

Japan Vision 2050

Principles of Strategic Science and Technology Policy
Toward 2020

April 2005

Science Council of Japan

Japan Vision 2050

Principles of Strategic Science and Technology Policy toward 2020 *¹

Summary

National Vision

By the year 2050, Japan will establish itself as a nation of dignity *² and will build Asian trust.

Targeted Missions in the National Vision

Challenges confronting humankind in the 21st century are: global environmental degradation, population growth, the widening North-South divide, and the sustainability of human society.

Our national vision will be achieved by addressing these globally shared challenges in a way that is both environmentally and economically sound.

Developing human resources is the bedrock of a nation. Promoting strategic utilization of science and technology and cultivation of human resources for the next generation in an integrated and consistent manner is a matter of utmost importance.

Key Issues in Targeted Missions

(1) Implementation of educational reform; (2) realization of democratic society; (3) realization of a society built upon equal-partnership *³; (4) firm national security, safe and free of fear, (5) development of infrastructure for healthy lifestyles; (6) formulation of industrial, economic, labor and employment policies; (7) coexistence with nature and restoration of nature; (8) restoration of national land and regions; (9) development of information and communication systems; and (10) energy and environment. Japan will achieve our targeted mission in each of these areas.

Time Framework for Targeted Missions

A set of three five-year plans will be drawn up and implemented over a period of 15 years from 2006 to 2020

Principles of the 3rd 5years Science and Technology Policy:2006-2010

The economically and environmentally sound science and technology policy must be built that encompasses fiscal years 2006-2010: the policy must take into account the missions and the national visions outlined in this report.

(*1) This is an English translation of a report published April 2, 2005, from the Science Council of Japan entitled 'Principles of Strategic Science and Technology Policy of Japan' that was written in Japanese.

(*2) The word 'dignity' used in this report implies a meaning of 'a state of decency, grace, honor, character, pride, eminence, self-esteem, prestige, self-respect, stateliness'

(*3) As seen many places in the world, Japan has been built strongly on 'male dominant societal structure'. In this report, we emphasize not only gender inequality, but emphasize a society that is fair and just regardless of gender, age, ability, nationality, etc.'

Japan Vision 2050 – Principles of Strategic Science and Technology Policy toward 2020

<Beginning of the 21st Century>

<2006⇒2020⇒2050>

<2050>

Bedrock of the nation is “building people”

- (1) Nurture individuals to develop a historical view of civilization so that they will be able to think strategically
- (2) Switch from a career formed through pure culture to one formed through blending
- (3) Get rid of the insular mindset and replace it with an open mindset

Strategic Use of Science and Technology

- (1) Place top priority on harmonizing the environment and the economy
- (2) Place emphasis on programs that attach importance to soft power
- (3) Management based on appropriate research evaluation and a high degree of transparency

2036-2050

2021-2035

Handling state issues

(2006-2020: 5 years x 3 terms)

- Educational reform
- Realize a society of equal-partnership
- Realize a convivial society
- Ensure the national security
- Social infrastructure for a healthy, secure life
- Industry, economy, labor and employment policies
- Co-existence with nature and rejuvenation of nature
- Rejuvenation of the country and region
- Develop an information communication system
- Energy and the environment

Achieve the targeted mission

Handle common global issues

Coexistence of the environment and the economy

Realize the national vision:

State with a sense of dignity

Asian trust

Global issues:

Sustainability of human society

-Degradation of Earth’s environment

-Population growth

-Expanding North-South Disparity

Japan Vision 2050
Principles of Strategic Science and Technology Policy toward 2020

Contents

| | |
|--|----|
| I. Introduction | 1 |
| II. Historical background of Japan and of the World in the 20 th Century | 3 |
| 2.1 Comprehensive Examination of Science and Technology | 3 |
| 2.2 Evolution of Modern Industrial Society in the 20 th Century | 3 |
| 2.3 Government-led Modernization of Japan | 4 |
| 2.4 Japan's Overseas Expansion that Could neither Admit Cultural Universality nor Diversity – and Its Aftermath | 4 |
| 2.5 During the Cold War Era, Japan Became an Economic Giant within the Framework of the Japan-US Alliance | 5 |
| III. Characteristics of the 20 th Century | 5 |
| 3.1 Rapid Development of Science and Technology, WWI, WWII, and the Cold War | 5 |
| 3.2 Benefits and Social Changes Brought About by Advances in Medical Care, Public Sanitation, and Life Science | 6 |
| 3.3 Science and Technology, and Improvement of Livelihood | 7 |
| IV. Issues Facing the World in the 21 st Century | 7 |
| 4.1 Global Issues Facing Mankind | 7 |
| 4.2 Population Explosion, Increasing Poverty | 7 |
| 4.3 Environmental Issues That Threaten the Sustainability of Human Society | 8 |
| 4.4 Expansion of the Gap Between North and South as a Destabilizing Factor in Global Dynamics | 8 |
| 4.5 Millennium Development Goals (MDG-s) | 9 |
| V. Challenges Facing Japan in the 21 st Century | 9 |
| 5.1 Japan and Asia in the mid-21 st Century | 9 |
| 5.2 National Vision and Targeted Missions | 10 |
| 5.3 Strategy for Building Asia's Trust | 11 |
| 5.4 Perception of Strategic Science and Technology Policies | 12 |

| | |
|--|----|
| VI. Targeted Missions of Japan's Science and Technology Policy and Strategy | 12 |
| 6.1 Tackling Environment Issues | 12 |
| 6.2 Science and Technology Policy and the Government's Targeted Missions | 13 |
| 6.3 Cooperation with Asian Countries | 13 |
| 6.4 Large-Scale Science and Technology Projects: Strategic Thinking and Targeted Missions | 13 |
| 6.5 Formation of Network of Individuals Attaching Importance to Soft Power..... | 14 |
| VII. Targeted Missions in the Science and Technology Policy | 15 |
| 7.1 Tackling Priorities | 15 |
| 7.2 Appropriate Evaluation and Highly Transparent Operation | 15 |
| 7.3 Cultivation of Individuals with a Sense of the History of Civilization and Capable of Thinking Strategically | 16 |
| VIII. The National Vision that Japan Should Aim for, Targeted Missions, Science and Technology Policies | 16 |
| <i>A Dignified Nation That Aims to Meet the Demands of both the Environment and the Economy</i> | |
| (1) Educational Reform: Human Resources Development is the Bedrock of Nations | 17 |
| (2) Becoming a Democratic Society..... | 19 |
| (3) Realizing the goals of a convivial society..... | 20 |
| (4) Ensuring Japan's Security: Safety and Security | 21 |
| (5) Social Infrastructure for Healthy, Wholesome Life..... | 22 |
| (6) Industrial, Economic, Labor, and Employment Policies | 23 |
| (7) Coexisting with Nature, Regenerating Nature | 25 |
| (8) Regenerating National Land and Regions | 26 |
| (9) Development of the Information-Communication System | 27 |
| (10) Energy and the Environment | 28 |
| IX. Summary: Principles of Japan's Science and Technology Policy | 29 |

Japan Vision 2050

Principles of Strategic Science and Technology Policy toward 2020 *¹

A nation's policy must be based on a concrete vision backed up by the philosophy and thought firmly grounded perspectives of a human and world histories.

