Infrastructure and Transport. Car navigation systems are provided either as optional equipment by car manufacturers when a new car is purchased, or as additional equipment sold at car accessories shops. A total of 25 companies sell car navigation systems in Japan, including nine car manufacturers.

It can be said that car navigation systems saw three different generations of development. The first generation included map data in a CD-ROM format, which had memory limitations and could not contain comprehensive street information or detailed information to a scale of 50 metres or less. The second generation, still currently the most popular, contains map data in DVD-ROM format, thereby solving the problem of storage size. The next generation of navigation systems moved on to hard disk drives, providing significant advantages in terms of data updates and writing.

At the governmental level, the MPHPT, the National Policy Agency and the Ministry of Land Infrastructure and Transport are promoting the VICS (Vehicle Information and Communication System) project, which provides and collects various types of information from and to vehicles, through the national infrastructure controlled by the government. For instance, traffic congestion information is collected thorough sensors attached to traffic signals that measure the speed of vehicular traffic. This information was already used to control the interval between green light signals. And now, further enhancements to VICS are allowing for convenient and timely information services, such as traffic congestion, road works, car accidents, availability of parking lots, and weather information. All the services are free of charge, once users buy and install the terminals. The information is provided through FM radio waves, radio wave beacons and optical beacons. A practical application is the service for drivers, which estimates the travel time to a given destination: this information is based on the calculation of another vehicle's travel time determined by the sensor ID. The total accumulated number of VICS units reached 7'783'528 at the end of September 2003, according to the Vehicle Information and Communication System Center.

Added functionality can be provided by the use of 3<sup>rd</sup> generation mobile systems with hard disk drives. For instance, map information can be updated continuously and delivered to the vehicle. A good example is Pioneer Corporation's latest product "Air Navi", which is equipped with a CDMA2000-1x communication module provided by KDDI. Once car navigation systems acquire always-on connectivity to the Internet, a large amount of relevant information can be provided during vehicular travel. This is not to say that second-generation car navigation systems did not provide an important information facility, allowing searches of various facilities such as hospitals, train stations, cinemas and restaurants near the position of the vehicle. However, that information was off-line and statically stored on a DVD-ROM. This was the first manifestation of Toyota's "G-Book" service. In 2002, the motor company released a new version of the service with a dedicated CDMA2000-1x data communication module. G-Book has user-friendly interfaces such as touch panel display, voice recognition and text-to-speech. Currently there are 60 different services falling into 5 different categories, as shown in Table 4.1 Toyota has released the first version of the on-line G-Book service in the car model "Will Cypha", a compact vehicle targeted at the younger generation. A large percentage of Will Cypha car owners subscribe to the service, a clear indication that demand is not limited to luxury owners. A surprisingly well-adopted service is karaoke, implying that users may be interested in information not related to driving or roads. From October 2003, Toyota has increased the number of models with G-Book, and expects to gradually expand the service to all of its car models. The main barriers of adoption are seen to be the cost of communications, the data throughput, quality of service and coverage.

**Table 4.1: Service category and representative contents of G-Book**

<b>Category</b>	<b>Contents</b>
<b>Safety &amp; security</b>	Emergency Call support: HELPNET RoadAssist24: 24 hours accident support with easy operation by interactive menu selection. Remote Maintenance Service: Communication with the car dealer and reservation of annual maintenance My Car Search: Confirmation of current location by PC, PDA or mobile phone.
<b>Live navigation</b>	Shop Search: shop information in the present area or destination. G-Walker Gourmet: Restaurant information with recommendation in the present area or destination.
<b>Information</b>	News Information: provided by NHK (National Broadcaster) Traffic Information: Congestion, Regulation Information Location-based Information: Near Toyota Dealers, Hospitals, Clinics and Gasoline stand information Parking Lots Information: Availability of Parking Lots at the destination. Phone to Navi: Automatic phone call through Hand-free dialing News of Stock Exchange:
<b>Entertainment &amp; e-commerce</b>	Gaming: Simulation game, Horoscope, etc. Karaoke: On-demand Karaoke service from the library of over 4'000 songs. Remote Monitoring: Accessing Remote controllable camera to monitor such as Pet's condition. Shopping "GAZOO Shopping" : Accessing to cybermall operated by Digital Media Service.
<b>Communication</b>	BBS Service. Address Book: Shared also through Internet by PC, PDA and mobile handsets. "Friend Search": Location Information of friends' cars in case of group tour. E-mailing.

In Japan, the major benefits of ITS or Intelligent Transport Systems can be classified under the following four general categories:

- a) Safety: Fatal traffic accidents to reduced to half current level in 30 years
- b) Smooth traffic flow: Traffic congestion reduced to one-fifth of current level in 20 years
- c) Environment: Car's fuel consumption and CO<sub>2</sub> emissions reduced by 15 per cent and NO<sub>x</sub> in urban areas reduced by 30 per cent in 30 years\
- d) Creation of new industry: The market scale of ITS is expected to reach a total of JPY 60 trillion by 2015 and create employment for about 1.07 million people.

#### 4.2.2 Towards the multimedia home

Owning a personal TV and stereo has been ranked high in the wish list of youth and adults alike in Japan. In terms of stereos, this wish has been partially realized through portable cassette, CD and mini disk players that make audio media easier to carry. However, watching TV in the private space of individual rooms was not always possible due to the lack of TV antenna interfaces in homes. Home networks are a technical solution to this problem. The section describes a few examples of home networking, either through the use of wireless LAN, or through mobile handsets and broadband for content viewing while outside the home.

SONY Corporation, for instance, has been developing a home server concept and in this regard, has released several multimedia terminals for home use. One of them is the personal IT Television known as “Air Board”, released in December 2000 (see Figure 4.3). “Air Board” was designed for late adopters or people who prefer simpler user interfaces and operations for using Internet access services. The “Air Board” is composed of a) base station with a built-in TV tuner, Ethernet interface and Wi-Fi and b) mobile monitor detachable from the base station with touch screen and Wi-Fi connectivity. For getting recommended service menu and contents, users can sign up for the ISP service called “airbonet” by paying JPY 1’950/month as an option. Through Wi-Fi, people can enjoy the Internet connection and TV programming at home through the portable monitor. Technically, AirBoard can be regarded as a simple or first-generation homeserver and wireless home networking system.

**Fig 4.3: Sony AirBoard: mobile monitor, base station and cradle (from left to right)**



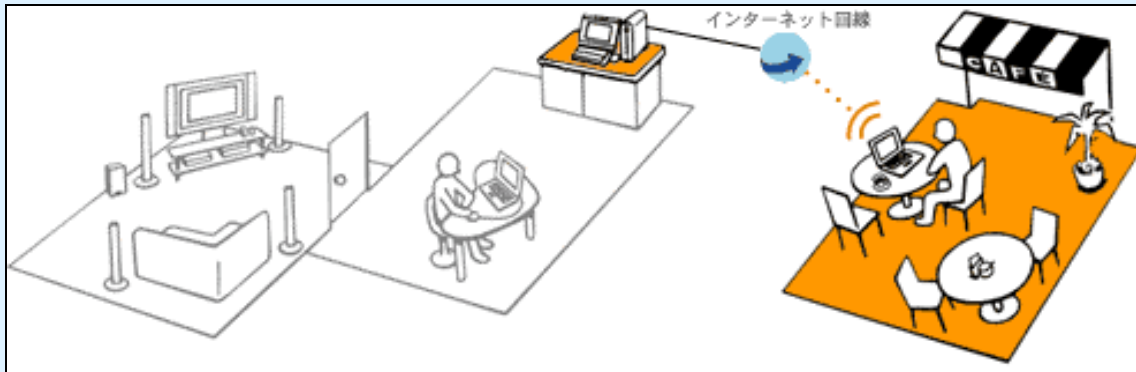
Source: Sony's URL (<http://www.sony.jp/products/Consumer/airboard/IDT-LFL1/index.html>).

Other examples include personal computers with built-in television tuners. SONY's PC “VAIO”, for instance, (named after the concept of “Video, Audio, Integrated Operation”), covers a wide range of products from the ultra light mobile laptop, to the very high performance desktop. SONY released the first VAIO model (VAIO-R), with built-in TV tuner and hardware MPEG-2 encoder in 1999. Since then SONY has been promoting the use of PCs as video recorders by releasing software to facilitate easy recording and viewing. From the autumn of 2002, the company is promoting “VAIO Media”, a collective term referring to the new uses of networked VAIOs. “VAIO Media” is a portal software provided to control content: stored video content by “Giga Pocket”, stored music by “Sonic Stage”, and stored pictures by “Picture Gear Studio”. The following 3 major services are enabled by “VAIO Media”.

- Content-sharing within home network: When a user has multiple VAIOs at home wired or wirelessly connected, users can share or access the multimedia contents stored in each terminal. For example, user can play music stored on a desktop in the living room from a laptop PC in the private room.
- Real time streaming of TV programmes via home networks: Similar to the case above, user can enjoy TV programming in real time on their PC by streaming from the TV with network media interface.
- Accessing contents at home from outside (Fig. 4.4): Users can access personal content from the outside, e.g. at hotspots. For example, users can enjoy Japanese TV programming recorded on one of their PCs or

watch it in real time even while they are away from home, when they have Internet connection with a sufficient bandwidth. To use “VAIO Media” from outside the home, technical requirements are a) global IP address or DDNS (Dynamic DNS) and b) router with support of UpnP (Universal Plug and Play).

**Figure: 4.4: Watching Virtual TV through ‘VAIO Media’**



Source: SONY VAIO Media Official Site (<http://www.vaio.sony.co.jp/Products/Solution/VAIOMedia/basic3.html>).

Another pioneering product is the channel server, “Cocoon”, first released in November 2002 under the license with TiVo, a operating system of Digital Video Recorder of US company TiVo Inc., famous for its digital video recorder. The unique function of TiVo is the automatic programming and recording function, through the use of EPG (Electronic Programme Guide) and registered keywords reflecting the user’s interests. The latest model includes a 500GB disk drive, where a maximum of 342 hours of video can be recorded. The unit is currently selling at 159,000 yen. “Cocoon” uses a TV antenna interface, plus an Ethernet interface, by which users can download EPG from the Internet.

Also in the broadcasting context, a service called “One Push” has been released by CYBIRD Corporation, a successful mobile content provider established in 1998. The company’s main focus is to provide linkages between mobile phones and other types of media. As described in 2.3.2, digital terrestrial broadcasting service was launched in December 2003, and can provide various related information such as metadata in BML (Broadcasting Markup Language) format, a Japanese local standard based on XML. “OnePush” links personal ID information with information provided BML, in order to create another new information cycle easily by sending information to and from the mobile handset. “OnePush” mechanism works as follows:

- First users should have “OnePush” java application included on their mobile handset with IrDA (infrared) interface.
- While watching a mail order programme or advertisement of interest on television, a user can push the appropriate button of their mobile handset once, after activating the “OnePush” application.
- That information is then sent to the OnePush center through the uplink of digital broadcasting service.
- The user can then receive more related information from the server directly to his/her mobile handset.

#### 4.2.3 Vending and ticketing

Ticketing via the Internet, known as “e-ticketing”, has been popular since 1999. Before the introduction of e ticketing services, people typically bought their tickets at sales counters, often a few days before the event, or would make a group-coordinated phone call to the ticket centre. Ticketing companies provided a solution for their members with annual membership fee by giving them advantage to book tickets a few days prior to the official sales start.

