I. JAPAN TEAM

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Summary of the Japan Team

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1. BEYOND THE IT REVOLUTION: THE JAPANESE BROADBAND STRATEGY

1.1. Introduction

The year 2000 marked the beginning of the Japanese IT Revolution, and public funds had been invested so far in various IT projects and the construction of IT infrastructure. Japan today, however, due to the effect of the bursting of the Net bubble in the US, has been suffering a recession in IT-related industries. The expectation such that the IT Revolution has come to an end has been widely spread. A second phase of IT Revolution, however, sooner or later will arrive, and when it does, the broadband will be the key factor for driving the revolution. This paper focuses on the characteristics and issues of the Japanese broadband strategy, and analyzes how the second IT Revolution in Japan can be promoted.

1.2. Lessons Learned from the Net Bubble

1.2.1. The IT Recession

The IT recession was triggered by financial phenomena. The Bloomberg US Internet Index started to head lower in March 2000, and in October 2001 it dropped by 87 percent, which was lower than that prior to the bubble. NASDAQ stock prices also showed a similar trend. Since 2001,

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IT-related manufacturing has also been affected, as evident by the shipment of PCs, for instance, which showed negative growth, and the layoffs which began in the IT industry. Telecommunications carriers, ISP, and DSL companies as well have also been suffering from lower demand and resulting lower profits.

1.2.2. The Causes for the Bursting of the Net Bubble

The bursting of the Net Bubble can be summarized as follows: (a) Overestimation of scale and pace. Since IT was new, it created an overestimation of the scale and speed of its diffusion by market participants such as investors and venture capitalists; (b) Robustness of existing systems. All systems have their reasons and strong basis for their existence, and it is impossible to replace them overnight; and (c) Immature technology. IT is new but its technological level is also far lower than what would meet customers' satisfaction.

1.3. Broadband Network Infrastructure

1.3.1. Current State of Broadband in Japan

A marked increase in broadband subscribers is mainly due to competition and the decrease in users' charges. Current broadband infrastructures are summarized into the following four accesses: (a) FTTH; (b) DSL; (c) CATV; and (d) FWA. All of these have the characteristics of flat rate charges and connecting to the Internet for 24 hours a day as well as high speed: (a) FTTH. It aims to deploy optical fibers to each home, and its speed is the fastest among broadband alternatives such as 10Mbps to 100Mbps. The current total number of subscribers of optical fibers is approximately 230,000 (as of September 2001); (b) DSL. The current number of DSL subscribers is about 1.2 million as of November 2001. Charges become low because of competition, and Yahoo BB offers about US$20 for 8Mbps; (c) CATV. The current number of subscribers is about 1.1 million, and users charges are about US$40; and (d) FWA. So far, three major companies have started this service, and the number of subscribers is not large.

1.3.2. National Broadband Network Initiative

The e-Japan project, which was announced in March 2001, sets the objectives so as to establish the most advanced IT economy in the world. According to this plan, the government has set forth the "National Broadband Networks Initiative," which identifies the abovementioned four accesses – FTTH, DSL, CATV, and FWA – as being the most important for achieving those goals. According to the National Broadband Initiative, by March 2003, almost all metropolitan areas including the wards of Tokyo and prefectural capitals, and by March 2005, almost all other 623 cities will be covered by high speed access networks to the Internet.

1.3.3. Recent Broadband Development: From Last One Mile to Last Quarter Mile

Here the recent development of four broadband infrastructures in terms of competition is examoned. FTTH, CATV, and FWA have their own networks, and they are independent from NTT's local subscribers' line. Thus, the situation is referred to as network competition. Through competition of the four networks, broadband infrastructures have become closer to their users, so the issue of the 'last one mile' now becomes that of the 'last quarter mile.'

In 2000, NTT East in Tokyo started high-speed Internet access service through the optical IP communication network, which was built specially for Internet connection service. This service is called 'B FLET'S.' Since then, this service has been expanded to other large cities such as Osaka, Nagoya, and Kobe. The speed is from 10Mbps to a maximum of 100Mbps. It costs about US$300 per month for business users, US$75 for the basic type, US$40 for the family type, and US$30 for the condominium type. Yusen Broadnetworks is another firm which provides FTTH with a maximum 100Mbps (best effort), and it started service in Tokyo in March 2001.

K-Opticom is an affiliated company of Kansai Electric Company. In June 2001, K-Opticom started a new service of high-speed Internet access through their electric wire lines. Regarding CATV, iTS Communications has been providing various broadband services since 1998. It will soon start high-speed Internet access services such as 30Mbps, and this is about four times faster than DSL. This high speed is realized by adopting

the optical-coax hybrid network such that optical fibers are used for the trunk lines and coax for access lines.

1.4. Possible Applications of Broadband: Case Studies

1.4.1. Telecare

This system provides telecare for bedridden patients and patients stricken with terminal diseases who require medical care. The characteristics are the real-time and two-way interactive transmission of motion pictures via video-conference systems or videophones. The telecare system in effect today in Japan can be broadly categorized into three groups in terms of aim, nature of medical information, equipment, and type of network as follows: (a) tele-home-care; (b) tele-health; and (c) community health and welfare management type. (a) and (b) are possible application of broadband, since they use motion pictures.

1.4.2. Distance Learning: Setouchi Town, Kagoshima Prefecture

In 1995, the Ministry of Education started to apply IT to further develop education in rural areas. The aim of this project is to interconnect schools, from elementary to high school, in isolated islands or mountainous regions with urban areas, via ISDN and satellites. In addition, another project for hospitalized school-age children has also been started to interconnect schools in the hospitals and the schools they are registered at. These projects interconnect two to three schools via optical fibers with the speed of transmission of either 64Kbps or 1.5Mbps. The schools share the same lectures and participating schools are the principal and branch schools, or schools in the same prefecture. As an interesting example is found in the project at Setouchi Town, Kagoshima Prefecture.