I. Introduction

In Japan, the Basic Law on Science and Technology was enacted in 1995. A program for basic science and technology was drawn up for the first 5-year period (1996-2000), and a further program was compiled for the second 5-year period (2001-2005). In the former, a total of ¥17 trillion (157 billion dollars) was invested on research and development of science and technology; in the latter, a total of ¥24 trillion (221 billion dollars) was invested for the same purpose. The amount invested during the two periods is equivalent to roughly 1 percent of Japan's GDP. This is a substantial amount, even taking into consideration the differences in social systems like education, research, and employment, among economically advanced countries. It is a manifestation of Japan's strong commitment to science and technology, and of the high expectations that the Japanese people attach to it.

As the third 5-year period approaches, we need to first examine, objectively, the social background against which the basic program for science and technology was drawn up in the first two periods. In 1989, the first year of Heisei, the Nikkei stock index peaked at ¥39,000, then plunged to the ¥20,000 mark during the subsequent two years. The first 5-year plan was therefore implemented in response to the collapse of the bubble economy created by the "Japan as Number One" model, hidebound by the iron triangle of government, industry, and bureaucracy. The second 5-year plan was undertaken against the background of administrative reforms that were carried out in response to, among other things, the continuing economic downturn, dwindling tax revenues, and a sense of social stagnation. These administrative reforms included the restructuring of the social infrastructure, involving turning state-run universities, research institutes, and hospitals into corporate entities. The discrepancy between the rapidly changing trends of globalization and the traditional Japanese socio-economic structure became very pronounced during this period.

(*1) This is an English translation of a report published April 2, 2005, from the Science Council of Japan entitled 'Principles of Strategic Science and Technology Policy of Japan' that was written in Japanese.

In this paper, we summarize the discussions of the Science Council of Japan, which represents Japan's scientific community, with a purpose of making contribution to preparation of the basic plan for the third 5-year period, which will start in 2006. The views presented here are by no means the only ones that were expressed, but they do represent the basic perspective and philosophy for the third 5-year plan. This perspective is in tune and in line with the views of the international scientific community and of the "Japan Perspective" by the Science Council of Japan in 2002, concert with those views, which include the declaration by the Club of Rome of "The Limits to Growth" (1972) the United Nations Brundtland Report entitled "Sustainable Development: Our Common Future" (1987), It is not 1978 but 1987. the report "Our Common Journey" (1999), which the National Research Council of USA submitted in concert with the Brundtland Report, and with the report of the Royal Society of the United Kingdom "A European Perspective" in 2000.

An view of these world opinions, the International Council for Science (ICSU), in conjunction with the United Nations Educational, Scientific and Cultural Organization (UNESCO), held an international academic conference in Budapest in 1996. Scientists from all over the world gathered at the conference to declare their commitment to "science and society, science and policy, science and peace and development." The 2002 World Summit for Sustainable Development (WSSD), in Johannesburg, responded by inviting ICSU to attend as an organization of major responsibility representing the international academic community. In the meantime, other international bodies were being formed. They include the Inter-academy Panel (IAP) (established in 1995, but did not begin operating actively and substantially until the general meeting was held in Tokyo in 2000), the Inter-academy Council (IAC), 2000, and the Science Council of Asia, 2000. These international bodies have enthusiastically undertaken various activities, including making policy recommendations to the United Nations and others.

The Science Council of Japan has played pivotal roles in these international scientific bodies as chairman, board member, board academy, and so on, gaining in the process high respect and trust. This typifies Japan's standing in the scientific community. The Science Council of Japan is involved in various activities, including implementing reforms of its own structure and functions, discussing international trends, and debating what the scientific community in general and the Science Council of Japan in particular should do as administrative reforms are carried out in Japan. The Council is also promoting cooperation between the scientific community and the general public, and furthering the awareness of the Japanese people. In this way, the Council is urging the scientific community to take the initiative in acting in a socially responsible manner.

In keeping with global trends and the ideas of scientific communities at home and abroad, and after deliberations at General Assemblies and in Combined Committees, the Science Council of Japan has obtained the approval of the Steering Committee to make a proposal on what Japan's strategy for scientific policies should be.

II. Background of Japan and of the World in the 20th Century

2.1 Comprehensive Examination of Science and Technology

In discussing Japan's science and technology policies for the coming years, it is essential to have a proper perception of world history which will enable a comprehensive understanding of Japan and the world at the beginning of the 21st century. All policies must be based on such an understanding if they are to be effective, and science and technology policies, while responding to the demands of the current age, must fully take into consideration their historical significance.

2.2 Evolution of Modern Industrial Society in the 20th Century

The 20th century was the century in which industrial society based on manufacturing was realized on a global scale. The origin of industrial society is for the most part found in modern European civilization, so the latter held an extremely important position in world history from the Renaissance, through the industrial revolution, and in the ensuing period. At the core of modern European civilization is the mindset that relied on science to understand the basic principles of nature and strove to develop science and technology that would make such an understanding possible. As a result, in industrialized countries, the daily life of people changed with dizzying speed over short timescales.

The changes in human society that occurred during the 20th century occurred at a speed faster than at any other time in human history and were more radical than anyone ever imagined to be possible, thus bringing about dramatic changes in the way human society functions and human beings think. The astounding advances made in the modes of transportation substantially reduced the time it takes human beings to travel anywhere on the earth. The rapid progress made in the means of transmitting and receiving information enabled a large number of people to share information instantly. It is because of the rapidity with which changes have occurred and the radical nature of those changes that we now see so many phenomena that put into question our basic assumptions, sense of values, norms of living, and other attitudes cultivated over the ages. It is essential that we start by realizing that this constitutes the undercurrent of "globalization" that defines the 21st century, and that this undercurrent is at the root of most of the issues confronting mankind around the world.

As is well known, with the astonishing improvement in navigation technology,

the so-called Age of Discovery of the 15th and 16th centuries saw European countries begin advancing to every corner of the world. The European countries that significantly developed their industrial sectors and joined in the 19th century competition for colonies are remembered by the term “imperialism.”

2.3 Government-led Modernization of Japan

Amid the global dynamics of the mid-19th century, Japan was still ruled by the Tokugawa shogunate which had enforced its policy of national seclusion for over 250 years since the early 17th century, but was about to experience the Meiji Restoration and begin modernizing. In the Meiji period, led by its enlightened government, Japan strove to develop its social capital including its educational system, and put in place a social system and infrastructure based on a policy of building a rich country with a strong military through the encouragement of strategic industries. These efforts enabled Japan to become one of the few Asian countries that managed to avoid being ruled by any of the Western powers. There are various reasons why Japan was able to avoid Western domination, including the cultural maturity achieved in the preceding Edo period, the latter’s high level of technology, and the maintenance of peace during the Edo period that enabled Japan to avoid becoming an effete state. Instead, Japan was soon to be recognized as a modern state, but Meiji Japan was in fact a very weak nation entirely dependent on the West for its science and technology, engineering, and energy resources.