PIA Corporation is one of the main ticketing companies in Japan and one of the first to introduce e-ticketing in 1999. Table 4.2 shows the history of PIA’s e-ticketing service. The ticketing service through the Internet reduced the number of people standing in queues or making desperate phone calls for popular events. Still,

the system for delivery of the ticket was not efficient, the main reason being the ticket format. As long as the ticket itself was paper, they had to be sent from PIA directly to the users by post and e-ticketing through Internet needed to be closed a week before the event. But since October 22, 2003, things have radically changed, with the introduction of a new mobile ticketing service, “E-ticket PIA”+”E-coupon PIA”, as shown in Figure 4.5. The two key components of this service are the introduction of a “Digi-Pocke (or digital pocket)” for each user and the establishment of new entrance gates at events known as “DigiGates”. “Digi-Pocke” functions as a virtual pocket in cyberspace, which saves the reserved ticket or transfers tickets between users in a secure manner. The issuing or downloading of e-tickets from “Digi-Pocke” is done via one of the following methods:

- a) Directly to the mobile handset
- b) Using a PC to a smartcard;
- c) Through a ticketing machine installed at convenience stores to either a smartcard or converted to a paper ticket;
- d) At the ticketing counter as a paper ticket.

After the ticket is issued, users will go through the “DigiGate”, an automatic entrance gate accepting the three kinds of tickets: printed paper ticket, tickets stored in a contact-less smart card, or tickets stored in a mobile handset and accessible by infrared. The new e-ticketing service offers a number of benefits. First, the deadline for ticket reservation is extended: users can purchase tickets electronically even on the day of the event over the Internet. Secondly, through the introduction of “Digi-Pocke”, users can easily transfer tickets to others if a group booking has been effected or if the ticket-holder is unable or no longer wishes to attend. Finally, the advent of convenient digitized or “paperless” tickets is facilitated through the use of mobile phones or contact-less smartcards.

An additional feature of e-ticketing is the use of electronic vouchers or e-coupons in conjunction with the purchase of tickets. These coupons are typically related to the particular event, such as a coupon for a sports store near the venue of a football match, or a restaurant coupon on the same street as the concert, etc... As coupons are electronic, the information gathered can be used for more personal services in line with the preference of users, can act as a key tool for customer relationship management (CRM).

According to recent statistics released by PIA, 15 per cent of tickets are sold through the Internet, of which 66 percent through PCs and 33 per cent through mobile phones. The company expects that their new service will enable a customer value chain between shops and event organizers. PIA has set the ticket-issuing fee at JPY 210 per ticket, which amounts to almost one third of the cost of sending paper tickets, i.e. JPY 600 per ticket.

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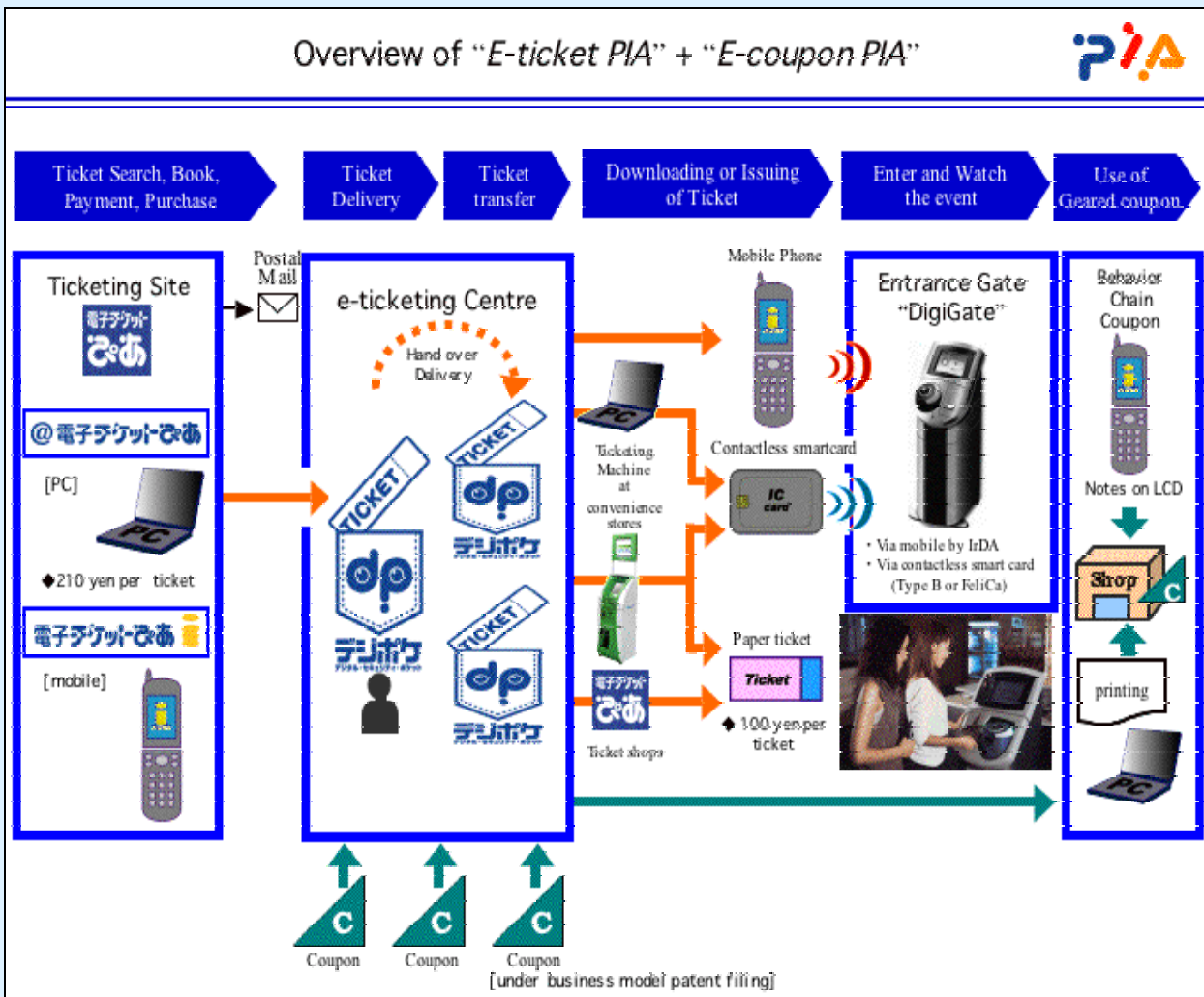
**Table 4.2: History of ticketing services offered by PIA**

Date	Service
May, 1993	Launch of automatic ticket reservation service via telephone
October, 1997	Opening Homepage “@PIA” for ticket information
December, 1999	Launch of a web-based ticket reservation service “@Ticket PIA”
June, 2000	Launch of a full-scale ticketing service for mobile Internet
February, 2003	Launch of automatic ticket reservation system by voice recognition
October, 2003	Launch of “E-ticket PIA” + “E-coupon PIA”

Source: PIA ([http://www.pia.co.jp/pia/annai/annai\\_frame.html](http://www.pia.co.jp/pia/annai/annai_frame.html)).

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Figure 4.5: Schematic representation of Pia's E-ticket and E-coupon services



Source: PIA Corporation.

#### 4.2.4 The mobile enterprise

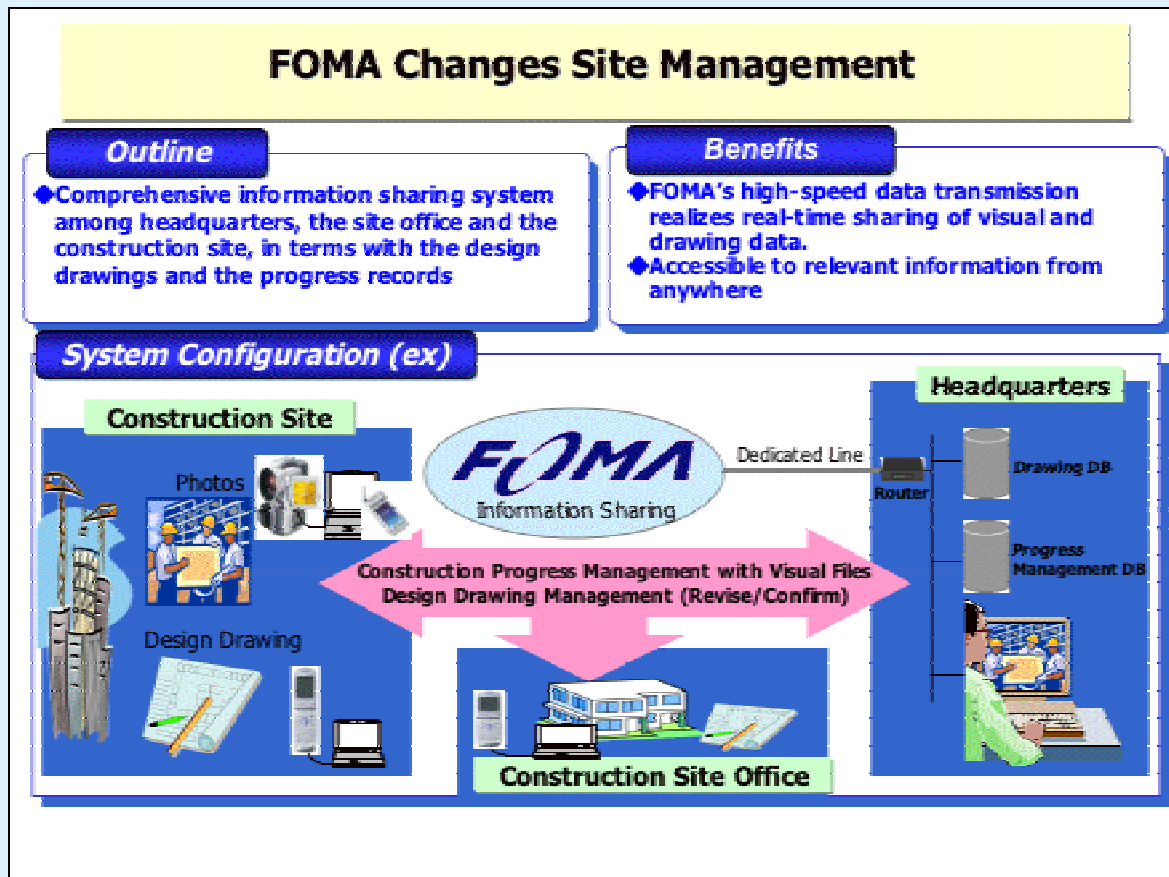
Japanese businesses are rapidly moving towards ubiquitous information and communication technologies. Figure 4.6 is a schematic representation of the use of 3G mobile technologies for the seamless and timely communication between a construction site and headquarters. In this example, staff at headquarters can share information with the people at the construction site, through the use of rich multimedia communication, (including live video phone, mapping information, and diagnostics) offered by W-CDMA 3G networks. Another good example is that of remote system installation. Before higher-speed mobile networks, specialists had to physically travel to the installation site. Now, however, less skilled engineers or first-year engineers can replace specialists and install systems by contacting specialists remotely through 3G video phone transmission, if and when it is necessary.

