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Can the sun rise again in the ubiquitous information age?

*Feasibility of a vigorous economic growth for Japan under the diminishing demographic trend**

Akihiko SHINOZAKI**

Abstract

The purpose of this paper is to examine the feasibility of a vigorous economic growth for Japan, which is dealing with aging and diminishing demographics. We first analyze the potential growth rate of productivity that compensates this diminishing demographic trend, and then we examine the effect of investment in information technology on productivity resurgence. Besides, we investigate reasons and causes that prevented Japan from reaping the benefit of new technologies in the 1990s, reviewing corporate systems and government policies. These analyses reveal that it is feasible for Japan to achieve three percent economic growth if appropriate corporate reforms and policies are enacted. It seems that Japan is ready to grow, making the 1990s not only the "lost decade" but also the "born-again decade" to lead the merits of innovation in information technology.

KeyWords : Japanese economy, economic growth, productivity, aging demographic trend, information technology, ubiquitous computing .

JEL Classification Code: O3, O4, O5, N1, N3

1. Introduction

Over the last two decades, there has been a controversial argument about the impact of information technology on the economy. Some analysts claimed that information technology contributed to the improvement of productivity while others argued it did not. As is well known, intensive academic research and business case studies ultimately revealed that investment in information technology paid off when it was combined with business process reengineering and institutional reforms. Take, for example, the

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macroeconomic impact in the United States. The annual productivity growth rate in the U.S. has accelerated 1.6 percentage points, or doubled from an annual growth rate of 1.5 percent to 3.1 percent (Jorgenson, et al., 2004). This productivity acceleration is one of the most important benefits of the information technology revolution.

In Japan, however, the dynamic impact of information technology seems to be entirely disregarded, at least in the national government's long-term economic projection. *Japan's 21st Century Vision*, for example, which was published in April 2005 by the Council on Economic and Fiscal Policy at the Cabinet Office, describes two kinds of scenarios: one to be avoided and another to be welcomed. Surprisingly, even in the positive scenario, the economy is slated to grow at a mere 1.5 percent annually.

What makes the Council members so pessimistic? One is the demographic trend of an aging and decreasing population. The other is the underestimation or negligence of the positive impact of the information technology revolution. Although the advantages of information technology and globalization are mentioned in the scenario, their ability to vitalize the economy is not reflected in the form of productivity resurgence and the resultant economic growth in the projection.

To address this over-pessimism, in this paper, we first examine the diminishing impact of the demographics on the growth rate of the Japanese economy, and then analyze Japan's potential growth rate of productivity and the effect of investment in information technology on productivity resurgence. We will also investigate reasons and causes that prevented Japan from reaping the benefit of new technologies in the 1990s, reviewing corporate systems and government policies. Through these analyses, we will examine the feasibility of a three percent economic growth for Japan, which is dealing with aging and diminishing demographics.

2. Macroeconomic approach

In this section, we would like to consider how productivity and demographic trends will contribute to the growth rate of the Japanese economy over the next few decades. We will then measure the fundamental productivity trend or structural growth rate of productivity since this measurement is necessary to examine whether a three percent economic growth is feasible in Japan.

2.1 Demographic trends and economic growth

Due to the demographic trends of an aging and

Table 1-1. Pessimism in the positive scenario of the Japan's 21st century vision

(annual percent changes)

Periods / Breakdown of growth	2006-2012	2013-2020	2021-2030
Economic (GDP) growth	$1.5^{\pm}$	$2.0^{\pm}$	$1.5^{\pm}$
Productivity (GDP per capita)	1.5^{+}	2.0^{+}	$2.0^{\pm}$
Demographic trends	-0.1	-0.3	-0.5

Source: Council on Economic and Fiscal Policy (2005), and related indices from the website (http://www.keizai-shimon.go.jp/english/publication/vision/index.html).

decreasing population, pessimistic perspectives are prevailing about the long-term economic outlook for Japan. According to *Population Projections for Japan: 2001-2050*, prepared by the National Institute of Population and Social Security Research, the total population will be decreasing at a clip ranging from 0.3 to 0.5 percent annually over the next few decades. The working-age population, ages 15 to 64, is estimated to decrease faster; at a pace ranging from 0.7 to 0.9 percent annually (table2-1). This demographic trend affects the annual growth rate of the economy, which will contract by 0.9 percent at most. The growth rate of the entire economy is formulated as follows:

GDP = population × output per capita,

where GDP represents the total output of the economy and output per capita represents the productivity. Then, this formula can be transformed as

$$g = n + p,$$

where g represents the annual growth rate of the GDP, n represents the annual percent change of the population, and p represents the annual percent change of productivity.

The Japanese government now realizes the importance of policy packages that raise the declining birth rate, but it is unlikely that any measures can quickly mitigate and reverse this trend. Moreover, it takes a generation for new-born babies to become a productive workforce even if the birth rate rises immediately. In the end, it is productivity improvement that should compensate for the contraction of economic growth under the diminishing demographic trend. Based on the medium variant estimation of population projections, productivity should grow 3.5-4.0 percent annually to make up for the 0.5-0.9 percentage point contraction of the demographic trend and to achieve the 3 percent growth of the entire economy.

Table 2-1. Demographic trends in Japan

Periods	Mean Age (years old)	Total population (annual percent change)	Working-age population (annual percent change)
1960s (actual)	30.3	1.1	1.8
1970s (actual)	32.7	1.2	1.0
1980s (actual)	35.8	0.6	0.9
1990s (actual)	39.5	0.3	0.0
2000s (projected)	43.0	0.0	-0.5
2010s (projected)	45.9	-0.3	-0.9
2020s (projected)	48.2	-0.5	-0.7

Source: Shinozaki (2005a), National Institute of Population and Social Security Research (2002).

Note: Projections of the mean age and annual percent changes of both total and working-age population are measured based on the medium variant estimation.

2.2 Measurement of the productivity trend

In this subsection we would like to measure the fundamental productivity trend of the Japanese economy in order to better grasp the macroeconomic clues needed to examine the feasibility of a 3 percent economic growth. We can measure the lowest productivity growth rate as a minimum base-line by focusing on the 1990s in light of the long-run trace over the last three decades. The economy experienced the deepest slump in the 1990s, often referred to as the "lost decade" of the economy. This measurement is necessary to distinguish the structural trend of productivity from the business-cyclical changes of productivity since productivity is so procyclical. For this purpose, we employ the following formula based on the growth accounting method.

$$Q = M(pK_o)^{\alpha}(pK_i)^{\beta}(hrL)^{\gamma},$$

where α, β, and γ represent income shares for each input respectively, $\alpha+\beta+\gamma=1$, Q is output, M is multifactor productivity, p is the utilization rate of capital assets assuming that the utilization rate is homogeneous in each asset, K_o represents non-ICT (Information and Communications Technology) capital assets, whereas K_i is ICT capital assets, hr is work hours per employee, and L is the number of employees. The utilization rate of capital assets is used as a proxy of business cycle effect in this equation[1]. Then, the equation above can be transformed as

$$\dot{Q}\text{-}\dot{hrL} = \dot{M} + \alpha(\dot{K_o}\text{-}\dot{hrL}) + \beta(\dot{K_i}\text{-}\dot{hrL}) + (\alpha+\beta)\dot{p},$$

where a dot over a variable indicates the rate of change expressed as a log difference. In this equation, $\dot{Q}\text{-}\dot{hrL}$ represents changes in output per hour or labor productivity, $\dot{M}$ represents changes in multifactor productivity, and $\dot{K}\text{-}\dot{hrL}$ represents changes in capital assets per hours worked, which is referred to as capital deepening. The capital deepening portion is further divided into the contribution from ICT assets ($\dot{K_i}\text{-}\dot{hrL}$) and non-ICT assets ($\dot{K_o}\text{-}\dot{hrL}$).