2.4 Japan’s Overseas Expansion that Could neither Admit Cultural Universality nor Diversity – and Its Aftermath

At the turn of the 19th century, Japan was about to become the first modern industrial state in Asia. (There are several definitions of the term “Asia.” The term used in this report refers to a “wider Asia” that includes not only East Asia but also South Asia and West Asia.) While striving to revise the unequal commercial treaties with the Western powers that it concluded in the closing days of the Edo period, and against the background of a complex struggle for supremacy among the civilized nations of the West (including the emergence of the United States as a Pacific power), Japan began to clash both economically and militarily with its neighboring countries. Through military clashes with China and Russia, Japan gained Taiwan in 1895, annexed Korea in 1910, and founded the state of Manchukuo in 1932. As happens to all countries at one time or another, Japan could not avoid being embroiled in extremely complicated international politics and dynamics. These developments inevitably triggered friction in a wide range of areas between Japan and its Asian neighbors, as well as in Japan’s dealings with Britain, France, Germany, Russia, the US and others. At the same time, the policy of new empire adopted by Japan became one that had no room for cultural diversity. Its lack of insight and sensitivity to international political trends contributed to the emergence of anti-Japanese sentiments in various parts of Asia, which still persist to

this day. Japan's defeat in the Pacific War sixty years ago may be regarded as a defeat caused by Japan's inability to admit the universality and diversity of civilizations.

2.5 During the Cold War Era, Japan Became an Economic Giant within the Framework of the Japan-US Alliance

In 1945, war-torn Japan came under the rule of the United States and various fundamental reforms were instituted that changed the very fiber of Japanese society. The Cold War broke out and divided the world into East and West camps. What enabled Japan to fully recover under such conditions was the special procurement demands brought about by the Korean War (1950-1953). Subsequent high economic growth was achieved against the backdrop of the Vietnam War (fought from 1954 to 1975; Vietnam gained independence in 1954, after which it was divided into North and South Vietnams). Another factor that contributed to Japan's economic growth was that, under the Cold War that lasted until the end of the 20th century, Japan was able to make relatively safe industrial investments under the Japan-US Security Treaty. Because of the social system and the diligence of its people, protected by the framework provided by the United States and under the economic growth policy of its government, Japan was able to devote itself to expanding its economic strength without the pressure of making decisions independently. In this way, Japan became the second biggest economy after the United States.

III. Characteristics of the 20th Century

3.1 Rapid Development of Science and Technology, WWI, WWII, and the Cold War

The 20th century can be characterized as the science and technology century. In this connection, we must not overlook the fact that the development of science and technology was realized as a result of a massive amount of research and development invested for military objectives. The 20th century was a war-torn era that saw two global wars and the Cold War that affected the whole world. In next to no time, new technologies become investment targets for military objectives and are used in armed conflicts. For example, it was in 1903 that the Wright Brothers realized one of mankind's most cherished dreams: flying. But only 11 years later, in World War I, aircraft were employed as a weapon. In World War II, the destructive power of aircraft was demonstrated through their combat efficiency – surpassing even that of battleships – and by carpet-bombing strikes, thus consolidating the aircraft's status as the principal weapon in modern warfare.

The atomic bomb, which was dropped over Hiroshima and Nagasaki to help bring World War II to an end, is a weapon developed by applying the relativity theory and the quantum theory, two important scientific discoveries made at the beginning of the 20th century. Large-scale development investment was allocated for the Manhattan

Project to develop the atomic bomb by linking science and technology with warfare. The success of the project spread to the energy field, so that today nuclear power accounts for 30 percent of Japan's electric power supply. The race to develop missiles and the Apollo Program, which was part of NASA's space exploration program, may also be viewed from the same perspective. Satellite television hookups and satellite observations, which we today take for granted in our daily life, the development of space technology, and the basis of information technology such as the computer and the Internet, are mostly technologies originally developed for military purposes, principally by the United States.

3.2 Benefits and Social Changes Brought About by Advances in Medical Care, Public Sanitation, and Life Science

The causes of communicable diseases, which have brought so much suffering to human beings, came to be better understood, and it began to be possible to adopt measures to counter some of them. Nutritional conditions improved and progress was made in medical care and public sanitation. Many communicable diseases – i.e., smallpox (the Jenner vaccination was discovered at the end of the 18th century), tuberculosis, tetanus, typhus, cholera, and polio – threatened the health of people in many societies in the mid 20th century. Improvements in nutritional conditions and public sanitation contributed greatly to reducing these communicable diseases. Today, a good number of them have been virtually eradicated thanks to the establishment of effective medical treatment.

The average life expectancy, which is estimated to have been 25 years during the time of the Roman Empire, was 40 at the turn of the 20th century, but reached 80 a hundred years later in the year 2000. The world population 2000 years ago is estimated to have been 100 million. A thousand years later, this had doubled to 200 million, reaching 500 million 500 years ago and 1.6 billion at the beginning of the 20th century. The population increased to 3 billion in 1970, and today it exceeds 6 billion. The short time it took the population to double, and the extension of life expectancy in the past one hundred years, are nothing short of astonishing.

The discovery of the DNA double helix structure in the middle of the 20th century and the decoding of the human genome base sequence in 2000, among other discoveries, have swiftly and dramatically advanced our scientific knowledge of the mystery of life and the potential for application of that knowledge. It goes without saying that computers, the discovery of epoch-making analytical methods and equipment, and automation, just to name a few, contributed greatly to these breakthroughs. These advances in medicine, life science, and science and technology, have benefited human society immeasurably. On the other hand, our common-sense view of life, reproduction, death, family, and so on, that have been developed over the

ages and built up by tradition, have been changing so swiftly during the past 50 years that it is also true that we are being forced to review conventional notions of bioethics and social institutional design, among other things.

3.3 Science and Technology, and Improvement of Livelihood

The quality of daily life has improved dramatically, not only in having homes with water and sewerage, and in improved clothing, but also through improvement of productivity in industrial goods and dramatic improvement in quality control. The spreading of books, newspapers, radio, movies, television, computers, mobile telephones, and so on, have changed the way we live, use information, and spend our leisure time. The proliferation of refrigerators, washing machines, air conditioners, and other household appliances, as well as dramatic improvement in the modes of public transportation and the spread of automobiles, have expanded markets and increased material affluence to exponentially boost the comfort and convenience of our daily life. The development of aircraft has made flying the principal mode of international travel, so that now 18 million Japanese travel abroad every year. The key industries shifted from primary (agriculture, etc.) to secondary (manufacturing, etc.) and, with the increase in economic affluence, society was transformed from rural life to urban life, the latter characterized by enhanced material affluence. The global trend toward large-scale production of industrial goods and the global market economy have both played a huge part in improving our livelihood. Most of these changes in society and lifestyle are changes that no one could foresee a hundred years ago, nor even fifty years ago.

IV. Issues Facing the World in the 21st Century

4.1 Global Issues Facing Mankind

The global issues facing mankind are the products of history up to the end of the 20th century. The main issues affecting the world in the 21st century may be organized in various ways, but we will categorize them into degradation of the global environment, expansion of North-South divide, and population increase. Each of these issues is a serious threat to human society's sustainability. The issues shared by the whole world in the 21st century may be summarized in two words: sustainable development.