One of the disadvantages of the use of mobile terminals has been its poor user interface, due to its size and keyboard limitations. To realize the "ubiquitous networked society", in a sense of anytime, anywhere plus "anybody", there has been a call for innovative solutions other than carrying a PDA or an attachable keyboard. The digital intelligent pen "Anoto", developed by Swedish company Anoto AB is just such a candidate for providing a bridge between the pen and paper world, and the digital world. Anoto's digital intelligent pen is equipped with a bluetooth interface and sensor to read the exact location of the pen while writing on specialized 3M paper. The information is transmitted wirelessly via bluetooth (either through designated bluetooth terminals or a mobile handset), and then processed via OCR (Optical Character Recognition). The written data is automatically stored and can be utilized for various purposes as shown in Figure 4.7. One of the applications of this system by NTT DoCoMo is in the fruit and vegetable wholesale market, where people use the special pen and paper to write down information about the fruit's origin, size,



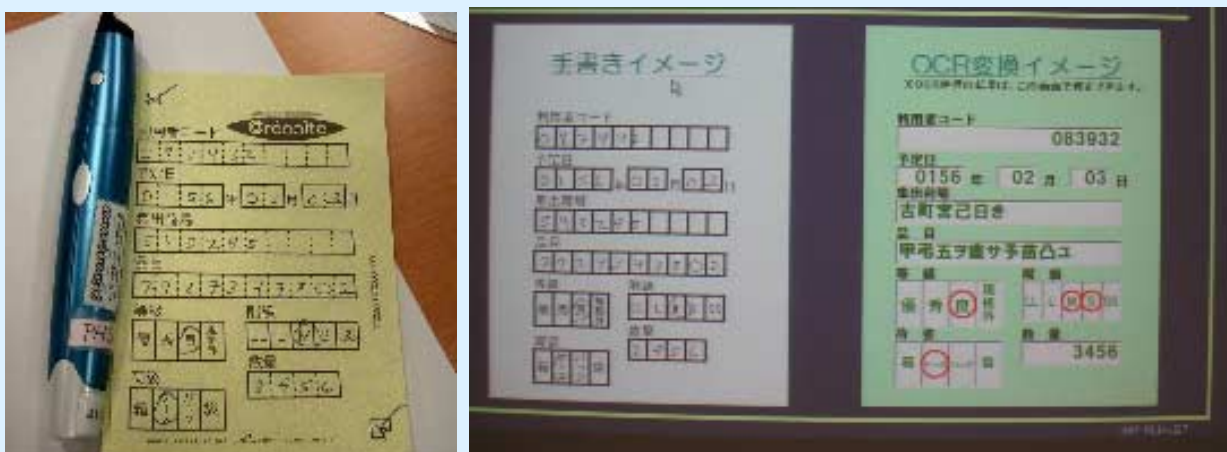
reseller and delivery route. That information is then made available digitally, and can instantly be transmitted to interested parties.

Figure 4.6: Rich Information Sharing by the 3G



Source: NTT DoCoMo Inc.

Figure 4.7: Ubiquitous input method (Left: Anoto Pen and Paper, Right: Recognized Info by OCR)



Source: ITU, NTT DoCoMo.

## 4.2.5 Cards, codes and chips

### 4.2.5.1 Chips

As mentioned in 4.1.2, microchip-networking technologies make up an important component of the government's R&D programme for the ubiquitous information society. Indeed, early manifestations of these types of technologies are already visible in Japan. NTT DoCoMo, for instance, has been fairly active in developing applications for radio frequency identification (RFID) tags.

RFID tags are essentially tiny microchips, some only 1/3 of a millimetre in diameter, that act as transponders (transmitters/responders), continuously waiting for radio signal to be sent by transceivers, or specially-designed RFID readers. When a transponder receives a certain radio query, it responds by transmitting a unique ID code. Most RFID tags are passive tags, that is to say they are not powered by any batteries. The most important functionality of RFID tags is the ability to track the location of the tagged item. RFID tags can cost as little as 0.50 US cents and the prices are dropping. Some analysts say that RFID will soon replace the familiar bar code in the retail world.

Since May 2003, NTT DoCoMo in collaboration with Tokyo's Academy Hills Library is testing an RFID library system in the trendy Roppongi Hills district<sup>19</sup>. Each one of the 12'000 books on the shelves of the Academy Hills Library contains an RFID tag on its binding. Each shelf is equipped with an RFID reader that can receive transmissions from books within 10-20 centimetres. Library users and staff are therefore able to locate books, even though they have been moved from their original position. Furthermore, checking out library books can be done quickly and efficiently using the RFID readers at the check-out desk.

This use of RFID tags at Roppongi Hills has now been expanded to retail shopping: the trial of NTT DoCoMo's "*R-click*" service<sup>20</sup> began on 1 November 2003 and will run until 1 February 2004. The R-Click service delivers information specific to a user's location using RFID tags. DoCoMo has issued about 4'500 RFID tags embedded in small handheld terminals (see Figure 4.8). 200 stores are already on board for the trial. Subscribers can inform the network that they wish to be located by pushing a button, but the default setting is off. The small, handheld device then enables users to receive a wide variety of area information as they walk around the new metropolitan cultural complex of shops, restaurants, entertainment facilities, residences and hotels. Information will be transmitted to the user's i-mode phone in three ways:

1. **Koko Dake** (Area Limited) **Click**: While standing in any of approximately 10 to 20 areas (cells) in Roppongi Hills, the user can click the button on their RFID tag to receive information about that area. The user receives information tailored to their specific interests based on personal data that they pre-register.
2. **Mite Toru** (Watch and Receive) **Click**: When a user positions him or herself in front of an electronic board which shows commercials of products and services, the user can press the button on their RFID tag in order to receive information on their DoCoMo phone as well as URLs of products and services shown in the commercial multimedia presentation. The feature also allows users to go to the web pages later, at their own convenience (See Figure 4.3).
3. **Buratto** (Walk Around) **Catch**: This feature automatically emails area information as it detects the user moving about Roppongi Hills. The user receives information before actually entering a new area, because the system anticipates the user's movements. The information can be customized to a user's specific interests.



**Figure 4.8: Only an R-Click away in Roppongi Hills**

*R-Click terminal and “Mite Toru” board (left picture). Service logo on a sidewalk in Roppongi Hills (right picture)*



Source: ZDNet Japan.

Whether the RFID tag has been activated or not, it is continuously sending identification and location information to nearby readers every 0.7 seconds. For this reason, the place and the forward direction of a user can be calculated for the delivery timely and relevant services.

RFID tags are also making their appearance in food establishments. Pintokona, a Sushi restaurant in the Roppongi Hills district, has introduced RFID tags to track and price their plates of sushi that are presented on a rotating belt. The system facilitates the calculation of the bill, as each tag contains information such as price, sushi type, chef, time stamp and other types of information. And as it can track the precise time when the sushi is placed on the plates, once a thirty-minute period has expired, the sushi is automatically removed from the rotating belt, in order to ensure that only the freshest pieces are made available to patrons.<sup>21</sup>

#### 4.2.5.2 Cards

In Japan, the use of integrated circuit (IC) cards has had notable success. IC cards (type C<sup>22</sup>), manufactured by Sony, under the brand name “FeliCa”, are commonly used to ride the JR railway lines. In addition, ten million Japanese use Edy (euro dollar yen) prepaid cards. A number of telecommunication businesses are considering the use of IC cards in combination with mobile phones as a new business opportunity.

NTT DoCoMo and Sony announced a joint venture in October 2003 to promote the use of FeliCa cards with mobile technologies. And at ITU Telecom World 2003, NTT DoCoMo announced the 2004 launch of mobile phones with integrated circuit cards, namely Sony’s “FeliCa” card. This will enable mobile phone users to utilize their mobile phones as tickets or cash for services such as public transport, concert tickets and so on. On 15 December 2003, the company announced details about the trial service, entitled “i-mode FeliCa preview service”. DoCoMo will supply 27 participating service providers with FeliCa-equipped “mova” N504iC and SO504iC handsets (approximately 2’500 each) and each company will distribute the phones to its customers and employees. The phones will be used for public transport tolls, electronic money, personal identification and other trial services between December 17, 2003 and the summer of 2004.<sup>23</sup> KDDI and Hitachi have also developed handsets with Sony’s Felica card.<sup>24</sup>

The SIM (subscriber identity module) card embedded in GSM mobile phones will also see significant evolution. The new 3G version of the SIM card known as the UIM (universal identity module) will be incorporated into mobile phone with security measures such as PKI (public key infrastructure). This will enable secure user authentication, allowing for a wide variety of content to be stored on the mobile phone in the future, such as pre-paid coupons or credit card information as well as roaming information. Since 2002, the mobile operator KDDI’s slogan has been “ubiquitous solutions company”. It is currently elaborating plans for the enhanced use of UIM cards.

#### 4.2.5.3 Codes

Not only are chips and cards finding their way into Japan's mobile phones, but two-dimensional (2D) code readers are also being explored. The new Quick Response Code (QR Code) is a 2D code developed by DENSO Corporation.

**Figure 4.9: Quick response for Mobile Phones**

*Image of a 2D or quick response code to be read by mobile phones*



*Source: NTT DoCoMo.*

It allows for the fast reading of large amounts of alphanumeric data: a QR code can contain up to 7'366 characters of numeric data and 1'888 Japanese characters, thereby enabling it to display to same amount of data smaller area than conventional bar codes (See Figure 4.9). NTT DoCoMo has already released two models with code readers, the Fujitsu 505i series and the Sharp 505i series. For a phone to be able to read the 2D code, it requires a digital

camera and the appropriate software. From 2004 onwards, all of NTT DoCoMo's mobile phones will be 2D-code compatible. Codes will begin appearing on all kinds of products, such as newspapers, artwork, retail goods, foods and so on. By reading the code with their mobile phone, users will be able to download additional information about the product. In the early days, only text will be made available, the 2D codes will be static and off-line. But dynamic on-line 2D codes will be available shortly, embedding hyperlinks and multimedia content. This is likely to further transform the way in which we Japanese people use their mobile phones. There are currently 500'000 terminals with the appropriate software and camera capability in circulation, and NTT DoCoMo estimates that the development of a mass market for 2D codes is not far off.

The 2D code reader may be a first step towards the ubiquitous communicator or "U-Code" being developed by Japan's T-Engine Forum (Box 5.1). The U-Code is currently at an experimental stage of development. Branded "U-code", the device looks much like a personal digital assistant, but communicates in a wide variety of ways, through TCP/IP, VoIP, bluetooth, infrared and other systems. It contains a special reader and writer for small RFID chips that can be embedded in a wide array of items, and which may eventually have broadcasting capabilities.

### 4.3 Key challenges

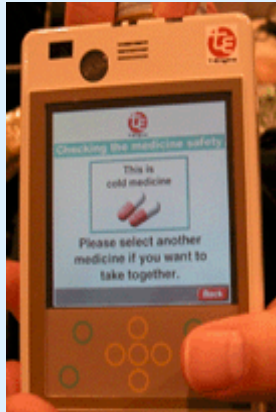
#### 4.3.1 Radio policy

One of the key challenges for the development of the ubiquitous information society in Japan, as in many countries, is the efficient use of spectrum. Japan's Radio Law, enacted in 1950, provides the legislative framework for the utilization of spectrum. The MPHPT is currently assessing the extent to which radio spectrum is being effectively used by inviting public opinions, based on the legislative scheme set out by the amendments to the Radio Law in 2002. Moreover, in order to facilitate spectrum reallocations, a system to provide compensation to existing licensees who will suffer economic costs in the case of spectrum allocation is planned to be introduced by the amendments in 2004. With the introduction of this compensation system, it is expected to promote prompt reallocation of spectrum to new demands for spectrum such as high-powered Wireless LANs.

**Box 5.1: The ubiquitous communicator**

*The ubiquitous communicator “UC” at Japan’s YRP Ubiquitous Networking Laboratory\*

Ubiquitous communicators can offer local-area communication for accessing microchips that store “ucodes”, such as RFID tags or smart cards. Furthermore, such communicators incorporate functions for wide-area network (WAN) connections, in order to obtain information about the ucodes in objects, as well as additional services associated with the objects. For example, communicators support connections with one or more of the following networks: W-CDMA 3G mobile networks; public telephone networks (for PHS and other devices); WLANs via IEEE 802.11b; or personal-area networks (PANs) via Bluetooth.



The Ubiquitous ID Center itself provides a link to information services for the objects in which ucodes are embedded. This is done using both local area networks and wide area networks. A communicator works as follows:

1. Step 1: A UC is positioned over an RFID tag in which a ucode is stored. As the UC is brought near, it uses local-area communication functions to read the ucode.
2. Step 2: The UC sends this ucode information to the Ubiquitous ID Center's ucode Resolution Server to find out where there is information about the object to which the ucode is attached. The information might be available over a WAN, and the UC may be able to obtain a website address on the Internet.
3. Step 3: The UC searches the product information database of the address obtained to retrieve information about the object.

Not only can data be retrieved, but the database function allows for data to be recorded as well.