1.4.3. International Distance Learning

The International Distance Learning Project was carried out by HIT by using a TV conference system via international ISDN between Waseda University and Hanoi, Vietnam. The Project was implemented in 1998 with three series of lectures and terminated in February 2001. Courses related to multimedia and telecommunications were offered from Waseda University, and each session lasted 90 minutes, including inter-

active questions and answers. The results were highly evaluated by Vietnam, and considered more satisfactory than initially expected. The factors, which led to such a conclusion, can be analyzed as follows: (1) ISDN, if available, can much more simply and economically implement an international distance-learning program. (2) The recent PC-based TV conference system enables high quality transmission and voice presentation together with clear video images of class scenes and lecture documents in a sufficient resolution to the receiving side even at a low speed of 128Kbps.

1.5. Conclusion

Thus far, we discussed how broadband has been introduced to the Japanese economy, and now due to technological development and competition among Internet accesses companies, broadband charges have been decreasing. Therefore, it can be said that the recent increase in CATV and DSL subscribers has been triggered by a 'technology-push' and 'cost-push.' Consumers, however, are not necessarily satisfied with the existing content. Without introducing the 'killer contents' mentioned earlier, competition between broadband and existing e-commerce will end up with the zero-sum game, that is, broadband will only replace e-commerce. Further development of broadband requires a 'demand-pull.'

2. TIPPING, STANDARDIZATION AND CONVERGENCE: CATCH-UP AND FAILURE IN THE JAPANESE STANDARDS STRATEGY

2.1. Introduction

Technical standards have three categories: De facto standards, forum standards and de jure standards. De facto standards are the result of competition. Consumers decide the popularity of products. Tipping is related to de facto standards. Group efforts of manufacturers bring about forum standards which can avoid losses and risks which come from severe competition through de facto standards. De jure standards come from public or international organizations to regulate and harmonize public and international concerns. We should utilize these standards according to consumer satisfaction, market conditions, product characteristics, product cycles, social as well as global systems.

2.2. Tipping and De Facto Standards

2.2.1. VHS vs. Betamax

A famous example of tipping was the market war between SONY and Japan Victor/Matsushita regarding home videocassette recorders (VCRs). Both companies tried to introduce videotapes with a 0.5 inch width and two-hours of recording time. The former first introduced a videotape called Betamax in 1975, whereas the latter one was called VHS. After more than ten years of war, SONY decided to produce VHS tapes in 1988, ending the videotape war. This is a good example of de facto standards. Some lessons can be drawn from this example. First, quality is an important factor in selling products but it is only one factor. Above-average quality may be acceptable. Second, advertising and sales networks are necessary in order to sell products. Third, those who bought Betamax (tapes and VCRs) had to eventually change to the VHS system (loss for consumers).

2.2.2. Forum Standards

Manufactures organize a consortium or association to form common standards for a new product. Membership is open. A member can use other members' patents if the member also offers its patent. In this case, the time taken to formalize standards is greatly reduced and thus less initial cost is incurred. In a sense, forum standards are a kind of strategic alliance. A good example of this was seen in the development of digital versatile disks (DVD) by a consortium, which was referred to as the DVD forum.

2.3. De Jure Standards

2.3.1. De Jure Standards by Governments

Public standards are necessary for private goods when they are related to safety, the environment, and public health. Those standards are also called 'mandatory standards.' Stated technical standards are convenient to all users within a country so usually domestic standards are stipulated for private goods by government institutions. 'Voluntary standard' (or industry-based standard) is another example, which is found in the stan-

dard on terrestrial digital TV. Producer associations formulated the standard on the transmission method of terrestrial digital TV in May 2001 as its standard, ARIB STD-B31.

2.3.2. *Standards by International Organizations*

It is logical that standards for resources or goods for international use should be regulated by international organizations. Such organizations as the International Telecommunication Union (ITU), the International Electrotechnical Commission (IEC) and the International Organization for Standardization (ISO) are examples. The ITU regulates IT-related standards and IEC does the same for electronics-related standards, while ISO covers standards on goods and services including systems which are internationally traded.

2.4. **Japanese Defeat in the Standards War**

Japan had not shown much interest in global standard games until quite recently. Japan had always followed or assimilated to the environment of the host country in order to sell its products. Japanese manufacturers are capable and skilled enough to produce products to any standard.

2.4.1. *Failure Case Studies*

Notorious failures for Japan were the ISO 9,000 and ISO 14,000 Series. Japan did not take the initiative in the ISO discussions though Japan was a leader in these fields. The major standards on ISO 9,000 Series were determined based on the British Standards in 1987. The Japanese government did not send any mission to the first meeting. Yet, up to date quality management was Japan's pride known as quality control (QC). Regarding ISO 14,000 Series, Japan failed to take any positive initiative in the discussion, although Japan had extensive experience in environmental management. It is ironic that Japan's certificate acquisition number on this ISO series is number one in the world.

2.5. Technology and Satisfaction

2.5.1. Coexistence

The examples of coexistence of two networks which satisfy similar needs are found in letter vs. telephone, and radio vs. television. These methods of communication continue to exist today because of their own strengths, particularly because people have their own taste for both services.

2.5.2. Disappearance

Technological changes kill some products. Functions and prices are the main reasons for their failures. Examples are found in typewriter vs. word processors/PCs, and mainframe computers vs. PCs. Superiority of word processors or PCs over typewriters lie in innovation such that the former has editing and memory functions. PCs can be bought and mastered to an acceptable extent by individuals and used at home as well as work due to their relatively inexpensive purchase price and easy application systems. They wiped out mainframe computers.

2.5.3. Consumer's Preference

People's tastes and personal inclinations are of importance because individual participation becomes very crucial in the Internet world. Government-engaged projects sometimes forget what the public wants. Over-investment or investment under misguided demand will cause disaster later. An example is NHK's analog-type high-definition TV. Key factors here are technological changes, timing, and interpreting changes in users' demand and tastes.

2.6. Convergence of Technology

2.6.1. Analog vs. Digital TV

The invention of the digital TV method (DigiCipher) in the US in 1990 was a great step forward. There was a long dispute in the US during the 1990s regarding high definition TV (HDTV) or advanced TV (ATV). Digital TV finally won out against the analog-type because of the invention of DigiCipher.