Based on the above formula, we can measure the fundamental productivity trend separate from the business cycle effect, using the datasets that are published officially by government ministries for output, entire capital assets input, labor input, and utilization rate as well as the datasets in Shinozaki (2004) for information and communications technology assets input.

Table 2-2 shows the results of the measurement. The first line in the table represents the growth rate of the entire economy and the third line shows the productivity growth rate as a formula of the first line (growth rate of output) minus the second line (growth rate of labor input). The fourth and fifth lines allocate this productivity growth rate to the business cycle effect and the fundamental trend.

Japanese macroeconomic performance has changed drastically over the last two decades. Fig-

1 In Japan, labor statistics, such as work hours per employee or the unemployment rate, do not exactly represent the business cycle effect because work hours tend to decline during business booms to attract workers by offering higher payments for fewer work hours, whereas in a recession layoffs cause longer work hours for remaining employees. As for the unemployment rate, it is apparent that the increase in unemployment in the 1990s resulted from such fundamental changes in the labor market, rather than cyclical changes, such as reforming the so-called lifetime employment system. Consequently, labor market indices may not accurately represent the business cycle effect in Japan.

Table 2-2. Productivity trends in Japan

(annual percent changes)

Periods / Breakdown of growth	76-80	81-85	86-90	91-95	96-00
Growth rate of output	4.81	3.65	5.21	1.56	1.45
Growth rate of labor input	1.37	0.92	1.29	-0.27	-0.83
Output per hour	3.44	2.73	3.92	1.84	2.28
Business cycle effect	1.15	-0.02	0.29	-0.81	0.00
Fundamental trend	**2.29**	**2.75**	**3.63**	**2.64**	**2.28**
Capital deepening	1.66	1.62	1.83	1.76	1.35
of ICT assets	0.09	0.17	0.48	0.38	0.53
of non ICT assets	1.57	1.45	1.35	1.38	0.81
Multi factor productivity	0.63	1.13	1.80	0.88	0.93

Source: Selected figures from Shinozaki (2004) table 3, p10.

ures in the first line illustrate this transformation well. Apparently, the economy enjoyed a powerful boom in the late 1980s and plunged into a deep slump in the 1990s. The economy grew at healthy 3.7 percent annually in the early 1980s and at a vigorous 5.2 percent annually in the late 1980s. Conversely, it grew at a mere one and half percent annually in the 1990s. The economic growth rate in the 1990s was less than one-third of the rate in the late 1970s or late 1980s, and less than half of the rate in the early 1980s. On the whole, the 1990s growth rate fell drastically from past periods.

As for the fundamental productivity trend, however, the changes in the 1990s were not as drastic. The fundamental productivity trend was relatively moderate due to the sharp decline in the entire growth rate, which resulted mainly from the decrease in labor input and the business cycle effect on productivity. Even in the lost decade of the 1990s fundamental productivity trends grew at around 2.5 percent annually; at 2.6 percent in the first half and at 2.3 percent in the second half of the 1990s. Although an approximate 2.5 percent growth trend is about 1 percentage point less than 3.6 percent trend in the late 1980s, the second half of the 1980s might be considered an exceptional period of overheating boom. For this reason, in comparing fundamental productivity trends of the 1990s with those in the late 1970s or early 1980s, we find the figures were almost the same, ranging from 2.3 percent to 2.8 percent. It therefore seems appropriate to conclude that an annual productivity growth rate of around 2.5 percent is the fundamental trend that the Japanese economy still preserves as a potential minimum.

2.3 Feasibility of a 3 percent economic growth

For the 3 percent economic growth under the diminishing demographic trend mentioned above, the productivity should grow at 3.5-4.0 percent annually. Thus, it is necessary for the Japanese economy to attain an additional 1.0-1.5 percent annual productivity enhancement on top of the approximate 2.5 percent fundamental productivity trend. The mat-

ter in question in this argument is whether a mature economy such as Japan's, not emerging economies like BRICs, can revitalize and push its productivity upward again.

The answer lies in the remarkable macroeconomic performance in the U.S. since the late 1990s (Table 2-3). As Chandler (2000) states, the U.S. economy underwent "the transformation from the Industrial [Age] into the Information Age in the last decades of the twentieth century." [2] There was an intensive investment in information technology and it surely paid off. The U.S. economy has reaped the full benefits of technological innovation in the form of achieving productivity resurgence. Because the annual percent change of labor productivity has accelerated from 1.5 percent to 3.1 percent since 1995, the living standard will double in 23 years rather than 47 years, a generation faster than before. The most important implication of this acceleration is that even a mature or a developed economy like that of the U.S. can raise its productivity growth rate even after a long economic slump if it can successfully ride the wave of the information technology revolution.

At the other end of the Pacific Ocean, namely in Japan, a different state of affairs has existed since the 1990s. We have already reviewed Japan's experience in the 1990s and learned that roughly 2.5 percent of the annual productivity growth constitutes a fundamental trend or a minimum base line of the economy. We also learn from that time period that Japan failed to transform its economy from the Industrial Age into the Information Age and that it missed the chance to take advantage of the information technology revolution.

As Jorgenson (2001) pointed out, capital deepening of ICT assets represents the effects of the user side of information and communications technology whereas multifactor productivity represents efficiency gains from either the user or the producer side of technology, or both. Table 2-2 demonstrates that there were no accelerations in either ICT capital deepening or multifactor productivity in the 1990s and that the Japanese economy missed the chance to benefit from them. (Reasons for this failure are considered in the following sections.)

Looking at the other side of this failure, however, it could be argued that there remain huge potentialities open in Japan. In other words, it seems reasonable to believe that the Japanese economy

Table 2-3. Sources of U.S. productivity growth (annual percent changes, percentage point)

Periods / Breakdown of productivity	1959-73 (a)	1973-95 (b)	95-2003 (c)	changes (b)-(a)	changes (c)-(b)
Labor productivity	2.85	1.49	3.06	-1.36	1.57
Capital deepening	1.41	0.89	1.75	-0.52	0.86
of ICT assets	0.21	0.40	0.92	0.19	0.52
Labor quality	0.33	0.26	0.17	-0.07	-0.09
Multi factor productivity	1.12	0.34	1.14	-0.78	0.80

Source: Selected figures from Jorgenson, et al. (2004) table 1, p. 3

could attain a 1.0-1.5 percent productivity bonus on top of the 2.5 percent minimum base line if it manages to embrace the Information Age and take full advantage of the dynamism of the information technology revolution as the U.S. economy certainly did in the 1990s. Given the Japanese macroeconomic fundamentals, advanced assets of R&D, social and political stability, higher level of education, etc., it is most definitely a realistic scenario for Japan.

After all, 3 percent economic growth seems feasible if Japan succeeds in riding the dynamic wave of the information technology revolution. Japan will then be able to reap the full benefits through structural reforms that allow innovation and competition. This step into the future will also create a friendly economic policy under a small government, as well as reforms in the private business sector to regain competitiveness in a level market.