If the RFID tag in question has only sufficient memory capacity for data about the object, the communicator can obtain this data directly from the RFID. And with the product information database, object information can be stored in the RFID or in the database. If the RFID has only enough memory capacity for data about the object, the communicator can obtain this data directly from the RFID. And with the product information database, object information can be stored directly in the RFID or in the database.

*Source:* Ubiquitous ID Center.

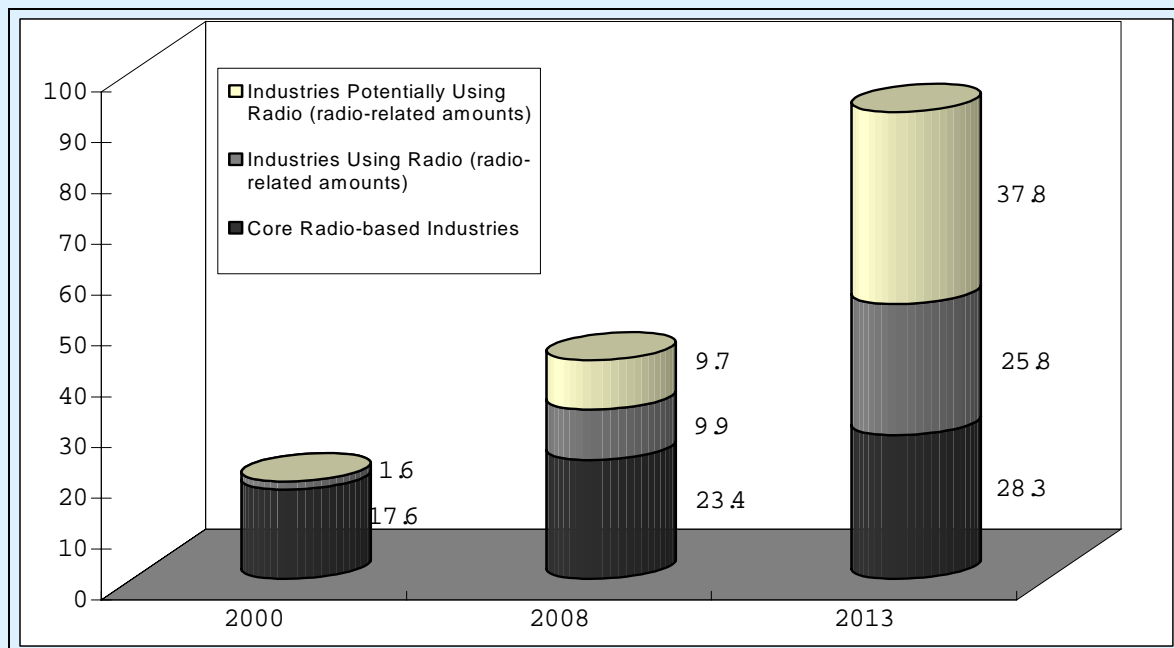
In August 2002, the MPHPT also requested consultation with the Information and Communications Council, who submitted their mid-to-long term vision (5-10 years) for Japan’s radio policy in July 2003. The Council estimates that the demand for spectrum will grow significantly over the next decade. Indeed, revenues from radio-related industries will surpass 90 trillion Yen by 2013 (Figure 4.10). For this reason, the Council raised its mid and long-term targets for spectrum allocation, and recommended a dynamic review of policies for allocation, reallocation and use of spectrum. This would include, *inter alia*, initiatives to:

- encourage licensees to return redundant spectrum not being use efficiently;
- reallocate radio spectrum to mobile systems from systems that can replace their infrastructure with, for instance fibre optic cables;
- swiftly reallocate radio spectrum in a transparent manner to new radio systems that have higher demand (reduce the time period of approximately 10 years for the return of spectrum).

In terms of mobile spectrum below the 5-6 GHz band, about 270 MHz are currently utilized but in about 10 years, the Council estimates that between 1’060 MHz and 1’380 MHz will be needed.

**Figure 4.10: A growing demand for spectrum**

*Revenues from radio-related industries for 2000 and estimates for 2008 and 2013 (trillion Yen)*



Source: MPHPT.

### 4.3.2 Broadcasting policy

Another key challenge that comes with the increase use of ubiquitous multimedia applications in the mobile world relates to broadcasting policy. The Radio Law and the Telecommunication Business Law cover telecommunication businesses using radio as their core business. The Cable Television Broadcast Law (hereinafter referred to as the “CATV Law”) regulates CATV operators that are categorized as broadcasting stations. They must obtain permission for installation from MPHPT and submit the notification of service commencement to MPHPT when they start CATV broadcasting services. These processes are applied only for their CATV broadcasting services. Thus, before a CATV operator launches an Internet access service, it must also obtain permission for Type I Telecommunication Business under the Business law. About 310 CATV operators had a Type I business licence and offered Internet access service by the end of January 2004. In Japan, the incumbent telecommunication operators, such as NTT East and West, do not operate CATV businesses.

The Broadcasting Law requires operators to obtain broadcasting licences when they launch broadcasting services. Under this Law, operators that plan to offer only facilities, not TV programmes, for broadcasting must obtain broadcasting licences. Although they can broadcast only by using a broadcasting station or a cable television broadcasting facility, by the enactment of the Law Concerning Broadcast on Telecommunications Service, the service which is transmitted on a telecommunication service provided by a person who operates a telecommunications business, enables it to broadcast. As broadband telecommunication networks and the quality of service have improved, more demand to broadcast programmes through broadband networks has arisen. The legislation covering broadcasting over wired telecommunication networks was enforced in January 2002 to meet these demands. This Law enables a telecommunication operator to offer its networks to a broadcasting station that registered as “a broadcasting station using wired telecommunication network” prescribed by the legislation. In this case, therefore, the telecommunication operator need not obtain a broadcasting licence. From the view of a broadcasting station, if it is registered as a “broadcasting station using the wired telecommunication network”, it can launch a broadcasting service by “borrowing” telecommunication operators’ networks. BB Cable, a subsidiary of SoftBank BB which offers ADSL broadband access service “Yahoo! BB”, registered in July 2002, making it

the first broadcasting station to do so. It launched a trial broadcasting service in December 2002 using Softbank BB's ADSL network.

Given the developments in broadband fixed and mobile services, the MPHPT set up a Roundtable Conference on the Future Aspects of Broadcasting in the Broadband Age in November 2001, and the conference released final report in April 2003, which indicated its main courses of action for the problems surrounding broadcasting. At the same time the conference also formulated the Third Action Plan for the Promotion of Digital Broadcasting.

Given that analogue television has already made its way to mobile handsets in Japan, and that digital television is not far off, a suitable regulatory framework is required, which encourages the wide distribution of content while ensuring adequate incentives for its creation.

Another important challenge for the take-up and viability of new services, is the issue of privacy and data protection. These issues are discussed in section 5.

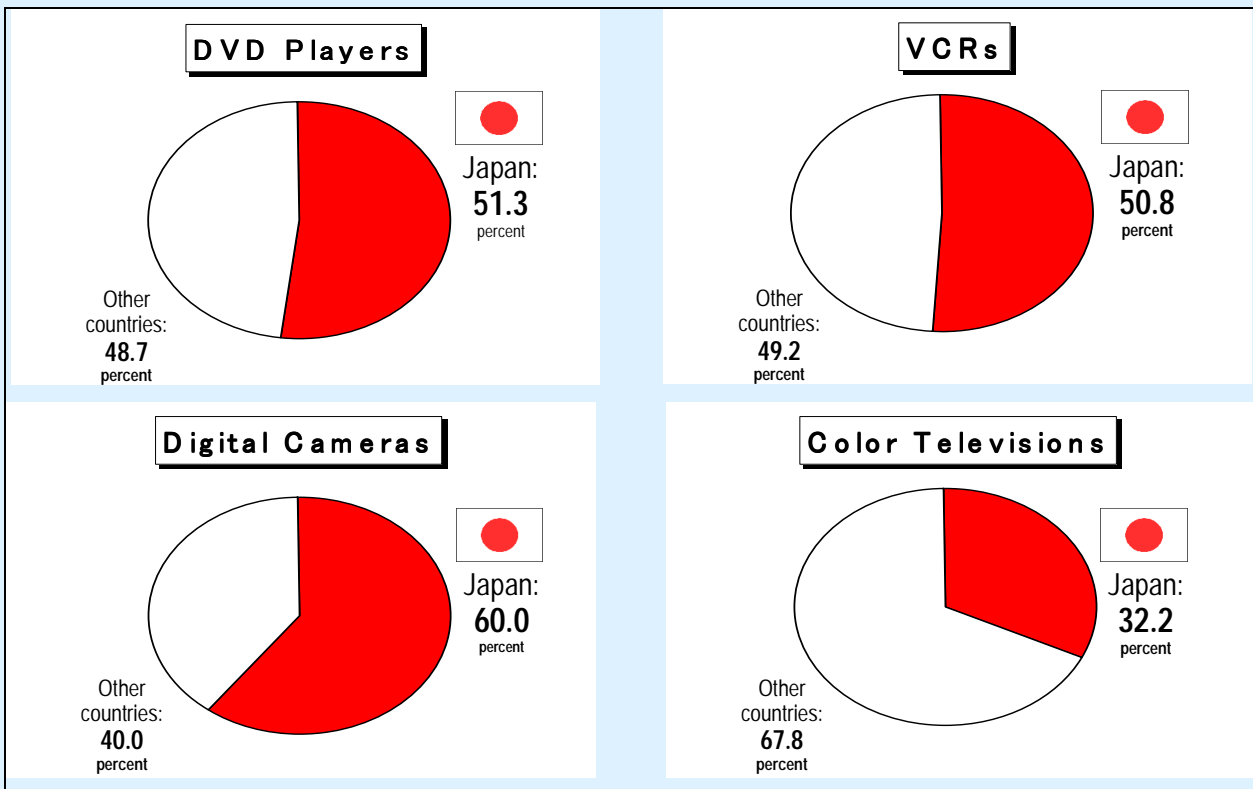
## **5 Living in the mobile information society, Japan-style**

### **5.1 Peculiarities**

No one will deny the perception that the Japanese are a highly technophile people, who are regularly seen sporting the latest technological gadgets. This holds just as true for the mobile phone. No tourist visiting Japan can miss the dazzling array of mobile handsets and accessories on display all over Tokyo, and notably in the "electric towns" of "Shibuya" and "Akihabara". Indeed many of those interviewed during the research phase preceding the publication of this case study, pointed to the cultural factors affecting the take-up of new technologies in the country. In particular, they highlighted the fact that the Japanese consumer is informed and demanding, carefully choosing technology for its innovative quality, functionality, and value for money. At the same time, Japan is a highly homogeneous society, and consumers are keen on having the latest gadgets, in order not to be outdone by their neighbours and friends. Therefore, the threshold for a product to hit the mass market is much lower in Japan than in other countries. If a service or technology reaches 15 per cent penetration, it is well on its way to becoming a mass-market product.

In terms of manufacturing and distribution, Japan is famous for developments in miniaturization and product packaging. Foreign pharmaceutical firms, for instance, face significant challenges when distributing products in Japan, due to the strict packaging requirements imposed on them. The look and design of a product are key marketing elements, particularly for mobile phones, and the discriminating Japanese consumer takes careful note of these when purchasing electronics. Given the country's success in miniaturization and robotics, it is not surprising that Japan has a relatively large share of the worldwide market of home electronics. The lower market share figure appears only in the context of larger-sized colour televisions (see Figure 5.1).