4.2 Population Explosion, Increasing Poverty

The demographic issue is especially serious. The benefits derived from the development of medical care and public sanitation are especially significant. The world population, which was 1.6 billion in 1900, surpassed the 3 billion mark in 1970. It exceeded the 4 billion mark in 1980 and the 6 billion mark in 2000. It has now reached 6.4 billion. Not only is it continuing to increase, but 80 percent of the population are living in developing countries. Twenty percent of human population now live in

extreme poverty (i.e., on an income of less than \$1/day) and structural inequalities appear to exist. To illustrate, the new communicable disease HIV/AIDS first appeared in 1981. Since then, 20 million people have died of AIDS and 40 million people are currently HIV/AIDS, 70 percent of whom live in impoverished sub-Saharan Africa. Many factors are responsible for this tragedy, including population distribution and increase, religion, culture, ethnicity, and regional interests.

4.3 Environmental Issues That Threaten the Sustainability of Human Society

Environmental issues are widely known and many points have been made about them. Problems related to, among other things, energy, food, water, waste, global warming, environmental degradation, the spread of deforestation and desertification, and decreasing biodiversity, are today more serious than ever. The situation is such that the sustainability of human society is being threatened on a global scale. The question of how growth and environmental conservation should be harmonized within the context of globalization fueled by the demands of capital is becoming the issue, not only in advanced nations where energy continues to be consumed in large volume but also in countries like China, India, and Brazil, and in regions where industrialization is only now being promoted in earnest. Population is concentrated in cities (70 percent in developed countries, 40-50 percent in developing countries). “Megacities” or giant cities (generally defined as cities with a population of more than 10 million) are increasing in Asia and elsewhere. There is no predicting what effects, both positive and negative, such huge cities will have on the environment, economy, society, and so on. Thus it is very important to carry out scientific studies of their effects and to develop counter-measures to such effects.

4.4 Expansion of the Gap Between North and South as a Destabilizing Factor in Global Dynamics

The gap between North and South is expanding on various fronts. An estimated 1.25 billion people throughout the world are living in extreme poverty (those living on less than \$ 1 per day). Of these, 700 million live in Asia, 400 million in Africa, and 150 million in Latin America. In these regions, the average life expectancy at the time of birth is 40 to 50 years. The population growth rate, at over 2 percent, is very high in many of these regions, so a growing number of regional countries are suffering high rates of fertility and infant mortality caused by extreme poverty. Moreover, the changes in world population and religions that have occurred in the past 20 to 30 years are manifested most vividly in the sharp increase in the world’s Islamic population*². Social factors, such as insufficient educational and employment facilities and opportunities, can easily become a destabilizing element in any given regional community. Thus, poverty is an issue reflected in many of the problems afflicting the world today. Meanwhile, the world has become smaller as advances are made in the means of information communication and of transportation. Consequently, various

destabilizing factors in the global situation have emerged against the background of economic, cultural, religious and other differences such as North-South friction and the acceleration of population mobility. These factors are not only persistent but are expanding.

(*2) A comparison of the religious composition of the world population in 1980 (4 billion) and that in 2004 (6.3 billion) shows that 32.8%/32.9% were Christians, 16.5%/19.9% were Islam, 13.3%/13.3% were Hindus, 6.3%/5.9% were Buddhists, and 31.1%/28.0% were others. The sharp increase in the number of Islam is obvious. It is estimated that Islamic population will account for 30 percent of the world population in 2025.

4.5 Millennium Development Goals (MDG-s)

The United Nations “Millennium Summit” was held in 2000 in response to the rapid global changes discussed in this paper and the situation in which the sustainability of human society is endangered. During the summit, the 8 “Millennium Development Goals” were set and adopted by 189 member nations. Ten task forces carried out scientific factor analyses, made future projections, and studied the cost effectiveness of the solutions to be adopted. In January this year, the task forces announced ten feasible policy proposals. They have also initiated calls for UN member countries, especially those that are economically advanced, to make political commitments within the international framework. In September this year, the level of an implementation will be reviewed at summit level, and this will demonstrate the high expectations that the international community attaches to the proposals.

V. Challenges Facing Japan in the 21st Century

5.1 Japan and Asia in the mid-21st Century

In the 21st century, the Japanese population will age at an unprecedented rate, with the result that its economy will most likely stagnate. The Asian region as a whole, which includes Japan, will see its population increase from 3.7 billion today to 5 billion by 2030, accounting for nearly 60 percent of the world’s population. The economic growth rate in the Asian region is quite high today, which means its impact on the world economy will continue to grow, thus creating that much more load on the environment. Moreover, the aging of the region’s population will follow the pattern observed in Europe, the United States, and Japan. In other words, Asia is emerging as a region that will have a great impact on the way the world evolves in the 21st century. Being the nation that was first in Asia to succeed in industrializing, modernizing, and ultimately becoming an economic powerhouse, Japan is facing the most important policy issues of the 21st century, including how it should deal with and contribute to the development of Asia, and what it can do to help solve the environmental issues.

5.2 National Vision and Targeted Missions

The desired future of Japan should be examined carefully on the assumption that several of the situations at home and abroad as described above will definitely take place. There is room neither for excess pessimism nor excess optimism. If we familiarize ourselves with our own history and that of the outside world, calmly observe the effects of international trends and the momentum of the age that moves those trends, and view and think of the world objectively and comprehensively, then we should be able to come up with a clear national vision and targeted missions as the means of achieving that vision.

In respect of national visions it is necessary to set up a realistic timetable. This timetable should not be a short one, covering only several years. What we have in mind is one covering the period until around 2050. Those who turn age 60 in year 2050 would today be 14-15 year-old; those who turn 50 be 4-5. We can predict, with considerable accuracy, the composition by age of the population in 2050. It should be relatively easy to imagine what kind of life experiences and education people in these age ranges will have over the next 10 to 20 years, and the kind of national vision Japan will have by that time.

We need to have a number of targeted missions as policies based on such thinking, and a strategic idea and design that incorporate the timetable in that direction. The year 2020 would be the most appropriate timetable. Why? The year 2020 is 15 years from now. What was it like 15 years ago? In 1989, among other things, the Nikkei average peaked at ¥39,000 (dropping to ¥20,000 the following year; this triggered the collapse of the bubble); the Berlin Wall collapsed (two years later the Soviet Union disintegrated); and the Tiananmen incident broke out (how was China regarded in those days?). How time flies! The dynamics of international affairs in the coming months and years are expected to be faster than ever. This is why we set 2020 as our timetable. In this way, the government's medium-term and long-term plans will be understood more widely. Many of those with a stake in the various policies, instead of considering their interest for the next one or two years, will be able to adjust their interest over a longer span of time. This is the matter of political leadership, and this is the necessary condition of the political leadership.