3. Revisiting the Japanese economic system

As is well known, information technology, the Internet in particular, began to deeply affect economic performance world wide in the 1990s. At the same time, a clear contrast emerged on both ends of the Pacific Ocean: the longest and vigorous economic expansion in the U.S. and a dawdling slump in Japan. This contrast was partly but significantly caused by a difference in corporate attitudes about investment in new technology. The "ICT capital deepening" figures in tables 2-2 and 2-3 clearly illustrate this disparity. Managers in the U.S. invested intensely in technology while in Japan they seemed to take a wait-and-see position.

Why were the implications of information technology lost on Japanese management? To address this question, we would like to reexamine the features of the Japanese industrial organization, or corporate system, which produced a prosperous economy through the 1980s and conversely caused it to stagnant in the 1990s. Using this argument, we can analyze possible impediments that prevened the Japanese economy from reaping the benefits of the information technology revolution in the 1990s. We can then discover the best way for Japan to realize a productivity resurgence and resultant economic growth in the Information Age.

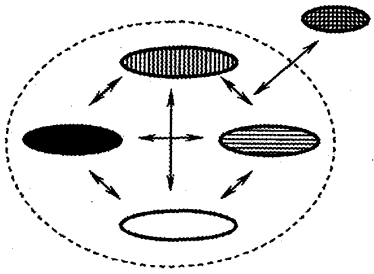
For this purpose, we will first review the strengths of the Japanese industrial organization, or corporate system, and then analyze how those strengths became weaknesses when it came to leading the economy into the Information Age.

3.1 Integral system vs. modular system

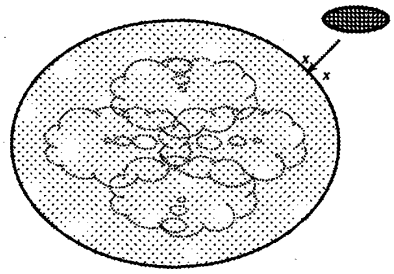
According to the Economic Planning Agency (1990), which analyzed the strengths of the 1980s Japanese economy, Corporate Japan's organizational structure had several principal features. These characteristics facilitated success in technological improvement and in transforming the economy from energy-consuming heavy industries into well-advanced R&D manufacturing through the 1970s and 1980s. The features were: (1) intensive face to face communications based on an intimate human network; (2) shared business information through informal communication; (3) some overlap in jobs under a flexible organizational structure and unre-

2 See Chandler (2000) p.3. The word within the bracket is added, not in the original.

Figure 3-1. Modularity versus Integrality



Modular Organization
(Corporate USA Type)



Integrated Organization
(Corporate Japan Type)

stricted job descriptions within a firm; and (4) the extension of these characteristics transactions between the firms and the creation of long-term relationships in an industrial organization.

Herein, we refer to the above-mentioned characteristics as an "integrated organization" or "integrated system."[3] In an integrated organization information circulates by means of informal traffic and is shared in a tacit manner. Accordingly, an integrated system is quite appropriate for technological improvement through "learning by doing"[4] because invisible and tacit skills can be shared and transferred easily among employees or an exclusive group companies and are accumulated within a membership day by day.

For that reason, Corporate Japan has performed well through continuous improvement such as *kaizen* or total quality management in its production lines. As Arrow mentioned, "knowledge is growing time,"[5] learning by doing is an important engine of R&D activities in an integral organization, which is characterized by its continuous improvement, tacit skills, long-term relations, integrality, common culture, gradual (flying geese style) progress, etc. That is one reason why Japanese business maintains better performance in such industries as automobile and liquid crystal display manufacturing, even in the Information Age.

In contrast, Corporate America has different features in its organizational structure (Figure 3-1), which we refer to here as a "modular organization," or "modular system."[6] In a modular organization, formal job descriptions define the mission of each job position. Moreover, borders that separate job units or divisions are much clearer than in an integrated organization. However, a modular system sometimes makes it difficult to understand the internal activities of other job units and to share information that involves the entire organization. To resolve this difficulty, a standard format for an open interface is created, which promotes smooth formal communications among the units. This common interface and simple protocol ease communication, even with newcomers or outside participants, in a modular organization. This is in sharp contrast to

3 Policy Research Institute (2000) refers to a Japanese system as an integrated system.

4 Arrow (1962) argues the implication of learning by doing.

5 *Ibid*, p. 155.

6 Langlois and Robertson (1992) argue the nature of modularity.

Table 3-1. Economies in the information age and the industrial age

Types of Merit	Emerging Information Age	Matured Industrial Age
Scale Merit	Network Effects (Externalities) - consumers' scale merit	Economies of Scale - producers' scale merit
Resource Merit	Economies of Outsourcing - outside resources - multiple organizations - synergy effect - innovations (new combinations)	Economies of Scope - in-house resources - single integrated-organization - cost saving - learning by doing
Desirable Industrial Organization	Multiple small players Competitive market Compatibility Modularity	Larger organization Oligopoly, or monopoly Continuity Integrality

Source: Shinozaki (2004), p.18, Table A-2, with some modifications.

communication outcomes in an integrated organization.

As mentioned above, one type of activity that improves the R&D payoff is what Arrow calls "learning by doing," which is suitable for an integrated system. Another type of activity that improves the R&D payoff is what Schumpeter (1926) refers to as "innovations." Innovations are characterized as disruptive changes, new combinations, open source relations, modularity, novelty and variety, random (or leap frog style) progress, etc. These characteristics are more suitable for the modular system of the U.S. rather than the integrated system of Japan.

3.2 Transformation of the economies

Progress and diffusion of information technology seems to cause dynamic changes in the economic environment. In fact, it seems reasonable to assume that economies are going to change from those favoring an integrated system to those favoring a modular system. The reason for this presumption is that with open network and digital technology prevailing, not only "network effects" emerge, but also "economies of outsourcing."

Table 3-1 clarifies the notion of "economies of outsourcing" and incorporates it into other concepts of economies; "economies of scale," "economies of scope," and "network externalities." Economies of outsourcing are the obverse of economies of scope just as network effects are the obverse of economies of scale.[7] Under economies of outsourcing, economic benefits arise from resources outside the organization, rather than from in-house resources under economies of scope, inducing a synergy effect of dynamic "new combinations," which

7 Network effects represent the scale merits of the demand-side (consumption), whereas economies of scale represent those of the supply-side (production). Katz and Shapiro (1985) argue the nature of network externalities. For detailed arguments, see Shinozaki (2003), chapter 9.

is the key concept of what Joseph Schumpeter refers to as a driving force of innovation.

With an open network and digital technology prevailing, modularity has come to gain an advantage over integrality, where some of the strengths of an integrated system turn into weaknesses. This is what is thought to have happened in the 1990s, the period of transformation from the Industrial Age into the Information Age.

3.3 Challenges to the Japanese system

Information and communications technology has progressed and changed its nature from simple high-performance automatic transaction machinery to an effective business communications tool. This will enable modular organizations to easily adapt the technology to a standard format of formal communications and reap the benefits of that technological change in the form of productivity resurgence.

In contrast, integrated organizations tend to fail in adapting technology. Their intimate human networks have performed so efficiently and effectively that management cannot easily understand the importance of using the technology and so pays less attention to using that technology.[8] It therefore takes a while for integrated organizations to fully implement new technology as a communication tool, and so they lose their advantage over time. Furthermore, even if integrated organizations recognize the importance of using the technology, they need drastic business process reengineering and business unit restructuring in order to gain the benefit of the technology.