**Figure 5.1: Worldwide market share of home electronics - Japan (2001)**



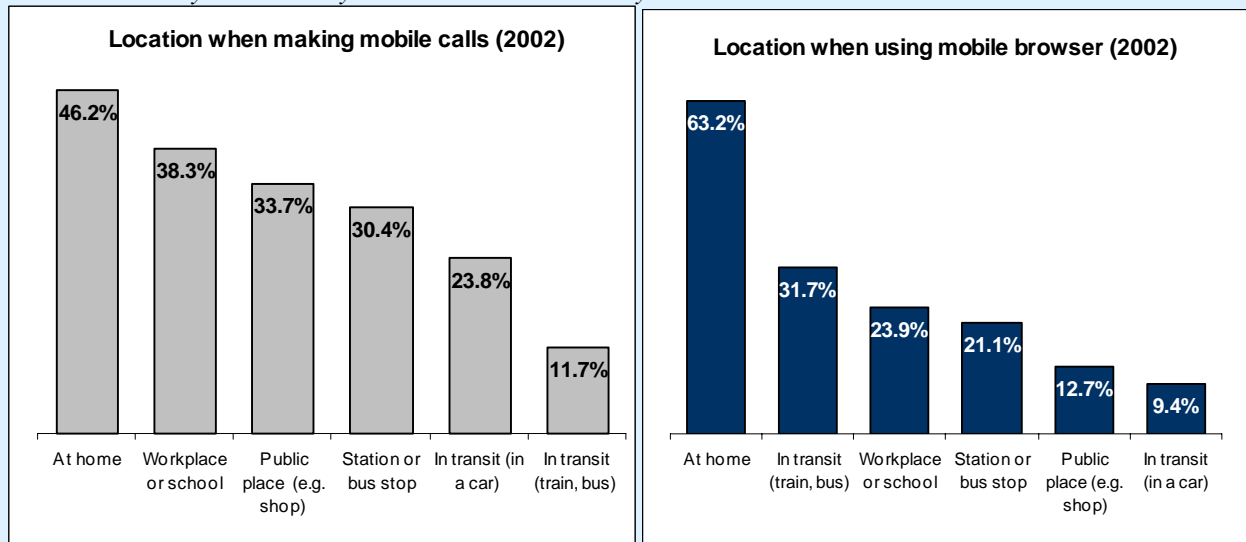
*Source:* MPHPT, adapted from “Market Share Survey Report of 100 Leading Products and Services, 2001”, Nihon Keizai Shimbun, materials from New Growth Policy Committee of the Industrial Structure Council, Ministry of Economy, Trade and Industry, and the Semiconductor Industry News (2001).

Another important trend in Japan is the use of mobile phones as a fashion accessory. Users have access to a wide variety of colourful tags and stickers that can be used to personalize mobile phones, in line with the latest trend and fashion of the day. Handset replacements are thus very common in Japan. According to a survey conducted by Video Research in July 2002<sup>25</sup>, 63 per cent of users replace their mobile devices within two years. Young students have an even shorter replacement cycle: almost half of those surveyed reported an annual replacement cycle. 40 per cent of those who replaced their handset at least once, reported one of the following reasons for their latest replacement: a desire to have the latest model or service, or the fact that the design or function was “out of date”. Mobile phones have become such trendsetters in Japan that KDDI has recently released a “retro” design, with a certain hint of the past, in order to appeal to the younger generation. The slim-line phone is known as “Infobar” and comes in three different colours, each with a different catchy name.

There is a general misconception that Japanese people use their mobile phone mostly while commuting. In fact, a large majority (46.2 per cent) of Japanese use their mobile phone at home to make calls (see Figure 5.2, left chart). Similarly, although some consider that the most frequent use of the mobile browser function in Japan is on commuter trains and public transport, the reality is quite different: a survey conducted by MoCoBe reveals that the use of the mobile browser in Japan is highest at home and this is confirmed by Video Research’s survey in 2002 (see Figure 5.2, right chart).<sup>26</sup> In fact the peak time period for browser usage is after working hours, between 19:00 and 23:00 on weekdays and 21:00-23:00 at weekends.<sup>27</sup>

**Figure 5.2: User location when using browser functions and making phone calls from mobile phones**

*Based on a survey conducted by Video Research Ltd in July 2002*



Source: Video Research Limited, 2002.

Another interesting aspect of mobile phone use in Japan is the portability and proximity of the device to the human user. According to the Mobile Content Forum, 70 per cent of Japanese mobile users keep their mobile within one meter of their body during the day time, and 40 per cent during the night, most likely not far from their pillow. In this respect, the mobile phone has become somewhat an extension of one's physical self, intrinsically linked to identity and accessibility. Box 5.1 describes a day in the life of a typical 22-year old Japanese and her mobile phone.



**Box 5.1 A day in the life of 22-year old Kyoko and her *keitai***

*A fictional story based on the observations of authors and interviewees while researching this case study*

Kyoko, a 22 year-old woman works at an office in the city. Kyoko woke up at 6.30 AM to the sound of her mobile phone. She checks her *keitai* (the Japanese word for mobile phone) immediately for new mails: 10 e-mails from friends/family and 5 SPAM messages. Her best friend Noriko suggests a new movie tonight. Her newly met boyfriend Takeshi asks for a date over the weekend. Her sister Kaori, currently studying in USA, asks for easy Japanese recipes. Her mother in her hometown asking how she is. Her father on a business trip wants to know what souvenirs she would like. After acquiring a mobile phone, she has more had more contact with her father and he is so happy that he continues to subsidize her mobile bills. Kyoko then starts her commute to work.

During her time on the train, she replies to most of her messages. She interrupted her mobile game, after she received a call. Before she boarded the train, however, she had set her mobile to 'manner mode' so that it didn't ring. Her mobile also has a sticky film covering, an accessory for the LCD display. This film covering is recently a popular item to avoid a snooping by others especially in the very crowded trains. It means that mobile screens can only be viewed by the person who is facing the phone directly, and not by people on either side of the phone. Kyoko heard from her friends that a new ringing tone of a popular Japanese song has just been released, so she immediately downloads it to her mobile phone for a small fee. Kyoko works as a secretary for a worldwide trading company. Typically, she sits in front of her PC in the office, but she communicates with her friends only through her mobile phone, because she doesn't have a computer at home.

After her day at work, she goes shopping and replaces her mobile phone with a newer model, one that has a very secure system with fingerprint identification. Now, she can assign different fingers for accessing different data: for instance, the right forefinger for Noriko's folder, the left middle finger for Takeshi's folder and so on. Another attractive function that Kyoko enjoys mobile chatting: this allows a series of messages to be exchanged in the form of near real-time dialogue similar to Internet chatting software. She did end up going to the movie with Noriko, after buying both tickets electronically through her *keitai*. She did not find the new movie interesting. So in the theatre, she wrote a few more e-mails and sent pictures to friends with her new mobile handset....

*Source: ITU.*

**5.1.1 Selected demographics and patterns of use**

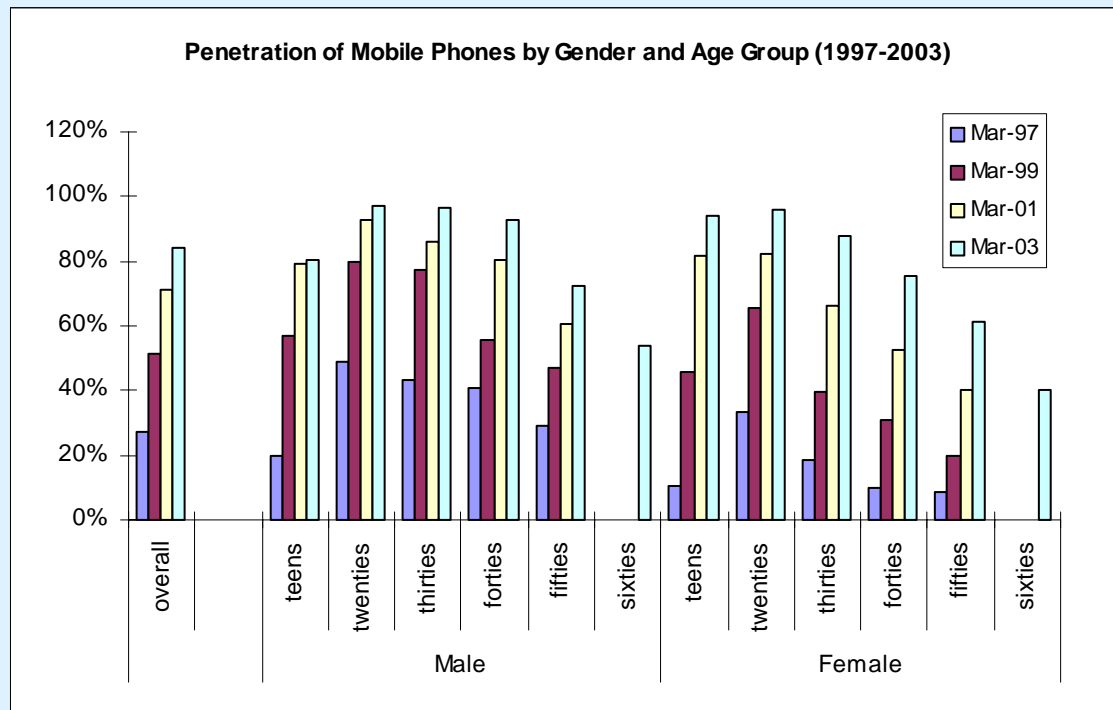
This section outlines some of the demographics and usage trends that can be observed in Japan. It is largely based on Nomura Research Institute's survey "Cyber Life Observations", which has been conducted annually since March 1997 and is based on a comprehensive questionnaire.

As Figure 5.3 indicates, in 2003, the penetration rate of cellular phones reached 84.4 per cent among people between the age of 15 and 59. Except females over 60, more than 50 per cent of people own a cellular phone in all the user categories. More than 95 per cent of people in their twenties own cellular phones and the market is almost saturated. Though the increase during the last 6 years is 300%, recent trends show a slowdown clearly, such as a 2.4 per cent increase among people between the age of 15 and 59.



**Figure 5.3: Trends in penetration rates of the mobile phone in Japan, by gender and age**

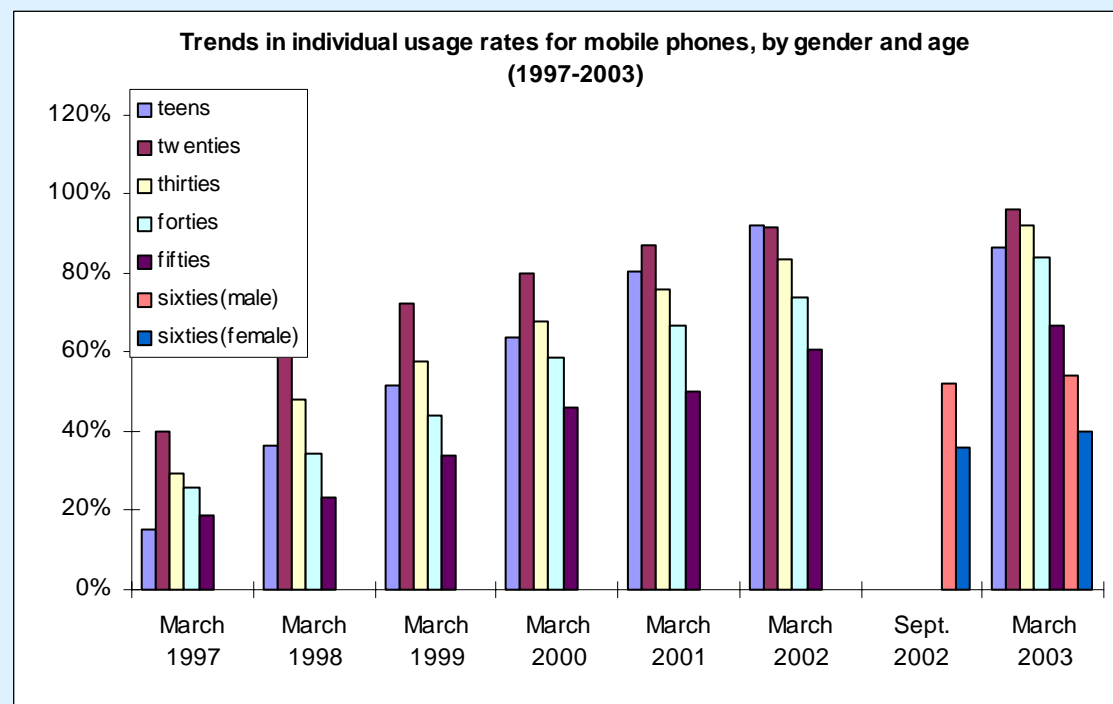
*Penetration rates from March 1997-2003*



Source: Cyberlife Survey, Nomura Research Institute.