2.6.2. Development of Digital TV in Japan

Satellite digital broadcasting began in June 1996 under the Communication Satellite (CS). At present two stations are functioning: SkyperfecTV and Wire Broad Networks. NHK started digital services under the Broadcasting Satellite (BS) in December 2000. Now BS digital services include 8 TV companies (three channels for NHK plus one for each of the 7 private companies), 10 private FM radio companies and 9 private data service companies. CATV started digital services in July 1998 and began re-transmission of BS digital programs from December 2000. With respect to terrestrial digital TV, services for three areas (Tokyo, Nagoya and Osaka) will start in 2003 and other areas in 2006. All analog-type broadcasting is planned to end by 2011.

2.6.3. Unknown Factors: Interest Groups, Technology, and Demand

Regarding the future of digital TV, there exist unknown factors. First, there are severe conflicts of interest between interest groups such as CATV groups, satellite TV groups, other broadcasting stations, computer industries, TV manufacturers, mobile phone companies, multinational corporations (MNCs), and new entrants who are interested in multimedia and entertainment. Second, technology will produce cheaper methods of TV transmission. Third, a reasonably large number of consumers may remain satisfied with their present analog TVs and digital TVs may not diffuse as originally planned.

2.6.4. Digital TV Standards

At present there are four types of digital TV standards. NHK mainly developed the Integrated Services Digital Broadcasting-Terrestrial (ISDB-T) method, based on the US (ATSC) and European (DVB-T) methods. That is why ISDB-T is more flexible than the previous two methods. It is said, however, that the Chinese method (DMB-T) is better than the Japanese method in terms of mobile reception and data reception. Japanese TV makers, however, are said to be reluctant to push the idea. Standards do not matter for them to sell digital TV sets since they can correspond to any type of standard.

2.7. Concluding Remarks

Determination of new standards should be free from the egoism of advanced countries or MNCs because they have a tendency to reign over markets. Particularly, international standards should be transparent and neutral. Japan has always followed foreign standards in order to export its products. Japan has never taken initiatives in standard discussions up until quite recently. Japan was forced to adopt European or US standards as global ones in several important occasions. Since Japan's technical levels and management skills are satisfactory as compared with those of other advanced countries, Japan should contribute more to international standard formations.

3. IS THE JAPANESE PRESS A DINOSAUR IN THE 21ST CENTURY?: THE IT REVOLUTION AND NEWSPAPERS IN JAPAN

3.1. Introduction

Some media critics liken the Japanese press to a dinosaur. These observers think highly of digital media, such as the Internet and satellite broadcasting. They often say that electronic newspapers distributed through the Internet, satellites or both will replace conventional ink-on-paper. Tough competition among Japanese national and local newspapers has forced publishers to digitize the processes of editing, printing and shipping. At the same time, pressure from overseas has led them to expand their news distribution services from conventional ink-on-paper to such digital media as the Internet, cell phones and satellite data broadcasting. This essay analyzes the Japanese press in the age of the IT Revolution, focusing on one of the leading national dailies, The Yomiuri, where the author is employed.

3.2. Newspapers in Japan

Today, Japan's press comprises 122 daily newspapers printing 72 million copies every day across the nation. This compares to 56 million copies in the US and 42 million copies in China. Given that Japan has a population of about 126 million people in 43 million households, this works out to more than one newspaper per household. At the root of this world-lead-

ing readership are Japan's almost 100-percent literacy rate, economic prosperity and a coast-to-coast home delivery system. Yomiuri Shimbun prints The Yomiuri in Japanese and The Daily Yomiuri in English. The Yomiuri has both morning and evening editions printed at 22 domestic and five overseas printing sites. A total of 10.2 million copies are printed of the morning edition and 4 million of the evening edition, excelling competing newspapers The Asahi, The Mainichi, The Nihon Keizai and The Sankei. The Guinness Book of World Records lists The Yomiuri as the world biggest commercial newspaper. Japanese newspapers have been expanding their business in dog-eat-dog competition both with each other and with magazines, television and radio. Circulation has risen year by year, but recently seems to have reached a plateau.

3.3. Newspapers and Television

Japanese newspapers have strong ties with TV stations except the public broadcaster Nippon Hoso Kyokai (NHK: Japan Broadcasting Corporation). The Yomiuri is affiliated with Nippon TV Network (NTV); The Asahi with Asahi National Broadcasting Co., Ltd.; The Mainichi with Tokyo Broadcasting System, Inc. (TBS); The Nihon Keizai with TV Tokyo; and The Sankei with Fuji TV. In addition to TV news programs, The Yomiuri has provided news services for cable TV networks, radio stations and electric billboards (on the street and on bullet trains) since the 1980s.

3.4. Outlook of New Businesses

3.4.1. Internet

Primarily motivated by the rapid launch of Websites among the US media, the Yomiuri launched its own Internet news services in June 1995, as a way to multiply its news distribution channels. Yomiuri On Line (YOL) carries breaking news and editorials both in Japanese and English. It was updated only twice daily, in keeping with the deadlines for the morning and evening editions of The Yomiuri. In September 2001, YOL's monthly page views reached a record high of 90 million due to coverage of the terrorist attacks in the US. The Yomiuri puts up about 200 stories on its Website every day, updating the site around the clock. Around 80 percent of the Website content is taken from The

Yomiuri's morning and evening editions, with the remainder being original product written for YOL. Stories are taken verbatim from the newspaper, and visitors to the site can read these stories for no charge. One special program titled Internet Broadcasting uses streaming technology to transmit moving pictures and sound on the Web. Internet users can enjoy news services similar to TV. This service is still being offered on an experimental basis, to determine its business possibilities. Yomiuri Shimbun's Internet services are still in the red, but the situation has been improving somewhat. In fiscal 2000, the revenue from banner ads on YOL more than doubled to 465 million yen, up from 200 million yen in the previous year. Expenditures in fiscal 2000 totaled 877 million yen, 60 percent of which was allotted for employees' salaries. YOL's editors probably expected their Internet services to move into the black in fiscal 2001, but the ad market failed to grow as anticipated.