Take intensive face-to-face communication as one example. That preference engenders a locational constraint when the organization expands its business globally. Too much dependence on face-to-face and informal communications of the human network implies less, perhaps even inadequate, attention to creating a formal means of information traffic flow and a consequent reluctance toward building and using an information technology network as the main tools of business processes communication. Lacking appropriate technology, a global organization will fail to make prompt decisions.

Another problem arises from the overlapping missions and unclear job unit borders that gave Japanese firms an advantage in the 1980s. Such complexity or obscurity makes it impossible to reap the benefits of outsourcing or the more recent trend of offshoring because it is so hard to identify the job units that *should be* outsourced. In addition, the complexity or obscurity in integrated organizations must be confronted during any restructuring of the organization resulting from mergers and acquisitions.

The arguments in this subsection are not in any way intended to reject all the features of the Japanese system. The integrated system works quite

8 According to an international comparison survey conducted by Andersen Consulting in 1997-98, Japanese senior managements ranked last in web literacy among those in developed countries. Less than 80 percent of Japanese executives were using the web, while almost a hundred percent of U.S. executives were using the web. To make matters worse, only 15 percent of Japanese executives felt "comfortable" or "familiar" with web access, and only 13 percent had experience shopping on the web. In contrast, almost two thirds of U.S. executives felt "comfortable" and "familiar" with web access and enjoyed on-line shopping (Andersen Consulting, 1999).

well with some businesses such as high-quality consumer products industries that depend heavily on technological improvement through "learning by doing." Nevertheless, it can be concluded at least that the integrated system of the Japanese economy, which performed excellently in the 1980s, is unsuitable in general for the emerging Information Age. In some cases information technology performs far more efficiently and effectively than intimate human networks. Unfortunately, Corporate Japan was hesitant to introduce such technology that might erode its human network advantage, so they missed the chance to accelerate their productivity through intensive investment in the technology.

3.4 Private sectors reforms

Having said all that, there is no need to be overly pessimistic. There is an upside since investment in technology seems to be on the increase recently. In addition, private business sectors have finally realized the importance of business process reengineering and business unit restructuring for the Information Age although they are still at the halfway mark. To facilitate this momentum, we must clarify what kinds of efforts are needed.

Based on a nation-wide survey of 9500 firms (effective response from 3141 firms), multiple comparison analysis revealed that reforms in organizational structures and human resource management significantly affect the effective outcome of investment in information technology (Table 3-2, 3-3). Yet, it was also found that small-sized firms have difficulties with human resource management in their use of technology and that some industries such as medical and educational services are less enthusiastic about the effective use of information technology (Shinozaki, 2005b).

Likewise, logit model analysis revealed that reforms such as paperless transactions make the business process efficient both internally and between the firms whereas drastic and fundamental organizational reforms, such as changes in the top management's decision-making process, business unit restructuring through mergers and acquisitions, and the revision of long-term relationships with suppliers and customers, do not fully pay off yet (Shinozaki, 2006). The analysis also found that human resource management is more effective and important than organizational reforms in reaping the benefits of information technology, but that, so far, the major effectiveness in human resource management appears merely in training the *existing employees* in the firms rather than in hiring *new experts* from outside the firms.

These empirical analyses suggest that government support should concentrate on training for employees in small-sized companies and that medical and educational service industries need institutional reforms in accordance with their business process reengineering via investment in information technology. Furthermore, Japanese companies as a whole tend to plan sustainable corporate reforms rather than drastic reforms. This tendency implies that the inertia of Japan's integrated system persists in the midst of information technology innovation. In this sense, it still may be necessary for Japanese private business sectors to continue their intensive efforts for drastic business reforms that will lead to their transformation into the technology age.

Table 3-2. Business process reengineering and investment in ICT
(investment outcone score)

		Business Process Reengineering	
		Intensive effort firms	Less effort firms
Investment in ICT	Massively investing firms	3.6	2.6
	Less investing firms	3.0	2.0

Source: Shinozaki (2005b) Table 7, p. 30.
Note: The higher score represents a better outcome of investment in ICT. Score differences between the categories are statistically significant.

Table 3-3. Human resource management and investment in ICT
(investment outcone score)

		Human resource management	
		Intensive effort firms	Less effort firms
Investment in ICT	Massively investing firms	3.4	2.6
	Less investing firms	2.9	2.0

Source: Shinozaki (2005b) Table 8, p. 30.
Note: The higher score represents a better outcome for investment in ICT. The difference of scores between the firms of less invested and intensive human management efforts (score 2.9) and those of massively invested and less human resource management effort (score 2.6) is not statistically significant. Other differences of scores are statistically significant.

Nevertheless, Japanese companies are definitely making progress and are far from where they were in the 1990s. They made all-out efforts to deal with reducing holdover debt, selling off nonperforming assets, and eliminating excess employment over the past decade. Thus, the nineteen-nineties period was not only the "lost decade" but also the "born-again decade" – Japanese private business sectors have been struggling with transformation and now they seem to be managing successfully. In the end, it seems plausible to consider that private business sectors in Japan are getting ready to ride the wave of the information technology revolution and reap all the benefits on their own terms. If they do not hesitate to make continuous efforts to change and if they have the back up of government policies they will be well on the way to the Information Age.

4. Government's policies

As discussed in the above section, Japanese private business sectors faced several impediments that prevented themselves from reaping the benefits of the information technology revolution. There also were other obstacles in the form of national government policies including fiscal expenditures, regulations in the telecommunications industry, enforcement of competition policy, legislation of technology friendly business laws, etc.

Of course, appropriate government policy packages are necessary for transforming the economy and achieving a vigorous growth in the Information

Table 4-1. The U.S. Federal Government fiscal size

(percent to the GDP)

	1980	1985	1990	1995	2000
Federal outlays	21.2	22.4	21.6	20.5	18.2
of national defense	4.8	6.0	5.2	3.7	3.0
Federal receipts	18.5	17.4	17.8	18.3	20.6
Federal surplus or deficit (-)	-2.6	-5.0	-3.8	-2.2	2.4
Private business fixed investment	13.0	12.5	10.7	10.9	12.6
of information technology	2.5	3.1	3.1	3.6	4.8

Source: Data from Bureau of Economic Analysis, Office of Management and Budget.
Note: Figures may not add precisely due to rounding.

Age. To determine relevant policies, in this section we will first consider the implications of the U.S. macroeconomic and industrial policies of the 1990s. We then will review Japanese government policies over the last decade to analyze how that government's policies contributed to the failure of the Japanese economy to transition into the Information Age. Through these analyses, we will determine which relevant policy packages will lead to a vigorous economic growth over the next decade.

4.1 Implications of the U.S. in the 1990s

First of all, we have to remember the basic fact that it is private business sectors, not governments, that build the wealth of nations, especially in this era of innovation. Innovation generates not only economic opportunities but also economic uncertainties, where entrepreneurs pioneer new products or markets and expand the frontier of production possibilities. These dynamic activities are the underlying engines for economic growth. Governments should be backstage supporters whose most important role is not to be in the spotlight themselves but to prepare the stage for the entrepreneurs. In this sense, the macroeconomic frame of resource allocation should be largely focused on private business sectors under small governments, rather than budget allocation under large governments. The major playing field should be shifted "from governments to markets."