Figure 5.4 shows the trends in individual usage rates for mobile phones by gender and age. The usage rate had been increasing constantly during the last six years.

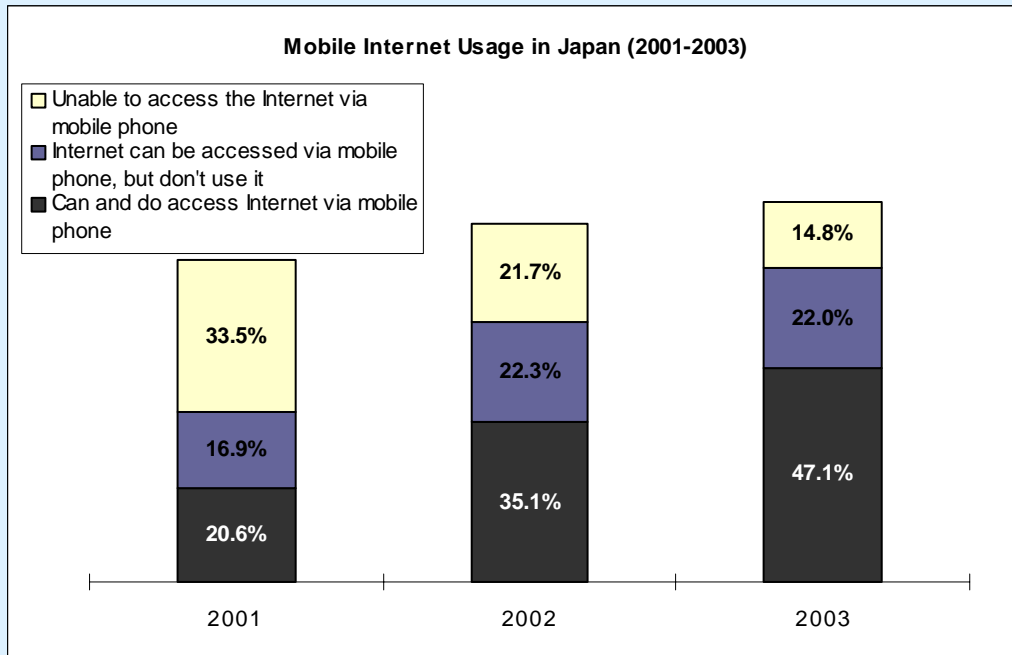
**Figure 5.4: Trends in individual usage rates for mobile phones, by gender and age**



Source: Cyberlife Survey, Nomura Research Institute.

Figure 5.5 shows the trends of dissemination rate of terminals with mobile Internet capability and the usage. 69.1 per cent of users own the terminals with mobile Internet connectivity. Mobile Internet users are 47.1 per cent of all which is 134 per cent of increase rate compared to the data of 2002. Figure 3.6 shows the detailed breakdown by gender and age. The ownership rate of mobile Internet handsets among teens, twenties and thirties is higher than 85 per cent and more than 50 per cent of users among teens, twenties, thirties and forties do access Internet via mobile handsets.

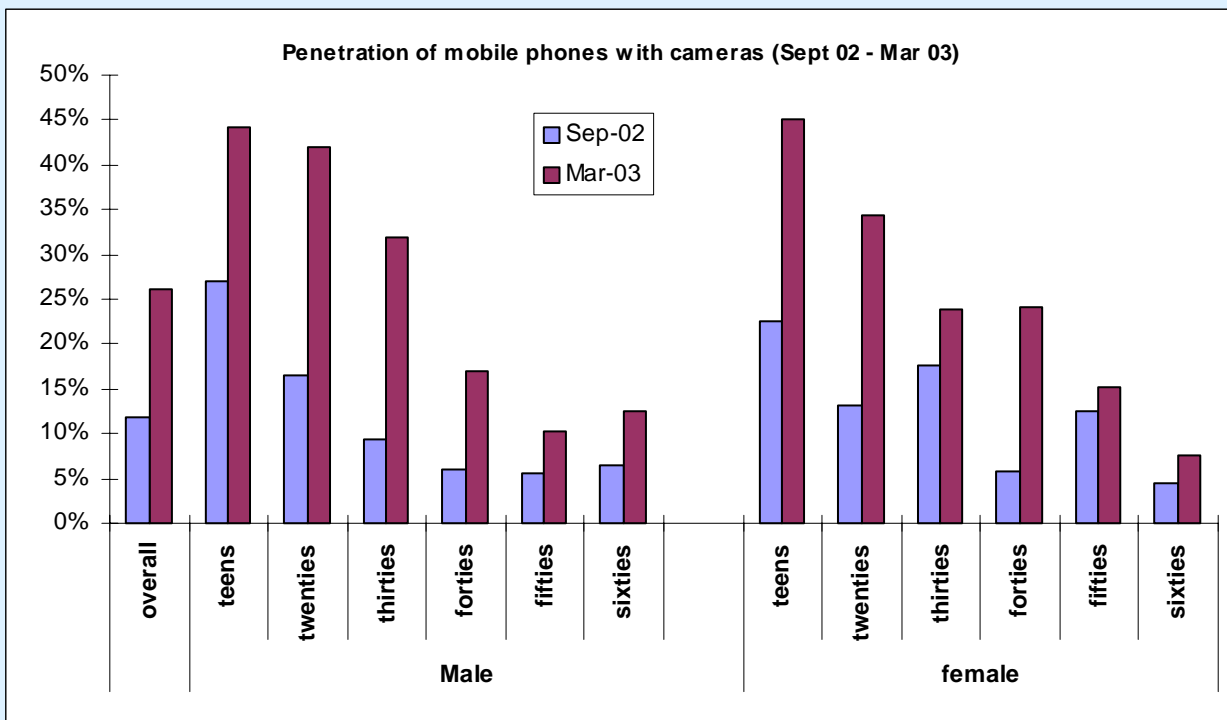
**Figure 5.5: Trends in individual usage rates for cellular phones (2001-2003)**



Source: Cyberlife Survey, Nomura Research Institute.

Figure 5.6 shows the possession status of camera-installed cellular phones by gender and age. Camera-installed phones are owned by 26.1 per cent of all the mobile phone users, which almost doubled in the six months from late 2003 to early 2004. The usage of cameras of those phones is very high among youth in particular.

**Figure 5.6: Ownership of mobile phones with digital cameras in Japan, by gender and age**

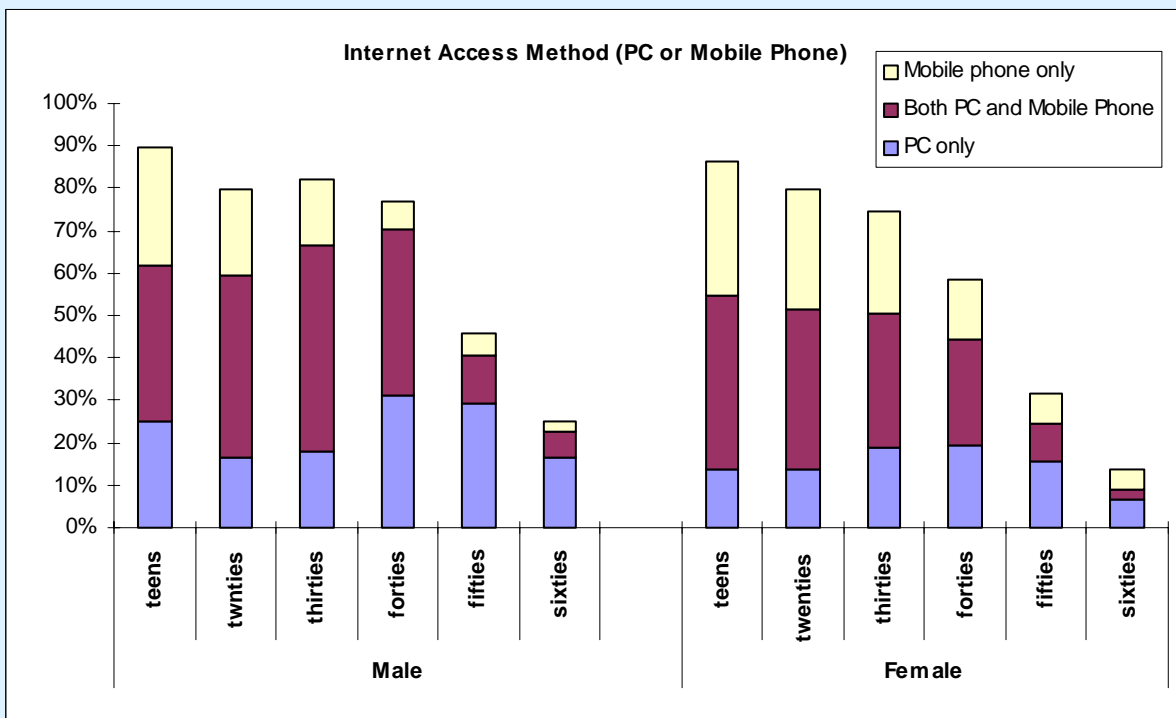


*Note:* Those who use cellular phones =100%.

*Source:* Cyberlife Survey, Nomura Research Institute.

Figure 5.7 shows the trends in individual Internet usage methods by gender and age. Most popular usage method is from both PC and mobile 30.8 per cent on average, though among youth in teens and twenties, more than 20 per cent of users access Internet only from their mobile handsets. Across all age categories, the rate of mobile Internet use is higher in female users than male users. Many operators are aware of this trend, and are now starting to develop and offer devices with women in mind.

**Figure 5.7: Internet access terminal, by gender and age**

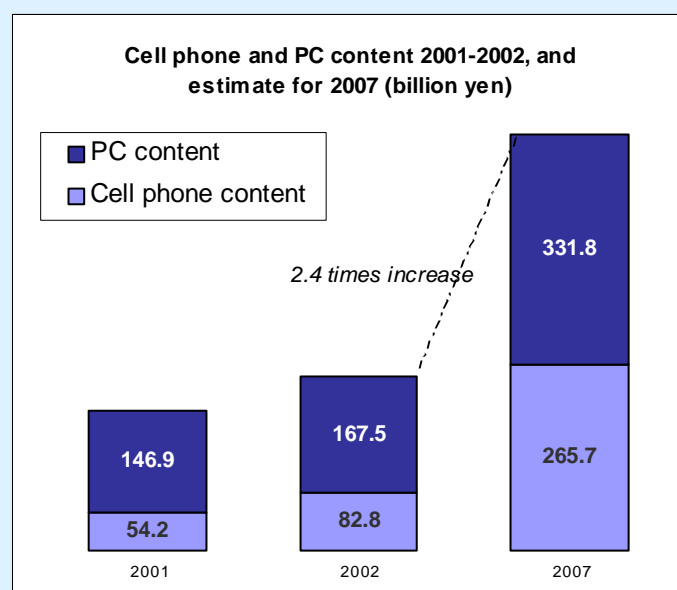


Source: Cyberlife Survey, Nomura Research Institute.

## 5.2 A question of content

In 2002, one-third of all content revenues stemmed from mobile content. The MPHPT estimates that by 2007, mobile content in Japan will more than triple (see Figure 5.8). For this reason, efforts to foster a healthy content market are also being stepped up at the governmental and industry level.

**Figure 5.8: Cell phone and PC content**



Source: MPHPT White paper on Information and Communications in Japan, 2003.