In the 20th century, within the framework of the Cold War structure and helped by the diligence of its people, Japan achieved remarkable economic growth, so much so that the world eventually came to acknowledge Japan as an economic powerhouse. However, in the 21st century – the age of globalization – a resource-poor Japan, which has to rely on foreign supplies for most of its resources including energy and food among other things, will survive only if a peaceful international society is realized and

Japan actively contributes to solving issues on a global scale. At this juncture, what is particularly important in forming our national vision is to realize Japan's goal of establishing itself as a dignified nation and thereby regaining Asia's trust. At present, what kind of nation would Japan look like internationally if we stripped it of its economic strength as symbolized by its innovations and manufacturing industry? Meanwhile, there are a number of countries in Asia and Europe that, despite being smaller than Japan, are for various reasons respected and watched closely by the whole world. Japan was like that when it won the Russo-Japanese War, and even before that war was generally regarded with respect and admiration for its sophisticated culture and the honesty, diligence, and humanity of its citizens. Of course, in the 21st century, it is unlikely that anyone will find it desirable for the national vision to be defined in terms of only military or economic strength. The important thing is to cast aside the image of a manufacturing and mercantile nation cultivated over the past 50 years and aim to establish that of a dignified nation befitting the 21st century. We should be extremely proud that many products are sold under the Japan brand, and that in a number of ways Japan is demonstrating to the world that it is a "soft" power. In this sense, we should also be proud that many imitations of Japanese goods are sold abroad. A look at recent history makes it clear that originality and creativity, and the training of individuals with these qualities, are what are truly valuable. This is the essence of Japan, a dignified nation. Here, "dignity^{*3}" is synonymous with "elegance."

(*3) The word 'dignity' used in this report implies a meaning of 'a state of decency, grace, honor, character, pride, eminence, self-esteem, prestige, self-respect, stateliness'

5.3 Strategy for Winning Asia's Trust

In various parts of the world, as globalization advances, progress in international and regional economic partnerships is being made. The European Union (EU) is expanding, and Free Trade Agreements (FTA-s) are being established. In the Asian region, of which Japan is a part, the economy is growing at a dizzying pace, but at the same time poverty is spreading. There are still many regions where international cooperation and support are needed. Because of the catastrophe Japan brought to a number of Asian countries in the first half of the 20th century, relations of trust have yet to be fully established with those countries. From now on, it will be extremely important for Japan, a part of the vast Asia region, to tackle global issues together with its neighboring countries. When this is begun, although the pace will be slow, Japan will eventually regain Asia's trust.

Unless Japan is trusted in Asia, it is inconceivable that the country will be able to maintain the trust it has over the years established and preserved with the United States, the expanded EU, and wider international society. Thus, Asia's trust is very important to Japan's national vision.

5.4 Perception of Strategic Science and Technology Policies

Science and technology policies must be treated as ways of realizing Japan's national vision. The goal of these policies should not be limited to the development of industry using science and technology as a lever. Rather the goal should be to enable each and every human being to live a happy life. As history often demonstrates, science always creates new knowledge, advances understanding of the laws of nature, and arouses human curiosity and capacity for imagination. Sometimes science has the power to change society substantially. Examples include Einstein's 1905 paper and quantum mechanics. In all ages, science is the bright light on the horizon. By the same token, there is no guarantee that the growth of science and technology will by itself make people happy. In establishing science and technology policies, a mindset that attaches importance only to the short-term economic growth of the homeland based on a conventional concept of values and social structure is too narrow minded, and may actually serve more to inhibit than promote the vision of a dignified nation.

In this statement, after describing Japan's strategy for establishing itself as a dignified nation, thereby winning Asia's trust, and against the background of a set of unprecedented developments – global environmental degradation, expansion of the North-South divide, and population explosion, we will set as one of our targeted missions the addressing of issues related to both the environment and the economy with a view to rectifying circumstances that are preventing the establishment of a sustainable human society.

VI. Targeted Missions of Japan's Science and Technology Policy and Strategy

6.1 Tackling Environment Issues

Wrestling environment issues related the economic growth of Asia as a whole is one of the greatest challenges we face in the 21st century. As several billion people, including those in China and India, aim to modernize, reducing CO₂ emissions from the transport sector will be extremely important, and here the resources and environment technology Japan has accumulated can potentially play a significant role. Simulations of global warming, energy related science and technology, biotechnology, nanotechnology, and chemistry are all highly promising fields in science and technology. Not only for the government investing in science and technology, but also for individual businesses trying to solve these environment issues, such efforts will be highly appreciated and judged from the perspective of corporate social responsibility (CSR). It is precisely this kind of science and technology policy and research and development orientation that will enable Japan to establish itself as a dignified nation and to grow.

The imperative is the sustainability of human society through attaining compatibility

of environment and economy.

6.2 Science and Technology Policy and the Government's Targeted Missions

Even in fields other than the environment, especially in that of science and technology in which Japan should cooperate and coordinate our efforts with Asian countries, we should be able to obtain resources (energy, marine, agriculture, forestry and fisheries), ensure safety and security (communicable diseases, disaster prevention, fighting terrorism, national defense), build an information society (ubiquitous, security, private information), and deal with the issue of aging (medical treatment, robots), among other things. These are merely examples. Also, the life sciences, bio, nano-technology, IT (information technology), green chemistry, and so on, are all means to be combined to meet the requirements of the environment and the economy. So, in this sense they are targeted missions. The important thing is that the policy of science and technology is one of the keys to ensuring Japan's very existence and survival. What we should aim for is to build a country that is fluent – culturally, economically, and internationally. Especially, in the 21st century, the main goal of our science and technology policies should be the lofty one of carrying out our missions. It is by contributing to the effort to reach this goal that Japan can hope to establish itself as a dignified nation and thereby win Asia's trust. This is the perception of science and technology as a vehicle for simultaneously combining care for the environment and from the economy.

6.3 Cooperation with Asian Countries

Cooperation with Asian countries is the most important theme in Japan's science and technology policy. The Asian region, which accounts for 60 percent of the world population, is projected to have the highest economic growth rate in the world in the years ahead. Asia is the world's biggest non-Christian cultural sphere based on the Chinese characters. Another salient feature of Asia is its large Hindu and Islamic population. For Japan, there is a lot of commonality with Asia in terms of geography, history, civilization, and anthropology, so that it shares with Asia many of the same challenges including achieving economic growth while solving the environmental issues. Coordination and cooperation with Asia, through science and technology and human resources development, is an extremely important step.

6.4 Large-Scale Science and Technology Projects: Strategic Thinking and Targeted Missions

Not all countries are able to provide science and technology investment nor research facilities that require large-scale investment. Most countries are unable, among other things, to plan, use, and analyze projects like the space program, observation satellites, the Subaru Telescope, radiant light, earth simulations with the use of super computers, high-energy research, "kamiokande", cyclotrons, genome decoding research,

and polar and deep ocean research. However, there is no reason for Japan to carry out all these projects alone. From the perspective presented here, except for matters related to highly classified national security, all large-scale projects, facilities, and data analyses must be open to the international research community. Of particular importance is to develop a strategic awareness of these projects, facilities, and data analyses and use it as the means for preparing the next generation of Asians by forming a network of Asian researchers and young participants, developing future human resources, and building a human resources network. Moreover, we should actively seek the participation of not only research institutes and universities but also Asian engineers and others working in private enterprises in the planning, production, and other processes involved in large-scale projects.