3.4.2. Cell Phone News Service

Japanese media are hoping that their news distribution services on digital cell phones will make up for their losses on the Web. Since 1999, NTT-DoCoMo's Internet mode services (i-mode) have made it possible for subscribers to access Websites specially designed for digital cell phones. The Yomiuri accepted an offer from NTT-DoCoMo to be one of its initial content providers. Since i-mode was launched, The Yomiuri has provided news abridged for the service, along with information on sports, entertainment and financial markets.

3.4.3. Digital Satellite Broadcasting

The year 2000 was a watershed for Japan's broadcasting industry. Major broadcasters formed new business alliances with non-media enterprises to enter into high-definition broadcasting services, also known as digital hi-vision. However, broadcasters have yet to air whole programs in high-definition, and against the expectations of those who, like it or not, got involved in satellite broadcasting services, Japanese consumers declined to buy new TVs only to watch brief clips in this high-quality format. The Yomiuri entered a new field of digital satellite broadcasting called independent data broadcasting, in which only text and sound data are transmitted. It is a simplified version of Internet satellite broadcasting, which can be displayed on a TV screen. Nippon Data Broadcasting mainly pro-

vides news, weather forecasts and market information, almost the same as the content of YOL.

3.5. Conclusions

In November 2000, The Yomiuri launched a new department called the News Distribution Center to efficiently disseminate breaking news to the Internet, satellite broadcasting and cell phones. Japanese reporters and editors have begun to change their 'newspaper deadlines first' policy and become more cooperative toward news distribution services for electronic and electric wave media. An opinion widely shared by Japanese newspaper publishers and editors is that the Internet would deliver a direct blow to advertising and editing, the lifeline of newspapers, and that if proper measures were not taken, newspapers would be driven out of the market within a few years. But Robert Fiddler, Media Laboratory of the Knight-Ridder Group once said, "There are many people who believe that newspapers are dinosaurs. We believe exactly the opposite. We believe that newspapers can in fact evolve into a new form of media that blends the old familiar aspects of newspapers with the new technologies that are emerging. So that you have the ability to read, browse and scan, and at the same time being able to interact with the newspapers, to interact with advertisers through your newspapers in ways that are not possible through media today."

Like it or not, the Japanese press must change in keeping with the IT Revolution.

4. PKI SOLUTIONS FOR TRUSTED E-COMMERCE: SURVEY UPON THE DE FACTO STANDARD COMPETITION IN PKI INDUSTRY

4.1. Introduction

The transaction basis has been shifting from face-to-face commerce to e-commerce via the Internet. How to ensure the mutual trust between those involved in the transaction has become an important issue. One measure to cope with this is system solution enterprises aiming to offer a trusted communication technology platform. Some of the systems established so far are a Digital Signature as a means of verifying the true identity of another party, and a Certificate Authority (CA) to verify registration of

the communication partner. These are both based on technologies of encrypted data transfer by the Public Key method. These are called Public Key Infrastructure (PKI). The purpose of this chapter is to clarify strategies of the main vendors associated with PKI (PKI vendors).

4.2. Analysis of Major PKI Vendors

At present, the major enterprises known throughout the world in the field of electronic authentication are; (A) RSA Security Inc. (US); (B) VeriSign Inc. (US); (C) Entrust Inc. (Canada); and (D) Baltimore Technologies (Ireland). Each of these companies has their own strategy and have been competing with each other for establishing the de facto standard. The division of the world in PKI business has begun by these 4 players. The specifics of the strategies of these companies are summarizes as follows:

A. RSA Security Inc.
The strategic theme for the company is 'Shaking off from its patent dependency and establishment of supremacy through its technical advances other than patent.' In September of 1983, the patent for 'Public Key Encryption and Decoding Algorithm' was granted, and the company has taken advantage of its patent, which continues to be the effective standard in the huge US market. Most of the rival PKI vendors use the RSA method, and a portion of their profits have been paid as licensing fees to RSA. This patent, however, lapsed on 20th September 2000. Unlike other companies, the certification system is not set for a specific business model; instead, RSA emphasizes the interoperability with systems from other PKI vendors.

B. VeriSign Inc.
The objective of this company is "From a security services company into the Internet's most trusted utility," and its strategies are to establish a solid business foundation. The company is succeeding in getting a network of multinational businesses based in the US using its company's certification networks. VeriSign's strong domain is to support companies in issuing electronic certificates on their own. Customers are not required to build the difficult-to-manage certificate authority infrastructure; they are able to completely outsource all the work prior to the actual issue of electronic certificate to VeriSign.

C. Entrust Inc.
This company's strategy is to build an authentication network focused on

large clients in North America, and to enhance the direct sales system aimed at powerful customers. Since May 1999, Entrust began operating an electronic certificate issuing business with the platform 'Entrust.net.' The operation is fundamentally different from the outsourced certificate authority offered by VeriSign. Entrust.net assumes the function of the certificate authority is operated by the enterprise itself (in-house).

D. Baltimore Technologies plc.

This company is headquartered in the EU, and its primary markets are the EU, including Great Britain and Ireland. However, since keen international competition has started in the electronic certificate market, it has become necessary to develop bases of operation abroad such as the US, Canada and Japan. This company's product strategy is to provide certificate authority supporting systems as well as certificate authority hosting services.

4.3. Strategy for Asian Market

The activities of these PKI vendors in the Asian PKI market is discussed in what follows:

A. RSA Security Inc.

In November 1996, a wholly-owned subsidiary (Japan RSA Ltd.) was established. In May 1998, Security Dynamics Ltd. was established as a wholly-owned subsidiary of Security Dynamics Technologies, Inc. In November 1999, these two subsidiaries merged to form the current RSA Security Japan Ltd. In order to strengthen its operations organization in Japan, an agreement was reached with Fujitsu in August 1999 to form a sales alliance.

B. VeriSign Inc.

In response to the expansion of the electronic certificate market, Versign has been expanding its operation in ASEAN, Japan, China, and Korea. The center of operations for Southern Asia is in Singapore, and a base for Northern Asia operations is being established in Shanghai, China. It has its own R&D facilities (encryption technology research in Shanghai).