The increase in unsolicited e-mail messages is a particular concern. Most “spam” messages on mobile phones are supposedly sent from personal computers. Readily available e-mail address generating software can even automate sending processes. For this reason, in Japan and in many other countries, spam has become a serious problem, particularly exacerbated when users are charged for each e-mail they receive. Slogans such as “are you paying for spam?” have been bandied about by those operators offering free e-mail reception service. Many operators have since begun providing free incoming e-mail packages: in the case of DoCoMo for instance, the first 400 packets per month are free. As for other measures, operators are repeatedly encouraging users to change their mobile e-mail address so that it differs significantly from their phone number, or to use more complicated and original nicknames, in order to make it difficult for address-generating software. Users can already block certain e-mails with Internet addresses and domains which they designated, but this may not be an effective measure given that spam messages are often sent from different addresses each time. On 25 December 2003, DoCoMo introduced a new anti-spam measure that will enable its i-mode users (including 3G or FOMA) to block all e-mails from user-selected domains of other cellular or PHS companies. DoCoMo has also taken aggressive countermeasures against spam mail sent from its i-mode network, such as limiting the amount of e-mails sent daily from a single i-mode account and suspending or rescinding the contracts of DoCoMo handsets registered to known spammers. With this new feature, users will simply go to the “i-Menu” official i-mode portal site in order to select which cellular or PHS domains to block. No packet transmission charge will be required to change the settings.

In July 2002, the Japanese government passed the “Law on Regulation of Transmission of Specified Electronic Mail”. This law addresses “Specified Electronic Mail”, which is defined as e-mail for advertisement purposes sent to users who have not opted in for the service. The legislation specifies that the sender’s name must be mandatory information, and prohibits e-mail delivery in the case of user opt-out and the use of address-generating software. Furthermore, it gives the right to Type I carriers to reject sending requests of “Specified Electronic Mail” and requires mobile operators to provide necessary information and develop technical solutions.

More and more content is being stored on the mobile phones of private users, such as personal e-mail, address book information and calendar. In this regard, operators limit access to contents providers, if they have read and write functions.

Internet dating is gaining in popularity around the world. In Japan, given the success of mobile Internet services, mobile dating and flirting services have been particularly successful. However, the number of crimes linked to such services has increased. According to the national police agency, there were 793 cases of mobile dating crimes in the first half of 2002, which represents a 260% increase from the previous year. 400 of these cases related to prostitution of underage youngsters and 390 of these were directly generated through mobile Internet communications. Mobile operators and government are working in tandem to address this problem. KDDI and NTT DoCoMo, for instance, have included information on their websites regarding “access to dating sites” in order to alert users to the possible danger of dating services. In addition, as of August 2003, NTT DoCoMo introduced an access restriction service, which limits user’s mobile Internet access only to authorized, “official” DoCoMo sites. At their end, in September 2003, the government enacted the “Law of regulating the act that attracts children using the Internet opposite-sex introduction sites”, of which the following are the main elements:

- a) Defines “dating service” as “electronic communication channel providing service for opposite sex”;
- b) Requires dating service providers to put effort to avoid subscription of youngsters under 18;
- c) Requires dating service providers to announce that their service is only for an adult and confirm the age of the users;
- d) Perpetrators of abuse cases, such as illegal prostitution for under age 18 or any types of dating based on payment will be punished. This means that, for instance, personal ads such as “I’ll give you 30,000 yen if you play tennis with me” are prohibited.

The question of whether this law will give police the right to violate private information is still under discussion. The Mobile Content Forum (MCF), an initiative established in 1999 by the private sector to band together to ensure a healthy mobile content market, submitted comments to the Government on this new law. They argue that the law may become a barrier for the development of community sites, a key content driver for the mobile community. MCF also pointed to the lack of technology that can determine a user’s age.

### 5.3 Privacy protection and data integrity

After the advent of the global Internet, many concerns surrounding the protection of private information have emerged. The Japanese government has been working actively to avoid these critical failures, through legislative measures and guidelines. For instance, the “Personal Information Protection Act” was enacted in May 2003. In December 1998, the MPHPT issued the “Guidelines on the Protection of Personal Data in Telecommunications Business” and has since been holding a regular study group concerning information privacy in the business field

The “Unauthorized Computer Access Law” was enacted in 2000 to prohibit unauthorized access either by a) using the person’s ID and password without authorization or by b) attacking a security hole. More recently, the “Privacy Protection Law” came into effect in May 2003. This law gave individuals the right to obtain information that companies have collected about them and restricts the use and sharing of such personal data. Backers of the new legislation say it responds to consumer complaints about personal information circulating in dubious databases and mailing lists. Critics argue that operators of Internet sites and other businesses will be overwhelmed by requests from individuals to delete personal information. There are statements mainly from the media that it could restrict freedom of speech. Its provisions were amended to exempt news reporting by media organizations, but magazine publishers have complained they may not necessarily be protected because they are not specifically mentioned in the law's definition of a media organization. Individuals who believe a company has misused their personal information can complain to the government, which can then act to put a stop for such activities or slap violators with penalties of up to six months in prison or up to 300'000 yen. It is likely that new mobile handsets with enhanced personal identification technologies such as biometrics (e.g. fingerprints) will be in great demand.

Important privacy concerns are also raised by the use and anywhere/anytime availability of digital cameras on mobile phones. Pictures have been taken of people surreptitiously and without their consent. Tipness Fitness, a chain of health clubs in Japan, has now banned camera phones from their facilities. Handset manufacturers have also taken note: self-regulatory measures have ensured that each mobile phone makes a noise when the camera phone is used, so that at least others can be alerted to the opening and closing of the shutter.

In mobile and Internet chat rooms, discussions that might foster mental abuse or violate privacy rights can sometimes occur. Individual users may also violate important intellectual property rights through the fixed or mobile Internet. In an effort to address the role of service providers in this regard, “the Law to Limit the Liability of Electronic Communication Service Providers and Permit the Disclosure of User Information” was passed in May 2002. The purpose of the law is essentially to limit the level of responsibility that an electronic communications service provider will have to shoulder when they are confronted with complaints about the activities or conduct of their users. Providers will generally not be held responsible, with the exception of cases in which a provider does not take protective action when they are aware of a violation and have an effective technical solution to address it. If the measures taken are reasonable, exemption from responsibility is granted. Another objective of the law is to allow service providers to reveal the personal details of a user when that user finds that their information has been used unfairly in a privacy rights case.

With advances in radio frequency identification and location-based services, protecting private consumer data may become a greater challenge. In order to ensure that users control information stemming from cell phone use, such as location and purchasing habits, appropriate regulatory measures must be put into place. The education of users is equally important. In an effort to raise awareness about some of these issues, the MPHPT has created web site entitled “MPHPT Information Security Site for citizens – for safe use of Internet”<sup>28</sup>. On this site, users can find basic information about Internet security, a dictionary of terms, examples of real cases, as well as a number of recommendations for setting secure network environments. MPHPT has also set up a number of study groups composed of experts, academics and industry representatives, in order to continue its work in this area.

### 5.4 Health, safety and environment

For the last several decades, many have been conducting research on the effect on human health of radio waves, such as those emanating from mobile towers or mobile phones. Japan has also contributed to this research. The government issued its “Radio Radiation Protection Guidelines for Human Exposure to Electromagnetic Fields”, that are on par with the values released by the International Commission on Non-

Ionizing Radiation Protection (ICNIRP) in collaboration with the World Health Organization (WHO). Since 1 June 2002, the local absorption value (SAR of 2w/kg<sup>29</sup>) applicable to mobile telephones and other radio communication devices used close to human heads became mandatory, rather than a mere guideline.

The MPHPT considers it one of its priorities to continue to scientifically investigate the relationship between radio waves and human health, particularly given the growth of mobile phone use over the last several years. For this reason, the MPHPT set up a “Committee to Promote Research on the Possible Biological Effect of Electromagnetic Fields” in 1997, chaired by Professor Shogo Ueno of the University of Tokyo, and composed of medical and engineering experts from governmental agencies. Thus far, the research conducted by this Committee does not point to any negative effects of mobile phone use on memory, learning, or the development of brain tumours.

The effect of mobile phones on medical equipment such as pacemakers has also been subject to study. Industry and government research has culminated in the formulation of a guideline that mobile phones do not exert any untoward effect on pacemakers provided the two devices are kept a minimum of 22 cm (about 8.5 inches) apart. In the Tokyo subway, there are regular announcements and signs requesting that commuters turn their mobile phones off when sitting or standing near a seat designated for commuters with pacemakers. Similar forms of industry self-regulation have led to restrictions in other metropolitan subway systems, suburban railway lines and medical centres.

Health concerns about mobile technologies, however, are being outweighed by the potential for beneficial mobile health and safety applications. KDDI’s Helpnet service and NTT’s L-mode “life support” system are good examples. The “Helpnet” service is a one-push emergency service for mobile phone users. On specific GPS-enabled KDDI handsets, users can push a single button on their mobile phone to alert emergency services to their location. NTT’s trial L-mode service “Life Support”, helps volunteers take care of elderly people living alone.

Like in many other countries, the use of mobile phones while driving has raised some safety concerns in Japan. The country’s National Police Agency (NPA) plans to carry out a major revision of Japan’s Road Traffic legislation within the next year that may further restrict the use of mobiles while driving. Under current laws, Japanese drivers are prohibited from using mobile phones while driving, but police authorities can only penalize drivers who are deemed a “threat” to others. An article in Kyodo news in late 2003 reports that the NPA is looking into a scheme which would see drivers fined up to 50,000 yen (\$465 USD) if they use their phones to talk or send e-mail while driving, even if they do not pose any immediate danger to other vehicles or people. Currently, all Japanese in-car navigation or entertainment systems are designed to function in a limited manner while the car is in motion.

In a country where mobile phones have become an important fashion trend, the number of replacement handsets is on the rise. The effect that the discarding of old mobile phones may have on the environment is a growing concern. In 2002, of the 25.3 million mobile phones sold by NTT DoCoMo, for instance, approximately 60 per cent were replacements. In Japan, most operators have recycling programs, offering incentives to users that return their old mobile phone. One operator claims that 90 per cent of its old terminals can be recycled for parts, and that currently about 30 per cent of their customers return their old phones. In March 2003, NTT DoCoMo released a report stating that it had achieved 100 per cent recycling of recovered mobile phones, in collaboration with non-steel metal manufacturers. At their end, manufacturers are working on standardizing power chords for recharging mobile telephones.

## **5.5 Youths and the mobile phone**

The penetration of mobile phones among teenagers in Japan is remarkably high, over 80 per cent (Figure 3.11). Among girls, the percentage is even higher: close to 95 per cent of Japanese teenage girls own a mobile phone.

Although the gap between the younger and older generations in terms of mobile ownership is narrowing, young people continue to have higher monthly phone bills than older mobile users: whereas the general population spends an average of 5613 yen per month, students spend an average of 7186 yen per month on their mobile phones<sup>30</sup>.

Teenagers use their mobile phone mostly for writing messages to peers and family. According to a 2002 survey conducted by Video Japan Research, 95.4 per cent of young students use mobile email compared with

75.2 per cent of the general population. The younger generation is also much more likely to open mobile email immediately, rather than wait until the end of the day or the end of a particular activity. This may have much to do with historical trends as well as the lack of alternative communication channels with friends.

Survey data from MoCoBe<sup>31</sup> suggests that female users spend more time using mobile Internet services than their male counterparts. The use of mobile email has transformed the way young people interact and socialize. They no longer, for instance, set up precise location meetings or times in advance. Quite often, there is an unwritten rule that a mobile text message must be sent before a voice call is initiated, so as to ensure that the other party is available. It has been observed that mobile e-mail or messaging sessions can occur over a remarkably long period of time, as youths exchange between 15 and 20 messages in one session, amounting to a quasi 'instant messaging' type of service.

With the advent of digital cameras, non-mobile services such as the "Print Club" or "Prikura" are adapting to appeal to a more mobile youth. Prikura terminals, or sophisticated instant picture booths, first appeared in the late 1990's and were extremely popular among young girls. Recently, NTT DoCoMo has developed on-line versions of such terminals that allow users to upload their own pictures from their mobile phone, either via infrared or memory card. Users can then add the familiar icons and colours to these pictures, before printing them out as stickers in a wide variety of sizes to exchange with friends and family.