Positive results of this shift of resource allocation are illustrated well by the reduced share of the U.S. fiscal expenditures to the total GDP during 1990s (table 4-1). The Federal Government outlay accounted for 21.6 percent of the GDP in 1990, only 0.8 percentage points less than in 1985 when the Reagan Administration was confronted with the largest ever "twin deficits." [9] However, the share of the Federal Government decreased at a faster pace under the Clinton Administration, which set two clear visions in their primary policy agenda: reduce the Federal deficit and rebuild economic competitiveness.

The Government outlay share was down to 20.5 percent in 1995, the third year of the Clinton Administration, and down 18.2 percent in 2000, the

9 Gramm-Rudman-Hollings law, enacted in 1985, requires the government to reconcile the federal budget by 1991.

Table 4-2. Changes in the U.S. resource allocation
(percentage point change)

	Changes in a decade		Changes in five years			
	80-90	90-2000	80-85	85-90	90-95	95-2000
Federal outlays	0.4	-3.4	1.2	-0.8	-1.1	-2.3
of national defense	0.4	-2.2	1.2	-0.8	-1.5	-0.7
Federal receipts	0.8	2.8	-1.1	0.4	0.5	2.4
Federal surplus or deficit (-)	-1.2	6.2	-2.4	1.2	1.6	4.6
Private business fixed investment	-2.3	1.8	-0.5	-1.7	0.2	1.6
of information technology	0.6	1.7	0.6	0.0	0.5	1.2

Source: See the footnote in table 4-1.

administration's final year. Symmetrically, non-residential fixed investment in private business sectors have recovered vigorously, particularly investment in information technology under the "National Information Infrastructure" policy packages led effectively by Vice President Al Gore.

On balance, the Clinton-Gore Administration achieved two goals. The first was to turn the huge Federal Government deficit into a surplus, which was attained in 1998 for the first time in the past three decades. The second goal was to re-boot business investment and to rebuild the competitive advantage of the private business sector, focusing on information and communications technology. The progress of these achievements is illustrated in table 4-2. Looking at the changes within the decade, the Federal budget balance improved 6.2 percentage points, from deficit to surplus. To this improvement, outlay reduction contributed 3.4 percentage points, of which reducing the defense burden contributed 2.2 percentage points, whereas the receipt increase that resulted from economic growth contributed 2.8 percentage points. As these figures show, the major contributions to budget reconciliation were expenditure cuts, especially defense cuts, a "peace dividend," rather than tax increases.

While the defense burden reduced the GDP by 2.2 percentage points through the 1990s, private business investment increased 1.8 percentage points, of which investment in information technology accounted for a 1.7 percentage points increase. It can be concluded, therefore, that the U.S. economy reinvested the "peace dividend" in information technology under the appropriate macroeconomic and industrial policy packages. The policy packages for the recovery of both a balanced budget and economic competitiveness worked closely together like a pair of wheels in the field of information and communications technology, and consequently revitalized the U.S. economy.[10] It seems that economic resources were shifted in general from a government-led defense industry to entrepreneur-led information technology industries via the labor market, financial markets, product markets, and R&D markets. The positive outcome of this dynamic shift has been evident in U.S. statistics of investment and productivity since the late 1990s.

These experiences in the U.S. remind us of two

basic economic principals: (1) although a government's fiscal expenditures have an important role in the redistribution of wealth, redistribution can occur only after wealth is generated; (2) wealth is generated primarily by economic activities in the private business sectors, not in the government budget, especially in this dynamic innovation age.

4.2 Greenspan's monetary policy

We also need to consider monetary policy. Lessons from the 1990s experience in both Japan and the U.S. are that the central bank or monetary authority should keep not only inflation but also deflation in check. Consider, for example, the economic prosperity under the Clinton-Gore Administration. The average inflation rate was 1.8 (ranging from 1.0 to 2.3) percent annually in terms of the GDP deflator, or 2.6 (ranging from 1.9 to 3.6) percent annually in terms of the core consumer price index, which excludes volatile food and energy prices.

Alan Greenspan, ex-chairman of the Federal Reserve Board, carefully monitored the changes of aggregate price levels, and he brought up the risk of deflation when the inflation rate was plunging below 2 percent in 1998 and 2003 because, as he said, "deflation is more of a threat to economic growth than is inflation."[11] The most recent anecdote occurred on June 25, 2003, when the Federal Reserve Board lowered rates 25 basis points stating that the risk of deflation was higher than the risk of inflation, because the inflation rate slowed down to 1.5 percent in terms of the core consumer price index.

An economy should be shielded from the risk of deflation since deflation weakens economic growth in such a way that "the lower bound on nominal interest rates at zero threatens ever-rising real rates if deflation intensifies. A related consequence is that even if debtors are able to refinance loans at zero nominal interest rates, they may still face high and rising real rates that cause their balance sheets to deteriorate."[12] Such a financial environment makes entrepreneurs reluctant or discouraged about raising funds for their start-up businesses. As a result, the economy misses the chance to reap the benefits of new frontiers that would be expanded even further by innovation.

In this sense, appropriate policy packages include a monetary policy that will allow and encourage full economic growth. In other words, roughly 2 percent of reasonable inflation rates should be added on top of around 3 percent of real growth rate, bringing the nominal growth rate to around 5 percent for the best scenario of the long-run projection of the Japanese economic growth.

4.3 Revisiting Japan's macroeconomic policy

In the 1990s, Japan's macroeconomic policy seemed completely opposite from that of the Clinton-Gore Administration. The Japanese national government expanded its fiscal size while private

10 Hundt (2000) argued that "the coincidence of new technologies, a pro-competitive legal framework, and a balanced budget caused the information sector to double its share of the total American economy from 1992 to 1998. It has been the domain of two-thirds of all new jobs and one-third of all new investment," mentioning the 1993 Omnibus Budget Reconciliation Act and the 1996 Telecommunication Act. *Ibid*, pp. ix-x.

11 See the Federal Reserve Board, "Remarks by Chairman Alan Greenspan, Before the Economic Club of New York, New York City, December 19, 2002."

12 *Ibid.*

Table 4-3. Annual percent changes of selected real GDP components in Japan and the U.S.

	Japan				United States			
	GDP	B-Inv	Gov-Exp	of P-Work	GDP	B-Inv	Gov-Exp	of Defense
1980s	**3.8**	**7.8**	**1.3**	**-0.2**	**3.0**	**3.3**	**3.0**	**4.7**
1990s	1.7	0.8	3.1	4.7	3.0	6.9	1.4	-2.4
92-2000	**1.0**	**-0.5**	**2.2**	**2.9**	**3.6**	**9.0**	**1.4**	**-2.5**

Source: Shinozaki (2003) p.8, table 1-1.

Notes: GDP represents total output; B-Inv represents private business non-residential fixed investment; Gov-Exp represents government expenditures; P-Work represents public works or public investment; Defense represents federal defense expenditures.

business sectors contracted their investment. In fact, from 1992 to 1999, the government made supplemental budgets nine times for additional public works, aiming at rebooting the economy. The government, however, could not attain the policy goal nor bail the economy out of its dawdling economic slump in the 1990s.

To make the matters worse, the government did not have clear visions of the information age while the Clinton=Gore Administration certainly envisioned the future in their industrial policy.[13] A combination of these misleading macroeconomic policies and lack of appropriate industrial policy in Japan gave business sectors such an incorrect signal that the government encouraged businesses related to public works instead of high technology venture businesses. Moreover, private business sectors embraced the incentives for receiving government's easy money rather than earning profits from market competition by producing goods and services that met consumers' updated demands.