C. Entrust Inc.

This company entered the Japanese market June 1998, and December Entrust Japan Co. Ltd. was established. As Entrust, the business operations focus mainly on supplying PKI products and consulting, with the bulk of the operations handled by NTT Data and SECOM TrustNet. In order to support e-government in Japan, which assumes certificate com-

patibility through Bridge CA, this company released the electronic certificate system 'Entrust PKI e-Government Edition' in April 2001.

D. Baltimore Technologies plc.

In the Asian market, this company is a strong PKI builder for the trading sector, successfully marketing to the trading and financial EDI system operations groups in various Asian countries, including companies in Hong Kong, Singapore, and Taiwan. Since January 1997, its Tradelink has been issuing electronic certificates for trading-related businesses as a voluntary certificate authority. Baltimore has come to have a 45 percent share of the Asian PKI market, including the rapidly developing Japanese market.

4.4. Future Prospects

So far, we have looked at the business strategies of the major European and North American vendors that are proceeding to divide up world PKI markets. So what are the developments expected in the future, in the PKI market including Asian markets? The following are two possible trends.

Scenario 1: Establishment of the open global standard for PKI

This case indicates 'Introducing of a world-class level electronic certificate infrastructure from a leading PKI vendor, and participating in a global certification network,' minimizing the power of nations or governments. This tendency is especially notable in areas with a strong dependence on trade with Europe and North America, and the authentication and certificate technology of the Western PKI vendors is actively introduced, with the priority on achieving smooth trade transactions with 'certification tools' that conform to Western standards.

Scenario 2: Revival of regionalism in PKI

The issue of Scenario 1 is the risk of European and North American businesses taking over specific technology areas. There is a deep-seated wariness, particularly toward US companies, in many Asian countries and it is considered entirely natural for government policy to eliminate monopolies of a business sector controlled by foreign capital. In fact, for the electronic certificate industry too, in Korea solutions from the PKI vendors in the country are offered for the certificate authorities under the close scrutiny of the government.

4.5. Closing Remarks

The trust system such as PKI is a national issue. The trust framework of each society will be determined in accordance with the status of each society respectively. It is not a simple matter of business tools, but of complicated political issues. Before selecting the trust system of society, we have to determine the national policy. Should the government have a decentralized or centralized structure? Should the society accept the international standard or not? If the trust system is set before the social consensus is reached on these points, such a society shall be 'distrustful.'

5. JUMPING UP TO THE INTERNET-BASED SOCIETY: LESSONS FROM KOREA

5.1. Introduction

Korea has made efforts to encourage IT and overcome its problems, and has shown initiatives to promote IT. As a result, Korea emerged as one of the most advanced countries in the world in the introduction of broadband Internet, especially ADSL (Asymmetric Digital Subscriber Line), and mobile phone. But some problems still remain and new social and economical issues are emerging. Although there are differences in preconditions between Korea and other developing countries for diffusion of IT, there are common facts and policy issues among them. What other developing countries can learn from experiences in Korea will be discussed.

5.2. Rapid Diffusion of New Technologies

5.2.1. Rapid Increase in Users of Internet and Broadband Internet

The number of Internet uses in Korea has increased rapidly. It increased from 138 thousand in 1994 to 1,634 thousand in 1997. The turning point was in 1999. Growth rate jumped up to 250 percent and penetration 23.2 percent in 1999. In 2000 the number of Internet users reached to 19 million and penetration 40.5 percent. The number of high speed Internet subscriber was over four million in December, and among them 2.1 million households were subscribing to ADSL and 1.4 million to cable modem.

5.2.2. Proceeding in the Introduction of New Technologies

Korea is proceeding in the introduction of new information technologies. A variety of contents and applications encourage the usage of broadband. The diffusion of broadband Internet enhanced needs to streaming and Webcasting. There are about 30 companies in Korea that provide paid Internet movie services. The number of Webcasting stations, which was about 200 as of January 2000, seemed to reach to about 1,000 at the end of 2000. Regarding Voice-over-IP (VoIP, Internet phone), its 50 percent market is occupied by five VoIP carriers: Serome (22 percent), ITCX (11 percent), Net2Phone (7 percent), iBasis (6 percent), and Deltathree.com (4 percent).

5.3. Accelerators of Rapid Penetration of New Technologies

5.3.1. Deregulation of Telecommunications Sector

Trade negotiations in the 1990s changed the stance of the Korean government on regulations on the telecommunications sector. The government has transformed regulations into more pro-competition ones, and has eased regulations for entry and pricing conditions, and foreign ownership limitations. Two significant changes in the regulatory regime happened in 1997. One is a change in the classification of service providers: The government newly introduced a category of special service provider that is a leased-line-based service provider. Broadband Internet classified as a value-added service, where entry and pricing were deregulated. The other is the introduction of competition to local call service that had been dominated by Korea Telecom. As a result, Hanaro Telecom, the pioneer of ADSL in Korea, was permitted to enter the local call market.

5.3.2. Significance of the Government's Roles and Support

Historically, the Korean government had initiatives in promoting industrial and technological policies. This is also true for IT. The priority of the policies shifted from building telecommunications infrastructure to R&D and new businesses. The Korean information infrastructure project was launched to build a high-speed network, and in 1995 the government allocated budget to it and the completion was set for 2010. In addition to network infrastructure, after Cyber Korea 21 in March 1999 that is a

comprehensive master plan aiming at the creation of a knowledge-based nation, the government gave more priority to development of human resources.

5.3.3. Certification and Evaluation of Technologies

Generally speaking, the Korean government plays roles in (1) analysis of trends, development and evaluation of policies for industrial technology, (2) support of development of industrial technology, and (3) promotion of nurturing technology bases and technology diffusion.

5.3.4. Mentality

Korean homogenous culture is one of the key drivers that promoted the adoption of the Internet and mobile phone. This generates a mindset of "all at once" and "I can do what he can do," and a sense of alienation in the case of making differences. *Pari pari* (means quick and quick) tendency fuels a social atmosphere that encourages learning about computers and the Internet. Changes in the job consciousness especially among the younger generation seem to be important. Before the crisis in 1997, the highroad to social success was only through access to government and large company jobs. After entrepreneurs in the IT sector realized success stories, more people have started new enterprises and entered into venture businesses.