Teenage girls have had a significant impact on the use and design of mobile email or text messaging. A new form of writing has even emerged, known as "Galmoji"<sup>32</sup>, to personalize messages between peers. "Galmoji" creates Japanese characters from other types of characters, e.g. "&" or "><". In so doing, girls can make their text messages and email unique and stand out from their peers. "Galmoji" is used as a type of personal mobile signature. Like in some other countries, concerns over the effect of the evolving "texting" language on literacy have been expressed. Japanese youth are increasingly using abbreviations of the phonetic "hiragana" and "katakana" alphabet in order to economize on the length (and cost) of messages. Although the use of "kanji" or Chinese non-phonetic characters is on the rise for similar reasons, its correct or proper use is being threatened. Many fear that "kanji" literacy is in decline in Japan.

## **5.6 Managing mobile use and the new mobile etiquette**

Japan is an excellent example of technological might tempered with a bit of moderation. A healthy and cutting edge mobile sector may mean that one is constantly surrounded by ringing phones and talking heads. However, visitors to the country are oft surprised that there seems to be a time and a place for mobile phone use.

For instance, most restaurants have signs requesting patrons to reduce the volume of their incoming call alerts, and to not use their mobile phones to make or receive calls. This means that restaurant-goers can enjoy their meal and outing, free from the nuisance of ringing tones, unanswered calls, or loud one-way conversations, while still managing to stay in touch through messaging or in rare cases, discreet conversations that may go unnoticed. Hence, although no governmental regulation has been put forward to manage the use of mobiles in public places, self-regulatory measures are taking effect. The most notable is the initiative taken by the JR Railway system and the Tokyo subway system, prohibiting the use of mobile phones on their trains and buses unless they are in "manner mode". "Manner mode" means that mobile phones are switched to silent mode or vibrate – this ensures that incoming calls, incoming and outgoing messages, and keypad tones are inaudible to other passengers. The national high-speed train network, known as Shinkansen, has recently allocated at least one wagon per train as a silent 'mobile-free' or 'keitai-free' zone (see Figure 5.9).

Individual mobile users in Japan are also very conscious of disturbing those around them while making mobile phone calls. Users are regularly seen covering their mouth while speaking on their mobile phone in public, even on a crowded street.

Similar manifestations of a "mobile etiquette" have emerged among teenagers. For instance, many young people first text or e-mail before engaging in a voice call, in order to ensure that the called party is available. Fewer and fewer mobile users are keeping to arranged appointment times. In many cases, meeting locations are no longer determined in advance. It has also become quite common among the young to exchange a long series of messages after a physical meeting, thereby extending the time of "co-presence".



Another aspect of mobile telephony is its effect on traditional hierarchical structures. Mobile e-mail has allowed Japanese to be less formal with each other, through accessibility and the use of truncated abbreviated language. Employer and employee relations have also become less formal due to the use of mobile e-mail.

Overall, mobile phones have certainly been changing the way Japanese interact and socialize. It remains to be seen how the introduction of new value-added services, such as those employing radio frequency identification tags, will further transform societal manners and etiquette.

**Figure 5.9 “Manner mode” sign in a Tokyo subway**



Source: ITU.

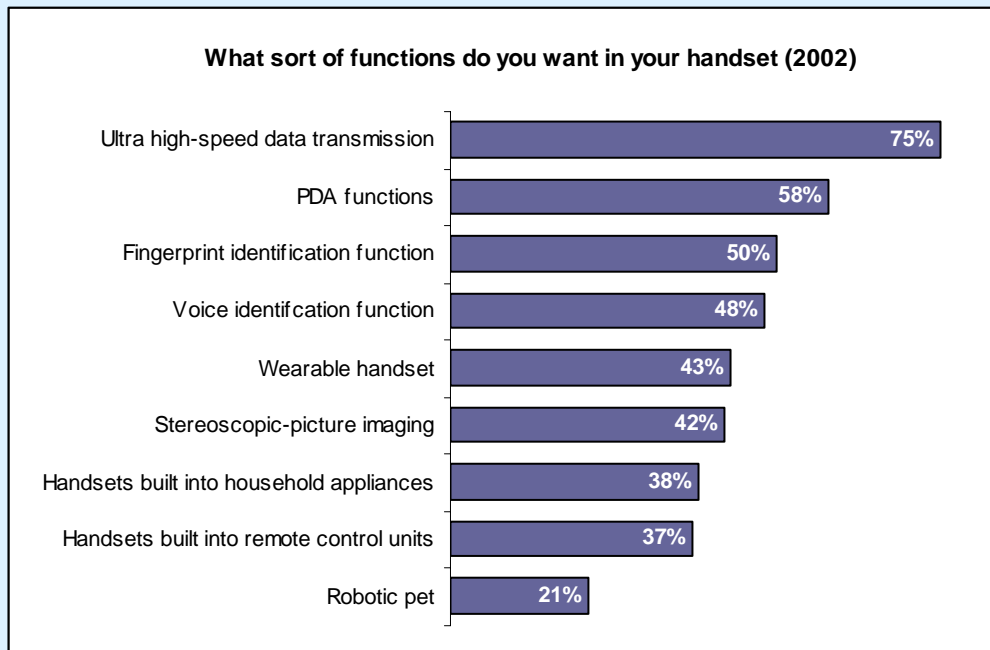
## 6 Conclusion

Mobile phones have now become the most individualized and intimate of information and communication technologies: nowhere does this apply more than in Japan. The mobile phone is far from completing its evolutionary path, and a study of the Japanese mobile sector with its cutting-edge technologies can provide a unique glimpse into the future.

In Japan, users continue to demand increased mobile functionality (see Figure 6.1) and service providers are eager to please. With the industry's continued efforts to developing new technologies and services and the government's establishment of a sound regulatory policy environment, Japan hopes to realize the ideal mobile information society, the "ubiquitous network society" in the near future.

**Figure 6.1: Continuing demand for mobile functionality**

*NTT DoCoMo users reveal they want from their mobile handset*



*Note:* Based on 2002 consumer questionnaire. There were a total of 22'157 effective respondents.

*Source:* NTT DoCoMo Annual Report 2003.

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- <sup>1</sup> If ISDN lines are not included as part of fixed lines, mobile lines overtook fixed lines in 2000 in Japan.
- <sup>2</sup> The UNDP's HDI is a composite of key indicators of well-being such as life expectancy, literacy, school enrolment and per capita GDP. See <http://www.undp.org/hdr2003/indicator/index.html>.
- <sup>3</sup> ITU World Telecommunication Indicators Database.
- <sup>4</sup> combined sales by Type I operators (MPHPT).
- <sup>5</sup> IT Strategic Headquarters: [http://www.kantei.go.jp/foreign/policy/it/index\\_e.html](http://www.kantei.go.jp/foreign/policy/it/index_e.html).
- <sup>6</sup> the Basic Law on the formation of an Advanced Information and Telecommunications Network Society: [http://www.kantei.go.jp/foreign/it/it\\_basclaw/it\\_basclaw.html](http://www.kantei.go.jp/foreign/it/it_basclaw/it_basclaw.html).
- <sup>7</sup> e-Japan Strategy full text: [http://www.kantei.go.jp/foreign/it/network/0122full\\_e.html](http://www.kantei.go.jp/foreign/it/network/0122full_e.html).
- <sup>8</sup> e-Japan Priority Policy Program summary: [http://www.kantei.go.jp/foreign/policy/it/0618summary/01\\_e.html](http://www.kantei.go.jp/foreign/policy/it/0618summary/01_e.html).
- <sup>9</sup> See ITU Internet Reports 2003: The Birth of Broadband, available at <http://www.itu.int/birthofbroadband>.
- <sup>10</sup> However, an unforeseen effect of all this competition was its negative impact on PHS operators. In October 1997, there were over 7 million PHS subscribers, but in January 2003, the number had dropped to 5.5 million.
- <sup>11</sup> In 1992, mobile phone subscribers were a mere 1 million.
- <sup>12</sup> See [http://www.kddi.com/english/corporate/news\\_release/2003/1022/index.html](http://www.kddi.com/english/corporate/news_release/2003/1022/index.html).
- <sup>13</sup> This number grew to 1.34 million at the end of October 2003.
- <sup>14</sup> See NTT DoCoMo press release "NTT DoCoMo FOMA Subscribers Top 2 Million", 29 January 2004, at <http://www.nttdocomo.com/presscenter/pressreleases/press/pressrelease.html?param%5Bno%5D=413>.
- <sup>15</sup> See [http://www.nttdocomo.co.jp/p\\_s/mzone/home.html](http://www.nttdocomo.co.jp/p_s/mzone/home.html) (Japanese only).
- <sup>16</sup> For 5 weeks starting on 17 November 2003, JR East, Japan Telecom and NTT DoCoMo tested a trial roaming service of Mzone at railway stations, thereby expanding the service to areas not covered by DoCoMo's own WLAN service.
- <sup>17</sup> See L. Srivastava, *3G Mobile Policy: The Case of Japan*, INFO, vol. 3, no. 6, December 2001.
- <sup>18</sup> *Ibid.*
- <sup>19</sup> For more information about the Roppongi Hills district, go to <http://www.roppongihills.com/en/information/index.html>.
- <sup>20</sup> To sign up for the service, users can go to <http://r-click.jp/> (Japanese only).
- <sup>21</sup> See <http://2.pro.tok2.com/~higashi-nagasaki/anti/pintokona.html> for pictures and text (Japanese only). See also [http://urawa.cool.ne.jp/vfsarah/kaiten2\\_pinto.html](http://urawa.cool.ne.jp/vfsarah/kaiten2_pinto.html).
- <sup>22</sup> Integrated circuit cards come in three main formats: type A, B and C. Type B is popular in Europe whereas Type A is more popular in the United States. Type C is being used in Hong Kong, Singapore and Tokyo. In these three cities, there are over 30 million such cards in circulation.
- <sup>23</sup> See DoCoMo's press release dated 15 December 2003 at [http://www.nttdocomo.com/presscenter/pressreleases/press/pressrelease.html?param\[no\]=400](http://www.nttdocomo.com/presscenter/pressreleases/press/pressrelease.html?param[no]=400).
- <sup>24</sup> See Yahoo Asia News at <http://asia.news.yahoo.com/031212/kyodo/d7vcp7g80.html>.
- <sup>25</sup> "Mobile Phone Usage Situation", Video Research Ltd, September 2002.
- <sup>26</sup> See the survey of the mobile Internet conducted by Philip H. Sidel and Glenn E. Mayhew of MoCoBe in "The Emergence of Context: A Survey of MobileNet User Behaviour", 2003. See the website at <http://www.mocobe.com/genpage/home>.
- <sup>27</sup> "Mobile Phone Usage Situation", Video Research Ltd, September 2002.
- <sup>28</sup> See [http://www.soumu.go.jp/joho\\_tsusin/security/index.htm](http://www.soumu.go.jp/joho_tsusin/security/index.htm).

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- <sup>29</sup> The SAR or “specific absorption rate” measures the amount of electromagnetic wave energy absorbed into a given tissue of 10g for an average time of 6 minutes when a human body is exposed to an electromagnetic field.
- <sup>30</sup> IPSe Communications Tokyo, “Third Annual Consumer Report: Survey Results from Research on Mobile Phone Usage” (2003), cited by Mizuko Ito and Daisuke Okabe in “Technosocial Situations: Emergent Structurings of Mobile Email Use” (2003).
- <sup>31</sup> Philip H. Sidel and Glenn E. Mayhew, “The Emergence of Context: A Survey of MobileNet User Behaviour”, 2003.
- <sup>32</sup> See [http://www.zdnet.co.jp/mobile/0205/08/n\\_galmoji.html](http://www.zdnet.co.jp/mobile/0205/08/n_galmoji.html) (Japanese only).