Consequently, Japanese private sectors missed dynamic business trends in the midst of the information technology revolution and hesitated to take business risks and invest in the new technology. It seems that economic resource allocation in the "lost decade" was mainly focused on conservative governmental sectors rather than on innovative private business sectors. Here again, economics tells us that wealth may be redistributed via government budgets but wealth can never be generated there.

4.4 Revisiting Japan's industrial policies

Reviewing the Japanese government's policies relating to the telecommunications industry, deregulation began in 1985 when the Nippon Telegraph and Telephone Public Corporation was privatized[14] as NTT (Nippon Telegraph and Telephone Corporation) and the market was liberalized for new startups. Right after the deregulation, several new common carriers started their businesses and many new information network service companies joined the market. Accordingly, investment in information and communications technology had increased throughout the 1980s.

The investment boom in the 1980s, however,

13 Backgrounds of this failure are considered in the following subsections.

14 This is not a perfect privatization but a kind of quasi-privatization because NTT has a special semi-governmental status under the NTT Law that obliges the government to hold at least one third of NTT's share. Besides, NTT does not have freehand in their business but has several constraints in its management under the law. Constrains include not only obligation of universal service but also government's approval regarding business plans, organizational structures, corporate governance, appointment of top managements, etc.

Table 4-4. Growth of nominal investment in information technology

(annual percent changes)

		1981-85	1986-90	1991-95	1996-2000
J	Investment in ICT	18.7	14.5	2.2	7.2
P	Hardware	17.6	10.0	2.6	5.3
N	Software	34.0	40.0	2.0	12.9
U	Investment in ICT	14.0	5.6	8.7	13.2
S	Hardware	12.8	2.5	7.6	10.8
A	Software	19.2	14.5	10.8	17.0

Source: Selected data from Shinozaki (2003), p. 94, Table 5-7.

ended suddenly in the early 1990s whereas the investment boom in the U.S. had just begun at that time. Coincidentally, information and communications technology has progressed further and changed its nature from simple high-performance automatic transaction machinery to effective business communications tools, as we discussed in the section 3.3. Driving forces of this change were the Internet or the underlying digital technologies of TCP/IP (Transmission Control Protocol/Internet Protocol) and the router network system, which made drastic transformations in the information network system architecture.

In other words, a telephony network or an expensive switched network system became a legacy system in the form of a data communications network. Instead, the new network system based on an inexpensive router technology dominated the data communications network all over the world. This technological change inevitably affected market conditions in the telecommunications industry (table 4-5).

Unfortunately, government policies did not keep up with this transformation. As policy makers' basic concept of the industry remained that in the legacy telephony age, arguments about the policy for the telecommunications industry were mainly focused on issues about the reorganization or breakup of NTT and its group of companies and the reform of the NTT Law that had been enacted in 1985 when NTT was privatized. One of the major reasons for these biased arguments is that, in accordance with the reorganization or breakup of NTT, the NTT Law should have been reviewed in 1990 to facilitate a pro-competitive market. The deadline, however, was extended twice: in 1995 and then in 1997. These arguments wasted precious time in the agile digital age. The resultant reorganization (not breakup) of NTT in 1999 still seems imperfect and tentative while the market conditions have been forcefully changing.

After all, government policy allowed NTT and its group of companies to be gigantic and dominant in the telecommunications market even after the market was liberalized. Thus, NTT's business strategies dominated markets that involved information and communications technology. This state of affairs partly but significantly affected the slowdown of the transition into the Internet-based information age because it seems apparent that NTT adhered to the switched network system instead of the router network system of TCP/IP technology. NTT had invested much in the expensive switched network system for a long period of time given that they

Table 4-5. Mutation in state of technology and network business

Periods	~ 1980s	1990s	2000s	2010s? ~
	Legacy network age	Transforming age		Ubiquitous network age
Technologies	Analogue	Digital		
	wired only	wired + wireless (FMC)		
	Narrow Band			Broad Band
	Copper Cable Line	(xDSL)		FTTH
	Switched network	TCP/IP, Router		(Next Generation?)
	Telephony	Internet		
Major Contents	Voice	Low Volume Data (text)	Medium Volume Data (picture)	**Extra-high Volume Data (video)**
Charge	Charge on Access Time & Distance	Flat Rate (Stay Online)		New Business Model?
Remarks	Business Oriented Computing → Ubiquitous Computing (Consumer's viewpoints) (Expansion of related industries) (Markets merge or integration) (Security Issues)			

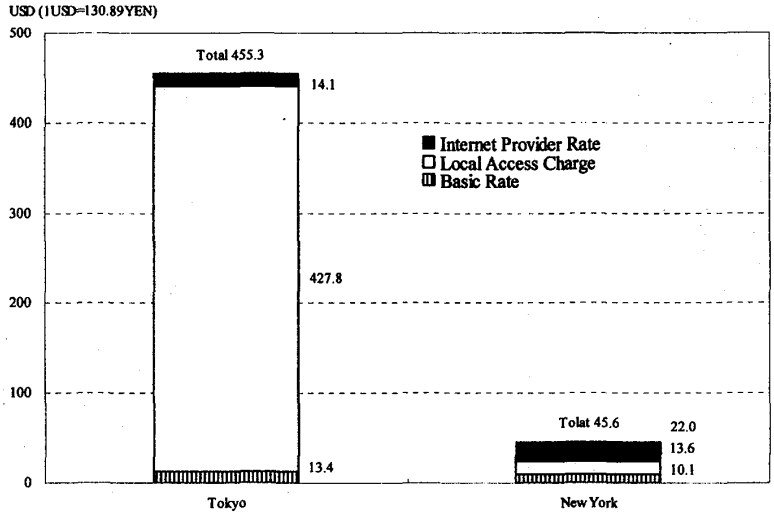
Source: Author's original concept.

were a government company and built a fine-tuned charging formula based on their switched network system, so that NTT kept charging by specific tariff that depended on access time and distance.

These business strategies, however, were a huge impediment that prevented Japanese business from reaping the benefits of the information technology revolution, even though their strategies were surely appropriate for their own business goals as a quasi-private company.[15] In the Internet-based information age, it is essential that network users be able to "stay online" and pay according to a "flat rate" formula, which is far from NTT's business strategies of the 1990s. Under NTT's business model, network users were charged in such a way that they had to pay a dime every three or five minutes for local access in addition to a monthly basic charge of

15 It seems that the Japanese government's policies in telecommunications industry were not exactly appropriate for both NTT and its competitors. As for NTT, they had a lot of constraints by the NTT Law designed specifically only for NTT although they kept an advantageous status as a gigantic quasi-private company. Under the law, NTT could not manage their business flexibly and speedily because they had to negotiate with government ministry and/or Diet members for getting approvals when NTT tried to transform their business in accordance with changes in the market conditions or taste of users demand. That made NTT conservative in the telecommunications market. As for competitors, they were still tiny and handicapped challengers but forced to confront a gigantic and conservative competitor of NTT, which is an indispensable competitive disadvantage of the competitors.

Figure 4-1. Rate of the stay-online Internet use as of 1999



Source: Cabinet Office (2004) p.3, Figure I-2.

thirteen dollars. As a result, network users were charged $455 a month if they stayed online all day (figure 4-1). In Japan the use of the Internet was ten times as expensive as it was in the U.S. even though Japanese internet providers offered lower rates than did U.S. providers.