5.4. Contrastive Effects of Accelerators on E-Commerce

5.4.1. Brief History of E-Commerce

Electronic commerce in Korea started in 1996. What is unique is that introduction of B2C preceded B2B. The first e-commerce and B2C was introduced by Lotte department store and Interpark. The latter is an in-house venture business of DACOM, a large communication company in Korea, which started B2B in 1999. Most B2B service was introduced after 2000.

5.4.2. Policy Framework for Promotion of E-Commerce

Policy framework to promote e-commerce is constituted by two parts.

One is a regal framework and the other is a general plan. The government enacted two fundamental acts in February 1999. One is the Basic Act on Electronic Commerce to promote the stable spread of e-commerce. The other was the Act on Digital Signature to guarantee the security and reliability of e-commerce. The policy for promoting e-commerce is composed of five main objectives and 40 action programs. Those are constructed by the following items: (a) to secure reliability of the cyber market, (b) to expand e-commerce infrastructure, and (c) to accelerate e-commerce in the public sector.

5.4.3. B2C E-Commerce and the Accelerators

In 1999, the size of B2C market was 246.4 billion won (US$207 million), and in 2000, it is estimated at 1,397 billion won (US$1,235 million). As of December 2000, there were 1,866 shopping malls. Although environment for B2C is improving, transactions through B2C are limited to standardized items which purchasers can get information on from catalogs or in stores and which they can experience as part of the services before purchase. Computer and accessories (35.5 percent), home appliances, electronics and communications (14.5 percent) and books (6.4 percent) are large items. There are, however, some obstacles here. The highest concern was the leakage of personal information. And other dissatisfactions are mainly problems related with off-line procedures such as delivery, customer service and product quality. Confidence such as payment procedure is also another issue for promotion of B2B.

5.4.4. B2B E-Commerce and the Accelerators

In 2000, the market size for domestic B2B e-commerce sales was 6.69 trillion won (US$6 billion), and 54 percent of it was conducted via conventional EDI and 46 percent via the Internet. As of March 2000, there were 153 e-market places in Korea. By classification of them by industrial sectors, general market places and B2B business were 28 and the most, followed by machinery, information and communication (21), textile (19), petrochemical (18). Korean B2B is facing severe competition before attaining critical mass, and difficulties are classified by three aspects: technological, economic, and mental factor. Standardization of classification and code of goods, electronic documents, and catalog has not been promoted until recently. The business structure of Korean com-

panies is also making it difficult to bridge company groups and Chaebols in order to found consortium for e-commerce by sector.

5.5. Issues to Society Caused by Diffusion of the Internet

5.5.1. Emerging Issues

Although new technologies spread over Korean society widely, preparation for problems caused by new technologies may not necessarily be enough. Actually several issues as stated below happened: (a) Distortions in personal life and society; (b) Effects of input device on language culture; and (c) High tech crimes such as leakage of personal information, stealing of credit card numbers, hacking, and computer viruses.

5.5.2. Countermeasure: Case of Cyber Terrorism

The number of reported hacking and virus incidents started exploding from 1999. That timing corresponded to rapid diffusion of ADSL. Hacker Investigation Squad was founded in the KNPA in 1995 for countermeasures against cyber terrorism. The Cyber Crime Investigation Squad was vastly expanded into the Cyber Terror Response Center in order to prevent and respond to cyber terrorism and all kinds of cyber crimes more effectively.

5.6. Concluding Remarks

Technology sometimes dramatically evolves. But the new technology will diffuse on the basic of existing physical and social infrastructure that includes social, political and economic systems, culture and ethics. Therefore the more receptive infrastructure to new technology a country has, the faster the speed of the diffusion in the country is compared with other countries. That is why this paper focused on government policies and Korean mentality.

6. INFORMATION TECHNOLOGY: SOME IMPLICATIONS FOR THAILAND

6.1. Introduction

As a small developing country, Thailand has played two roles in the IT Revolution era. First, Thailand plays the role of the IT consumer who adopts this new technology for both consumption and production to improve the quality of life of the people and to improve productivity. Thailand also plays the role of an IT producer. The country has been successful in attracting foreign direct investment in IT industry. This paper examines the current status of the IT Revolution in Thailand from views of both the IT user and the IT producer. Then the impacts on firms and employment, and some policy issues for promoting IT-literacy will be discussed.

6.2. Current IT Status

6.2.1. Internet in Thailand

In Thailand, the Internet became commercialized in 1995. Internet Thailand was first granted as an ISP in 1994 and started commercial operation in 1995. Currently Thailand has 18 commercial ISPs, 4 non-commercial Internet hubs, and 2 domestic Internet exchanges operating. There are 2,300,000 Internet users, 71,995 Internet hosts under .th top-level domain and 6,282 Internet domains under .th. Among 18 commercial ISPs, the three largest are the Internet Thailand Company, KSC Comnet and the Loxinfo Company. CAT (National Internet Exchange: NIX) and NECTEC (Internet Information Research: IIR) are the two domestic Internet exchanges. CAT (International Internet Gateway: IIG) is the only international Internet gateway, connecting domestic Internet networks to the global Internet network.

6.2.2. As the IT Consumer

There were 2,277,046 households having access to the Internet, accounting for 14.11 percent of total households in the whole kingdom. However, there were only 3.04 percent of total households having Internet access at home, with the remaining 11.07 percent using the

Internet from other sources, e.g. schools, work places, and Internet shops. Some 3,536,001 persons only have ever logged onto the Internet which is 5.64 percent of the total population. This penetration rate is relatively low compared to countries in the same region. Due to the low penetration of PCs and the Internet, e-commerce in Thailand is still in the early stages.

There are three main reasons for this low rate of IT use. The first one concerns monopoly in the Internet market. In Thailand, the international market is monopolized by a state-enterprise, the Communication Authority of Thailand (CAT). As a result, the cost of an Internet connection in Thailand is significantly higher than that of other Asian countries. The second reason is the lack of qualified IT personnel. The third reason concerns IT users. The English language has become the standard for Internet communication and therefore language becomes a burden for non-English speaking countries, including Thailand.