Japan has huge accumulations of data and systems related to disasters like the Asian tsunami that occurred in December 2004. With regard to satellite observations of disaster areas and the like, if we invite a large number of researchers from all over the world, especially from the Asian region, to participate in these research projects from the planning stage, within five to ten years many of these participants will form a core group of researchers in their own countries and play a leading role in their technological development.

Thus, it is especially important to provide large-scale science and technology research facilities for implementing collaborative projects open to the international research community, thereby contributing to the creation of humankind's new knowledge base as well as cultivating human resources for the next generation, and hence paving the way for building national trust and by extension providing the bedrock of national security. It is essential that we develop awareness of this process and realize that our collaborative projects are investments for building our national infrastructure.

In this way, though it may take some time, we will make progress in winning Asia's trust. From this perspective, when we undertake large-scale research projects we should take into consideration investments in scientific research, official development assistance, and other forms of funding, and set clear goals. It is precisely through human resources development that we will be able to contribute to the establishment of a sustainable international society.

6.5 Formation of Network of Individuals Attaching Importance to Soft Power

Until recently, Japan's foreign aid entailed granting public funds mainly within its official development assistance framework to assist projects for building facilities (hardware) in recipient countries. To the donor countries, this in itself is very important, but it is not always the best way to achieve Japan's goal of establishing itself as a dignified nation. We believe that in the field of science and technology policy,

international cooperation should center on human interaction and the development of human resources in areas where people widely share the concept that science and technology is not limited to national boundaries. In particular, Japan should adopt a strategy that attaches importance to what is known as “soft power.” Soft power is exercised by, among other things, reinforcing programs designed to promote exchanges among young researchers in the Asian region and implementing collaborative projects with Asian countries funded by Japanese research investments. Through such projects, Japan will be able to build and strengthen networks of individual researchers unfettered by national boundaries, thereby widely spreading relations of trust among many individuals. The most important challenge should be to promote programs for building networks by urging more Japanese to go abroad as, say, students, participants in exchange programs, and area study specialists. Furthermore, it is important that we recognize that the previously mentioned large-scale research projects are particularly well-suited for meeting this all-important challenge.

VII. Targeted Missions in the Science and Technology Policy

7.1 Tackling Priorities

From the perspective of what we have thus far said about national vision and targeted missions, attaching importance only to the industry and economy of one’s own country, or making selections that take into consideration only compatriot scientists, will be counterproductive in the medium-term. As indicated in sections 6.2 and 6.4, programs that address priority themes should attach importance to soft power, for their targeted mission is to create a sustainable human society. In other words, such programs constitute a science and technology policy that addresses issues related to both the environment and the economy. We must give priority to providing young scientists, particularly those in the Asian region, with ample opportunities to interact and exchange views. These efforts are very important for Japanese researchers, for through such exchanges they will be able to deepen their understanding and appreciation of diversity. Japan can be expected to make significant contributions toward resolving the environment issues that Asia will be facing as it grows over the next 20 to 30 years.

7.2 Appropriate Evaluation and Highly Transparent Operation

Needless to say, in our program planning and management we make sure that full transparency is observed by conducting milestone reviews at appropriate intervals so that the programs will be evaluated as objectively as possible. In this way, we will be able to achieve results of the highest quality. Evaluations should be made not only from the perspective of science and technology, but also from the perspective of the goals that were set when the theme for a particular program was selected, that is, from the perspective of national strategy. It is also important to make a reasonable projection for withdrawal based on our timetable. Moreover, research should be evaluated by

repeatedly subjecting its results to the criticism of rivals. The essence of research evaluation is comprehensive peer review from a broad perspective. It is necessary to establish a community of scientists made up of independent-minded scholars who willingly assume responsibility for ensuring a high level of transparency at home and abroad.

7.3 Cultivation of Individuals with a Sense of the History of Civilization and Capable of Thinking Strategically

Today, what Japanese society decisively lacks is the outlook of world citizens; that is, the capability of thinking not as members of an organization but as individuals who consider, plan, decide, and act independently. Such individuals are able to establish their humanity, have a diversity of abilities and a sense of values, and are capable of thinking about various policies strategically and from the perspective of the history of civilization and of the world. As stated in the Statement, science and technology policies are not exempt from this general shortcoming. The future of a country is dependent more than anything else on its ability to develop human resources. Indeed, the cultivation of human resources as individuals who have a sense of the history of civilization and are capable of thinking strategically is, in a fundamental way, the most pressing issue facing Japan today. It is also important, while valuing learning and art, to be aware of this kind of culture and build a society in which it is valued. Societies in which only the words like “economy” and “growth” are stressed, are definitely not dignified. It is necessary that we should move toward a world where groups of individuals will form functional organizations and societies to create an image of Japan as a “dignified” nation.

VIII . The National Vision that Japan Should Aim for, Targeted Missions, Science and Technology Policies

A Dignified Nation That Aims to Meet the Demands of both the Environment and the Economy

Science and technology policies are consistent means to accomplish the nation’s targeted missions. Defining a dignified nation and Asia’s trust as the bedrock of our national vision means nothing less than creating an image of Japan as a dignified nation that has the trust of Asia. Two things are important here: first, a national character that cherishes learning, art, and science, and the sensibility to care for nature and human beings; and second, a society formed by individuals molded by that national character.

To put it in concrete terms, the goal of Japan’s science and technology policies is to build a model nation that meets the demands of both the environment and the

economy. These requirements are grouped into a set of 10 challenges, which we discuss below. Meeting these challenges is the mission of those who are in charge of implementing the science and technology policies. Thus we need to carefully examine those policies and prioritize them, taking into consideration policies in other areas when necessary.

With regard to individual national targeted missions, we must set up 5-year plans in three stages for completion by 2020. A 15-year period, from 2006 to 2020, is a reasonable time for completing our plans. For the first 5-year period, we must be setting up the 3rd Basic Science and Technology Plan. Here it is important to consider and make proposals regarding whether the relevant issues to be addressed are, among other things, on a national level, local government level, community level, organizational level, family level, or individual level. The government, working closely with individual citizens, must consider what the targeted mission ought to be on each of these levels.

Science and Technology Cannot Solve Problems; Only Human Intellect and Wisdom Can Solve Them

(1) Educational Reform: Human Resources Development is the Bedrock of Nations

Historically, Japanese education, particularly primary and secondary education, is thought to have functioned well in enabling Japan to realize its national objectives. However, the goal of Japanese education has been to prepare school children to enter highly demanding national universities that attached higher government purposes. Japanese education was not designed to foster excellence in higher education either at undergraduate or graduate level. The percentage of students pursuing higher education passed the 10 percent mark about 40 years ago (1965) and has risen sharply since then, anyone who graduated from highly demanding universities being more or less assured of improving his position in society. Japanese education system did not produce dignified, learned individuals possessing deep insights and understanding grounded in a broad knowledge of philosophy and history. In a sense, it fostered individuals considered useful for meeting national objectives, thereby turning them into cogs in a machine called the social system.