Assuming "all-day" use may be extreme, but even the use of the Internet during business hours, from 9 a.m. to 5 p.m., was still too expensive. It was ten to fifteen dollars a day for local access charge only. The benefit of network externality can be attained in such a way that all users, from consumers to producers, from small firms to big names, are able to access a network at a reasonable rate. Unlike large companies that could afford a leased line, small business proprietors, independent contractors, and individual consumers were able to access network only via dial-up in those days. Hence, it could be concluded that in the 1990s the Japanese telecommunications industry did not provide appropriate access service by which every user could stay online and gain the benefit of network externality.[16]

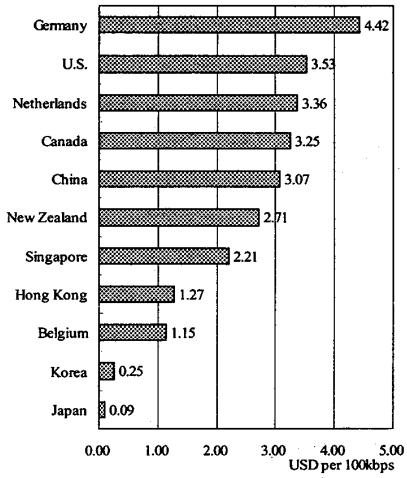
4.5 Koizumi Reforms and e-Japan Strategy

Having said all that, the situation has changed somewhat since 2001 because the Japanese government's macroeconomic and industrial policies have changed from those of the 1990s. Over the last five years the Japanese government has put together aggressive policy packages that resulted in positive outcomes in industries related to information and communications technology. When Prime Minister Koizumi took office in 2001, fiscal expenditure cuts were the top priority in his policy agenda and he began structural reforms toward his policy goals of small government.

The Koizumi Administration also demonstrated the leadership needed to promote investment in information technology under the "e-Japan Strategy"

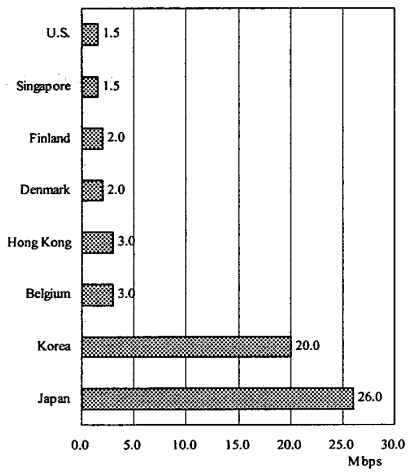
16 In the mid 1990s, there were 6.5 millions private business establishments of which small businesses run by individual proprietorship, not incorporated, amounted to as much as 3.5 millions. On the other hand, there were only 60 thousand firms that employ 100 employees or more. Furthermore, about 1 million incorporated establishments employed only 4 employees or less. Therefore, it is important to consider small businesses rather than big names when we examine the benefits of network externality.

Figure 4-2. Broadband access rate per 100kbps



Source: Cabinet Office (2004) p.5, Figure I-4

Figure 4-3. Broadband access speed



Source: Cabinet Office (2004) p.6, Figure I-5.

policy packages. As policy makers realized the importance of information technology and its dynamic potential, they had a sense of urgency that Japan was far behind not only a leading country like the U.S., but also several Asian countries like Korea and Singapore. Hence the launch of the e-Japan Strategy in 2001, setting aggressive goals for Japan to be a leading country within five years in the area of high speed network infrastructures and the effective use of them. This, in turn, would allow Japan to regain the competitive edge in the global economy.

So far, this policy mix seems successful. Now, the highest levels of broad-band and wireless communications infrastructures are available with the lowest service rate in the world (figure 4-2, 4-3, and 4-4). As for the wired broad-band market, the government strongly supported new business by enforcing a pro-competitive legal framework when several newcomers started up businesses and competed with NTT in the ADSL market. The Ministry of Posts and Telecommunications, a regulation authority of the telecommunications industry, provided guidelines that put pressure on NTT to open its wired access network to newcomers. In addition, the Fair Trade Commission strictly enforced the Anti-trust Law in the ADSL market.

Unlike the wired network market that has a long history of government business, the wireless network market has been so competitive because the history of cellular phone service is relatively new and NTT Docomo, a cellular phone service company and one of NTT's affiliates (spun-off in 1992), is a purely private company rather than a quasi-government company. Although analogue wireless service was started in 1979 by the former NTT as a government company, the market had been very small until 1994 when the market began expanding due to deregulation and the introduction of new digital technology (table 4-6). Therefore, competition really began in the mid 1990s. Since then, cellular phone companies have invested intensively in the enhanced wireless infrastructure and have provided a variety of new services such as Internet access service via cellular phones. As a result, the market is extremely competitive, compared with the wired network service market.

Although Japan failed to transform the telecommunications business from a switched network

system to the Internet access system in the 1990s, Japan has jumped into the broad-band and mobile Internet access system leap-frog style in the 2000s (table 4-5). Now Japan is ready to expand the new frontier of the ubiquitous computing information age. We therefore should not be too pessimistic about the growth potential in Japanese telecommunications and related markets. We should instead ensure that Japan has a huge opportunity in the next generation network of broad-band, mobile, and ubiquitous computing.

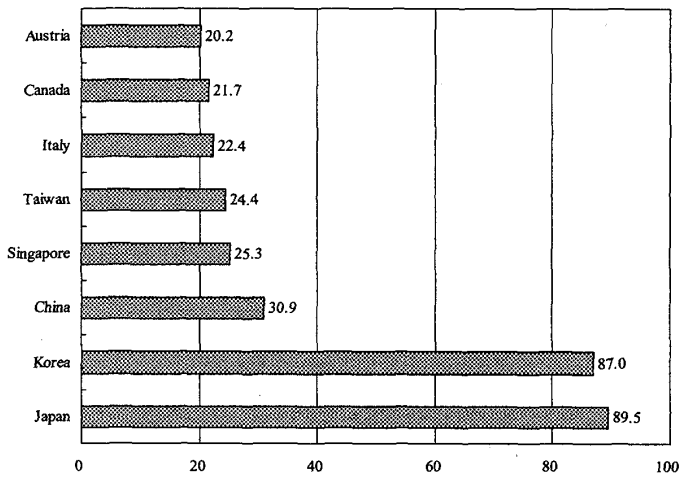
5. Opportunities and new challenges

As analyzed in the above sections, the Japanese economy has the potential to achieve three percent growth given continuous corporate reforms and the appropriate policy mix. The Japanese economy seems to have undergone several important reforms in both the private and government sectors since the 1990s. In this sense, the last decade was not only the "lost decade" but also the "born-again decade," which enabled the economy to prepare for the transition into the Information Age. In the final section of this paper, we will consider our course of the new state of technology. We will then list what Japan should do hereafter to realize a vigorous economic growth in the new dimensions of the information age.

5.1 Opportunities for the Japanese economy

As shown in table 4-5, information technology keeps changing. In the 1990s, changes were represented in the form of significant transformations: from analogue to digital; from a switched network system to a router (TCP/IP) network system; from charging according to access time and distance to charging a flat rate; and from intermittent access to staying online. Now, these shifts are different changes: from narrow-band to broad-band, from fixed (wired) network to fixed mobile convergence or FMC, from copper cable line to optical fiber bundle; from low-medium volume data communications to extra-high volume data communications; and from business oriented computing network into ubiquitous computing network such as home elec-

Figure 4-4. Internet access via cellular phone (percent of total cellular users)



Source: Cabinet Office (2004) p.7, Figure I-8.