6.2.3. As the IT Producer

Currently, the main IT products produced in Thailand are computer peripherals such as monitors, printers, keyboards, HDDs, parts, and PCBs, and integrated circuits. Since the Thai market is relatively small, 80 percent of products are for export. The main producers, all foreign companies, are ADI (Thailand) for monitors, Canon for printers, Fujitsu for printers and HDDs, Minebea for keyboards and HDD parts, and IBM for HDDs. As a result, for the past 10 years, computers and parts, and ICs have become the two most important exporting items, accounting for approximately 18 percent of total export value.

6.2.4. Telecommunications Infrastructure

Thailand's telecommunications development is under the direction of the government. At present, telecommunications infrastructure development is carried out by three organizations: the Post and Telegraph Department (PTD), the Telephone Organization of Thailand (TOT) and the Communication Authority of Thailand (CAT). The PTD is a government department directed by the Ministry of Transport and Communication. PTD is primarily responsible for policy rules and regulations. TOT's main objectives have been to operate and develop national telephone. TOT is also responsible for domestic services and international services to Laos and

Malaysia. CAT is a state-owned enterprise under the Ministry of Transport and Communications, and is responsible for the postal, telegraph, telex, telephoto and facsimile services. The Telecommunications Master Plan 1997-2006 has been proposed. One of its goals is to increase the competitiveness of the industry by abolishing existing state enterprise monopolies. Both TOT and CAT have to be privatized, and will be broken up into two separate entities; whereby two will compete in local and value-added services, while the other two will compete in long-distance services.

6.3. Impact on Firms and Employment in Thailand

6.3.1. Impact on Firms

With e-commerce growth in developing countries, one obvious sector to benefit is the IT industry, both hardware and software. IT can also be used as a tool in other industries. Here are different channels through which e-commerce may impact on Thai firms. First, IT makes it easier for firms to access B2C world markets. Secondly, IT can facilitate activities on the global market for Thai traditional products. IT allows local firms to tap into the B2B supply chains. Finally, IT allows service-providing firms to operate more efficiently and to provide certain services directly to customers anywhere in the world.

6.3.2. Impact on Thai Labor

One effect of IT is that working patterns are becoming independent of location and this will change management practices, the nature of the employment contract, and the quality of work. For a country like Thailand, however, multinationals may switch investments to other countries that have workforces more capable of using IT, and many Thai workers would lose their jobs. These workers are those who do not have the basic education needed to learn IT or who are in an IT unfriendly environment. Therefore they face a two-pronged attack on their livelihoods; directly from the relocation of multinationals and indirectly from being replaced by new technology.

6.4. Some Policy Issues

6.4.1. Liberalizing the Telecommunication Markets

Telecommunication is an indispensable infrastructure for e-commerce. Monopoly of the sector is the hurdle preventing countries from entering the IT globalized network. In Thailand, the whole market for international access is still monopolized by CAT. This monopoly creates many problems concerning the adoption of IT in Thailand. First, the cost of Internet access in Thailand is significantly higher than in many other Asian countries. The higher cost leads to a lower number of Internet hosts. Second, the state monopoly also imposes higher costs on users. CAT requires that every ISP hand over one-third of its user fee in return for the concession to operate. This leads to higher charges for IT users.

6.4.2. Human Resource Development

Human development is another important factor to improve the digital divide among countries and within Thailand. Since human resource is a public good that creates positive externalities, we face the problem of market failure. The Thai government has to play an important role as a main investor in IT human resource development. Not only by emphasizing the teaching of IT in schools but also by fostering an IT friendly environment. The main target is 'IT for All,' which implies that Thai people at any age, at any income level, and in any location, are able to learn and get access to new technology equally.

6.5. Conclusions

The paper showed that if Thailand as a developing country could use the Internet and e-commerce fully, it would benefit all consumers and businesses, including SMEs, to obtain easy access to the global network. In order to reduce this digital divide and create a literate IT society, the paper recommends the government liberalize the telecommunications market, to allow more competition from new entrants domestic and foreign. Market liberalization has been included in the Telecommunications Master Plan 1997-2006, however, it has not shown any progress yet. The other recommendation is on IT human resource development throughout the country. This includes formal education from elementary schools to

colleges, both hardware (equipment) and software (personnel), and informal education for workers and people of all ages, under the slogan 'IT for All.'

7. THE INTERCONNECTION AND PRICING OF THE INTERNET

7.1. Introduction

One of the current problems which economics is facing is how to analyze the rapidly developing Internet. In the 1990s, the Internet became a driving force for the growth of the world economy, and the term 'the New Economy' was quite popular. It is true that the spread of the Internet and the development of IT industries have significantly changed the structure of the world economy. The purpose of this paper is to consider to what extent we can analyze this rapidly evolving digital economy from the viewpoints of economics. This paper tries to provide a framework to analyze the industrial structure of the Internet.

7.2. What is the Internet?

7.2.1. The History of the Internet

The Internet is the worldwide networking of networks connected via a common communications protocol, namely TCP/IP. The essence of the Internet can be summarized in the following two points: first, the Internet is a set of protocols to allow access by various host computers in a fully distributed way; second, the Internet is the software and system agreements that allow disparate hardware and software to talk across disparate networks. As for the development of the Internet in Japan, the JUNET (Japan UNIX/University Network), a joint research project of three universities (University of Tokyo, Keio University, and Tokyo Institute of Technology) was established in 1984 and connected to the American CSNET (Computer Science Network) in 1986.

7.2.2. The Difference Between Telecommunications and the Internet

Telephone networks use circuit switching where an end-to-end circuit must be set up before the call begins. A fixed share of network resources

is reserved for the call, and no other call can use those resources until the original connection is closed. One advantage of circuit switching is to assure QOS (quality of services) such as guaranteed maximum delay. On the other hand, the Internet uses packet switching where the data stream from a computer is broken up into packets of about 200 bytes. One advantage of packet switching is to permit a statistical sharing on the communication lines on a first-come, first-served basis. If the network becomes overloaded, packets are delayed or dropped.

7.2.3. The Convergence of Services Via the Internet

The development of the Internet has provoked the collision and convergence of services previously regarded as separate ones (computers and data communications, content and conduit, equipment and services), and this development of innovative services unavoidably requires new business models, new network architectures, and new policy frameworks.