It might be worthwhile here to consider what exactly is the goal of education. Children are not vessels to be filled. Rather, the goal of education is to equip each child with the capacity to demonstrate to the full his or her potential. Under the present educational system in Japan, is it really possible to develop individuals that society will require in the days to come – individuals equipped with the ability to think for themselves, come up with a plan, and execute it decisively, while at the same time possessing the humanity to empathize with others? Is society doing enough to show children what it means to have this self-sufficiency and humanity? Children are born

with a clean slate, and grow up by interacting with the adults around them. Children are the mirror of society.

A person possessing dignity, who values learning, loves art, loves people, loves the world, and cares about nature. A society and nation that possess the dignity. Who in the world would think that a nation which develops children only to become cogs in a machine called “society” is dignified? Each person is different and has values and ability unique to each. The nuts and bolts of education is to cultivate human resources that are learned, dignified, and equipped with the capacity to look objectively at themselves. In other words, education should encourage children to become citizens of the world who, despite living in a remote place, are able to empathize with people in far off places and capable of taking the initiative to help the poor and victims of disasters throughout the world. To foster numerous organizations and business enterprises consisting of such individuals – herein lies the essence of how a dignified nation is formed.

We cannot allow promising youth to be boxed into a closed competitive environment early in their lives. Individuals should be encouraged to go out into wider international society to experience and become aware of the diversity of values and goals out there. Needless to say, it is of utmost importance that those in higher education – undergraduates, graduates, postgraduates, university personnel and researchers – who are engaged in human resources development and who push forward scientific knowledge and policy, must act on their own initiative by observing the principles under discussion. We need to build a career forming structure in which scientists, researchers, and educators are encouraged to mingle with their peers and refine their research by exposing it to the criticism of rivals. Especially in a “vertical” society like Japan’s, to introduce and perfect a system of integration in the early stages of education and socialization is the most basic policy for contributing to the future cultivation of human resources.

To reiterate, collaborative research and educational exchanges with Asia constitute an extremely important science and technology policy with an eye to the future. If we continue to look only to Europe and the United States, it will be difficult to foster individuals who have a clear grasp of Japan’s national vision and mission, and who understand the global trends and are capable of thinking and acting on their own initiative. It is important to cultivate individuals capable of pursuing happiness not only for the self but also as a member of society, country, and region and of contributing to their well-being. As major participants, leading universities, both graduate and undergraduate, should offer a considerable portion (50-80%) of their instruction in English with a view to becoming institutions of higher education so attractive that students, researchers, and teachers from Asia and the world will want to come to study

and do research. Why can we not do something as simple as this on our own initiative? In all honesty, even in this age of globalization, the Japanese are still narrow minded. What is needed is a change of attitude. Most university professors contemplate doing research abroad, but hardly any seriously consider widening their appeal outside Japan. This is no way to compete on the global stage. Worrying about one's reputation in the world, or lack thereof, itself betrays a lack of ideas.

Having a Japanese identity at the core of one's mental structure is extremely important in thinking about the world. From this perspective, it is imperative that we improve the way Japanese is taught in primary and secondary education. People who do not have an axis around which to position themselves will not be taken seriously by the rest of the world.

We can dub this, "education for consciousness of the importance of sustainability." In fact, the United Nations has designated the next 10 years as the "Decade for Education for Sustainable Development" and will soon begin implementing various measures as part of this movement. We should be proud that it was Japan that proposed the concept at the WSSD 2002 in Johannesburg.

(2) Becoming a Democratic Society

Is the state structure of Japan conducive to realizing a fully matured democratic society? Is the distinction between public and private clear enough? Is the principle of separation of powers being observed rigorously enough that the executive, judicial, and legislative branches are able to perform their respective functions? If yes, why is it that the huge gap in the weight of a single vote is allowed to continue? In the Meiji period, when Japan began modernizing, it was said that the concept of "public" did not exist in Japan. Has this changed over the past 150 years? Some people are under the impression that the government that has guided Japanese society up to this point is itself the public. But that same government has run up such a huge debt that it is completely paralyzed. Now is the time for the people to begin functioning as the public *⁴. There are signs that this change is indeed taking place. As reflected in the spread of NPOs, more and more ordinary citizens are now actively participating in society. The important thing is to expand the scope of their participation. This is an issue underlying all ten of the challenges under discussion.

(*4) Even since the Meiji Restoration of 1868, there is still a difference in the Japanese concept of "public" and the way it is understood by citizens in Western society, with the result that there are still many who confuse "public" with "government."

There is simply too much discrepancy between the views people express in

government surveys and the actual policies and measures the government implement. A glance at the changes that have taken place in public works projects, national income, and national attitude tests, make this clear. But what has brought about this difference? The total debts incurred by the central government, local governments, government-related firms, and others, amount to 200 percent of Japan's GDP. The only consolation is that the debts are external. Where is this country headed? What proportion of the people is aware of this situation?

In all of its processes and systems, the ability of the government to govern – that is, its governance – is being called into question in regard to its autonomy, transparency, and responsibility to society (the English term accountability is incorrectly translated in Japanese as “responsibility to explain”). International society is watching us.

(3) Realizing the goals of a convivial society

Japan is a male-dominated society. Is Japan a society in which women, the elderly, the disabled, or foreign residents, are able to enjoy active participation? This is another condition for being a dignified nation. As things stand, it must be said that there are still many areas that need to be improved. A word on the gender issue. While Japan ranks eighth in both the United Nations' Development Program's Human Development Index and the UNDP's Gender Development Index, it ranks only 41st in the Gender Empowerment Measure (GEM). We need to introduce a bold program, something like the affirmative action in the US. Numerous discussions have been held on ways to help women advance into the workplace but most look at the issue from a single perspective. Countermeasures for the falling birthrate, effective child-care support, expansion of child allowance, and other related measures, seem not to address the needs actually voiced by parents and those who provide child-care support. Children are state assets that will support the nation in the next generation, so a new culture needs to be built to spread the idea that everyone has responsibility for child-rearing, across generations and within the community. In the same context, we would like to propose that we adopt a plan to double residential space over the next 10 years (particularly, in the cities, for the same price as at present). This will not only lead to increased domestic consumption but also promote communication among three generations, and in the process have a positive effect on women's social advancement. It will provide an effective way to alleviate the difficulty of raising children in centralized families.

On the other hand, since Japanese society is built around men, during the second half of the last century the economy grew under a system of lifetime employment, seniority-based wages, and large retirement benefits, and by the end of the century society had become dominated by title-conscious men only able to function when working as part of an organization or company. Under such a structure, a

circumstance unique to Japan called “*karoshi*” (death from over work) has entered the English lexicon (there is no equivalent in the English language). Over the past six years, during which the economy remained sluggish, the number of suicides increased by 30 percent, nearly all being of men in their 40s, 50s and 60s – a phenomenon again unique to Japan. There is a definite lack of recognition that a society dominated by title-conscious men is indeed abnormal. Most Japanese males were organization or company men unable to exist as self-reliant individuals. After all, up to now had their lives not been shaped by industrialization, urbanization, and a single-minded dedication to economic growth at the expense of family? This is another challenge for Japan. Both men and women must shift their social behavior toward a pattern that increases their choice of lifestyle to one more suited to their ability and aptitude.