Table 4-6. Expansion of cellular phone service market in Japan

Year	Number of users (millions of users)	Market size (trillions of yen)	Remarks
1979	Service started	-	By former governmental NTT
1992	:	:	NTT Docomo spun-off
1993	2.2	0.9	
1994	4.3	1.3	Deregulation & digital service started
1995	11.7	2.8	
1999	:	:	Internet access service started
2003	86.7	5.8	
2005	93.6	8.6	Figures in 2005 are estimated

Source: Information and Communications Statistics Database, Ministry of Internal Affairs and Communications.

tronics computing network.

These ongoing mutations imply that the market conditions are further transforming. Numbers of network users are drastically expanding. Varieties of such gadgets are being networked as music players, cellular phone receivers, PDAs, and networking home electronics as well as personal computers. What is more, optical fiber bundles make it possible for a telecommunications network to carry movies and TV programs like broadcasting networks or CATV networks do. Volumes of data transactions, therefore, are mushrooming.

One of the resultant effects is that the wall separating the telecommunications business from the broadcasting business seems to be disappearing, at least in technological terms. Accordingly, wide ranges of related markets seem to be merging and integrating together. Then, a huge level market, rather than small fragmented markets, is emerging in the broadband and ubiquitous information age. The emerging single market consists of the markets of broadcasting, telecommunications, content businesses such as animation production and movies, gadget manufacturing such as home electronics as well as computers.

Adam Smith, considered the founder of modern economics, pointed out that the size of the market determines the degree of the division of labor and the resultant productivity level. In his context, these expansions and integrations of markets improve the potential rate of productivity and resultant economic growth as a whole.

Furthermore, the economic ripple effect from production expansion would reach not only the computer and semiconductor industries that have expanded since 1990s but also the home electronics industry in this ubiquitous age. Unlike the computer market where U.S. companies have a better competitive advantage over Japanese manufacturers, the home electronics market is the area that the Japanese manufacturers still have competitive edge. Also, the Japanese content businesses, such as animation production and TV programs, have been popular outside of Japan, especially in Southeast Asia. Thus, it may be appropriate to say that there are huge opportunities and possibilities for Japanese industries to expand their business in the ubiquitous information age.

5.2 Challenges for the Japanese econom

Although emerging new information technology paves the way for business opportunities and aggregate economic growth in Japan, these benefits are not automatically realized without any effort. As we describe in the above sections, it is necessary for private business sectors to make continuous efforts in business process reengineering and business unit restructuring in this ubiquitous information age, especially those industries that are less enthusiastic about the effective use of the technology, such as the educational and medical service industries.

Furthermore, the government must have a clear agenda and vision for its primary policy, which should include reducing the budget deficit and rebuilding economic competitiveness. More precisely, it is necessary for the government to reduce the budget deficit of a small government instead of tax increase of a large government and to keep both inflation and deflation in check. With this policy mix, the government facilitates private business investment in new technology to re-boost productivity and to achieve vigorous economic growth.

As for industrial policies, the government's support should be concentrated on training employees of small-sized companies to help them prepare for the transition, which will be needed to deal with the wide ranges of institutional reforms in both the user and producer sides of technology. In particular, some of the underlying regulations in broadcasting and telecommunications industries are no longer appropriate today. Most of these regulations were established decades ago when the state of technology was completely different from that of today and broadcasting and telecommunications were considered as having different businesses models. It is inevitable that existing regulations become a legacy in the midst of innovations. Thus, revisions of broadcasting laws, telecommunications business laws, copyright laws, and other related regulations are required in accordance with technological changes.

Take copyright law for example. The ministry's guidelines prohibit the dissemination of the contents of TV programs or movies via optical fiber bundle in a telecommunications network to the home while doing so via a cable television network is allowed. From the consumer's viewpoint, however, it does not matter whether TV programs or movies are provided by a cable television network, telecommunications fiber to the home (FTTH) network, or a ground wave broadcasting network. Consumers just want to enjoy TV programs or movies on a clear, advanced screen and pay the lowest service charges.

Revisions of informal constraints are also required in several industries. The broadcast industry is known for exclusive and ambiguous business practices and conventions.[17] In the legacy state of network technology, broadcasting memberships were so limited that they were able to obtain overwhelming advantages in their business and maintain high margins in their income statements – a kind of monopoly rent. As a result, broadcasting firms dominated the market and built business practices and conventions that were to their own advantage. For instance, content producers are obliged to be at an unreasonable disadvantage against broadcasting firms. In some cases, content producers have virtually no right of secondary use of their own content

17 For detailed discussions, see Kishimoto (2005).

because broadcasting firms have exclusive bargaining power to put the content in their broadcasting network.

In addition, we have to reconsider regulations in the telecommunications industry that seem inappropriate for both NTT and its competitors. It may be plausible that NTT is given a freehand as a purely private firm under the regulations of the Telecommunications Business Law in general and strict enforcement of the Anti Trust Law, rather than as a quasi-private (or quasi-government) firm controlled by specifically designed NTT Law. Otherwise, resources contained in the NTT group could never be excised to their full potential in an emerging and huge integrated market of network service, nor in the global market. The application of fair trade rules and pro-competitive regulations is certainly important since huge gaps in market share or competitive advantage between NTT and other competitors apparently exist in several areas in the telecommunication market due to incomplete liberalization and privatization over the past twenty years. One reasonable solution may be to break the quasi-private businesses of existing NTT group into two categories of business and operate by completely different standards without any ownership ties: (1) quasi-governmental businesses that operate and maintain physical assets of legacy copper line access networks and rights of way or conduits as a provider of public goods and services; (2) purely private network businesses that involve next generation networks and value added network services in the competitive market both domestically and globally. Thus, it is essential to examine the benefits of freehand for NTT's business and reorganization of the NTT group for prospecting the network industries in the next generation.

Finally, it would be helpful to consider integration of a couple of ministries and regulation authorities that commit and regulate network related industries, respectively. To be sure, it might be reasonable for a couple of authorities to commit to common policy goals separately from different point of views, allowing each ministry to compete to prepare better policies that meet technological progress and updated consumer demand. But if they just put their energy into merely expanding or defending their own territories of authority, it would simply result in waste of precious time in an agile digital age. To avoid these time wasters, the reorganization of regulation authorities might be worth considering.

The challenges mentioned above are not the entire list but just examples of what we need to address in the ubiquitous information age. One of the most important things we have to stress here is that both the private business sector and the government should make continuous efforts to be able to receive "reform dividends" and to reinvest them into information and communications technology.

6. Conclusion

As we demonstrated in this paper, an annual productivity growth rate of around 2.5 percent is the fundamental trend that the Japanese economy still preserves as a potential minimum, while investment in information technology pays off in productivity resurgence when it was combined with business process reengineering and institutional reforms.

Therefore, to ride the dynamic waves of the information technology revolution is one of the significant driving forces of a vigorous economic growth. Given appropriate corporate reforms and policy mix, we can conclude that in the years ahead it would be feasible for the Japanese economy to grow at a clip of around 3 percent in terms of the real GDP or around 5 percent in terms of the nominal GDP.

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