7.3. Pricing the Internet and its Problems

7.3.1. Pricing of the Internet

There are three representative schemes of Internet pricing. The first is flat-rate pricing, in which Internet users pay a fee to connect but are not billed for each bit sent. The second is usage-sensitive pricing, in which users pay a portion of their Internet bill for a connection and a possibly varying portion for each bit they send or receive. The third is transaction-based pricing which is different from usage-sensitive pricing in that prices are determined not by the number of bits but by the characteristics of the transaction.

7.3.2. Problems of Internet Pricing

One of the problems that Internet technology faces is how to guarantee QOS for various demands of users. Simple flat-rate pricing cannot finely differentiate QOS depending on the various demands. It has recently become desirable to establish explicit mechanisms to allow users to specify different needs, with the presumption that they should be differentially priced. The most serious problem of Internet pricing is how to control congestion. This is because a user's incremental packet imposes

costs on other users in the form of delay or even dropped packets when the network is at over capacity. To internalize the social cost of congestion, a real time auction mechanism called 'smart market' has been proposed by economists.

7.4. Industrial Structure of the Internet and its Interconnection Problem

7.4.1. The Industrial Structure of the Internet

The Internet is a network of networks and the global aggregate of various, large or small, local networks. Internet structure can be summarized simply as three-levels: the bottom-level local access, the regional or mid-level conveyance, and the backbone-level interconnection. There are two principal types of Internet providers. One is ISP (Internet Service Provider), which provides access services for end-users at a retail level, while the other is IBP (Internet Backbone Provider), which provides transmit services for ISP at a wholesale level. Therefore, an ISP has to connect to an IBP so that it connects to another ISP.

7.4.2. Japanese Internet Providers

Most Internet providers in Japan used to be personal-computer-communication companies that did not have their own telecommunications facilities. However, telecommunications companies that have their own telecommunications facilities have recently increased their market share.

7.5. The Model Analysis of the Internet

7.5.1. The One-Way Model and the Two-Way Model

It will be helpful to explain the key elements, such as the one-way, the two-way, and the components model, on which this analysis depends. The one-way model of connection is the network structure where one company needs access to another but the reverse does not hold. The two-way model of connection demonstrates that customers calling each other belong to two different local networks and each carrier must buy termination access from the other network.

7.5.2. The Basic Setup of the Model

This section will explain the basic setup of the model. We assume at this moment that there are two levels of 'components,' A and B. For example, component A means an access service from ISP to end-users while component B means a transit service between IBP and ISP. It is also assumed that each component has two types, namely A_1/A_2 and B_1/B_2. We call the combination of components 'system.' Systems are A_1B_1, A_1B_2, A_2B_1, and A_2B_2.

7.5.3. The One-Way Model

The one-way model demonstrates the case where two types of providers exist: one is a dominant company that monopolizes one level of components and the other is a partial entrant. The dominant company provides $A_1/B_1/B_2$ whereas the partial entrant does only A_2. The possible interpretation is that the dominant company is an IBP that integrates an ISP and the partial entrant is a disintegrated ISP.

7.5.4. The Two-Way Model

The two-way model means that there is no dominant carrier and that firm 1 provides A_1/B_1 while firm 2 provides A_2/B_2. For example, it can be thought that component A is a transit service between IBP and ISP and component B is the interconnection service between IBPs. Each component has two types, A_1/A_2 and B_1/B_2. Component B is compatible with two providers, and B_1 can be combined by A_2 as well as A_1 to produce the systems A_1B_1 and A_2B_1 respectively. The same thing can be said of B_2.

7.5.5. Results of the Analysis of One-Way and Two-Way Systems

Proposition 1 compares the social welfare between the one-way and two-way system. Since the total demand of the two-way is higher than that of the one-way, the social welfare of the two-way is higher than that of the one-way. Why is the two-way more socially desirable than the one-way? There are two reasons for this. One is the internalization of the vertical externalities. Vertical integrators can set prices considering the demands of systems instead of components. The other is the action of the horizon-

tal substitution effect. That is to say, since there is no company that monopolizes components, the price competition in terms of systems works effectively and system demands are increased.

7.6. Development of the One-Way and Two-Way Model

7.6.1. The Regulatory Model of the One-Way Model

Proposition 1 stated that the one-way is socially inferior to the two-way. Thus, we will examine how to regulate the one-way and improve its social welfare. There are two possible methods of regulation: price caps and unbundling.

7.6.2. The Price-Cap Model of the One-Way Connection

The price-cap model of the one-way demonstrates what happens when the government regulates the upper limits of prices of components B_1, B_2 up to f, whereas a dominant company provides $A_1/B_1/B_2$ and an entrant provides A_2. Systems as final products are A_1B_1, A_1B_2, $A_2 B_1$, and $A_2 B_2$. Firm 1 sets the price of component A_1 and firm 2 sets the price of component A_2.

7.6.3. The Unbundling Model of the One-Way Connection

The unbundling model of the one-way demonstrates what occurs when the government disintegrates the component B_1 and B_2 from a dominant company and determines the prices while the dominant company provides A_1 and an entrant provides A_2. Systems as a final product are A_1B_1, A_1B_2, A_2B_1, and A_2B_2. Firm 1 sets the price of component A_1 and firm 2 sets the price of component A_2.

7.6.4. The Result of the Analysis of the Regulation Model of the One-Way

Proposition 2 compares the social welfare between the price cap and the unbundling. Since the total demand in the case of price cap is larger than that in the case of unbundling, the social welfare in the case of price cap is higher than that of unbundling. Why is the price cap socially superior to unbundling? This is because the price cap can avoid the problem of

double margin as Proposition 1 has stated.

7.7. Further Discussion

The problem of how we should utilize these academic insights to actual economic policy-making will remain. Some economist pointed out that regulation should be more akin to safety and consumer protection than pricing and cost recovery. Another stated that the distinction between regulated 'telecommunications' and unregulated 'information services' is at the center of the US's 1996 Telecommunications Act, but this distinction was rooted in the conventional telephone network; it does not work in the IP world, therefore we needed to develop new ways of reconciling old telephone regulations with new IP networks.