(4) Ensuring Japan’s Security: Safety and Security

Safety and security need to be considered in a variety of dimensions: the national and international levels, regional level, as well as local government, community, small community, family, and individual levels. Moreover, in the local international community we need to adopt a comprehensive perspective that covers East Asia, Southeastern Asia, Central Asia, the Asia-Pacific region, and so on. Also, on an international basis, it is extremely important that we possess a sharp strategic outlook supported by a comprehensive sense of the history of civilizations, targeted at Asia, the EU, the Middle East, East Europe, Russia, Africa, Latin America, and so on.

National strength is the essence of international relations, diplomacy, and national defense, among others. It is the essence of a nation intricately and mutually related not only to its economic and military strength but also to its sense of culture and its historical and political thoughts and ideas. The key to Japan’s relations with other countries and regions – including Greater Asia, China, the Korean Peninsular, the EC, the USA, the Middle East, Latin America, and Africa – in this age of globalization is, in the final analysis, the issue of the quality of people, things, and leadership. Education, science, technology, and environmental issues are, at the end of the day, matters of human resources and leadership. This is precisely why the cultivation and exchange of human resources is such an important issue.

Is Japan really a safe and secure country? Of course, preparing for a natural disaster is important, but national security is also a key national issue. After World War II, Japan secured its safety by being a member of the Free World and cooperating with the United States, its leader. However, it has already been over 10 years since the collapse of the Berlin Wall; the vast economic sphere of the EU has developed, and emerging economic powerhouses such as China and Asia will, despite being beset by numerous problems, continue to grow. Therefore, based on the fact that we have a constitution that denounces the use of force as a means of settling international disputes,

we need to fully review the strategy for securing our safety. Building a nation's security structure is a necessary condition for demonstrating what we can do as a "soft power."

Strengthening its ties with Asia is one of the most important options Japan has. It is important to realize that to promote peace and prosperity with Asia and other regions, and to be recognized for its contribution to the attainment of peace in international society through these efforts, is an effective way for Japan to ensure its security. One measure we could adopt would be to undertake large-scale science and technology research projects such as space research, super computers, and high-energy research. These projects, as we discussed earlier, should be open to the international community and serve as a place, means, and strategy for actively cooperating with Asian researchers and developing human resources. It is essential that we maintain this approach.

(5) Social Infrastructure for Healthy, Wholesome Life

Japan's population will continue aging well into the future, with frightening inevitability. If the aging process continues unabated, 30 percent of Japan's population will be aged 65 years or older 30 years later, making it a super aged society. With 20 percent of its inhabitants today aged 65 and older, Japan's population has aged at a faster pace than any other in the world. Today's employment system, healthcare and pension systems, and other bases of Japan's social security system, were established on the assumption that the same society, economic structure, and economic growth would continue indefinitely. It is obvious that our social security system cannot effectively respond to social changes like the rapid aging of our population. For example, despite the fact that the percentage of people in their productive age group is decreasing, the social advancement of women and elderly people and their employment situation are woefully inadequate, so that those with talent and motivation are not being fully utilized. Social security and the annuity system, as well as the universal healthcare and nursing care system and the division of roles between public and private staff are now stretched to their limits. We cannot wait any longer to come up with an effective immigration policy and countermeasures to the falling birthrate. We need to discuss these urgent issues and make a policy decision on each of them without further delay.

During Japan's high economic growth period, the mainstream of its social system was a system of standardized mass production of industrial goods based on an ever-increasing population supported solely by males of a productive age and a central government that controlled them. But today that system is beginning to lose its effectiveness. It needs an immediate complete overhaul. Regarding healthcare, the system needs to reestablish the range of coverage provided by public healthcare and public insurance. We also need to consider the effect of promoting the development of new private insurance systems; without such systems, the future of healthcare is in

doubt. The increase in diseases resulting from aging (cancer of the elderly, Alzheimer's, etc.) and the shift in the structural emphasis of disease from communicable diseases to those associated with adult lifestyle habits (diabetes, obesity, etc.) has made it necessary to overhaul the healthcare system that was introduced in 1961.

Unless we improve the basis of our public healthcare system and reestablish the range of healthcare coverage the system provides, and also consider the effect of promoting the development of new private healthcare systems while restructuring the whole system to meet the different needs of residents in different regions, the future of healthcare as a form of social infrastructure will remain extremely uncertain.

Similarly, the demand for employment and care of the elderly needs to be met by simultaneously developing local social infrastructure as a comprehensive system. This in turn will enable local communities to be more independent, promoting decentralization of authority as a precondition for the independence of local communities, and transferring funds. Who is shouldering the cost of the service? What service? How much of the cost? To what extent should the system in question be funded by direct financing and to what extent by indirect financing? Who is going to propose the measures? What are the people demanding? These are the big questions facing Japan today. What's more, the banking systems, markets, and human resources now move over and beyond national boundaries, and it is highly likely that the conventional logic of Japan will no longer be valid.

(6) Industrial, Economic, Labor, and Employment Policies

Industry and the economy will have an extremely important role in any effort to harmoniously combine their demands with those of the environment. Over the past 50 years, within the context of the Cold War and the Japan-US security framework, the Japanese economy achieved high growth based on the political, industrial, and bureaucratic triangle. It combined domestic competition with innovation, and expanded the production of export goods in standardized mass production type industries oriented toward manufacturing and assembly, thereby making manufacturing a key industry. This key industry was financed exclusively through indirect funding, which maintained its closed structure throughout the high growth period. With the end of the bubble economy in the closing years of the 20th century when globalization trends began at the same time as the Cold War ended, and under the subsequent prolonged deflationary recession, these conventional structures ceased to function. However, a new key industry has yet to emerge. In the face of rapid aging, a falling birthrate, and decreasing population, how is Japan going to build a relationship of solidarity with Asian companies that are about to take off on the strength of their youthful vitality and lower wages?

The key to success in rejuvenating Japan's industries and economy in the years to come lies in our ability to create goods and services with internationally recognized brand names in line with our national vision and targeted missions. In a word, the key lies in our science and technology and in our innovations. For example, the importance of fuel-cell batteries and environment-friendly automobiles running on such batteries is one such innovation. Science and technology will be called to play a very significant role. The challenges in industrial structure and employment lie in responding effectively to the change from secondary to tertiary industry, undertaking research and development for cultivating new industries, and prioritizing investments and development projects. The challenge for the financial system lies in effecting the shift from indirect to direct financing through the market, and satisfying the requirements for winning the confidence of international society by, among other things, opening the equities market to foreign investors and ensuring its transparency.

Whether in the high-tech industries or the service industries, the basis of society will shift from making things to valuing knowledge, and industries that are not environment-friendly or products that are detrimental to environmental conservation will be forced out. This is the age of globalization. The ability to respond to the demands of the environment will become the key factor that will define the social responsibility of corporations (CSR).

Regardless of how new an industry may be, that industry will have to provide an environment that enables workers to exhibit their individual abilities and originality to the maximum. Reform of the educational system and of the social system on the one hand, and the rejuvenation of industry and economy on the other, are closely linked. In the meantime, what should industries aim at? What are domestic consumers willing to pay money for? By thinking deeply about what people would like to buy, the future direction will begin to come into view. Historically, passionate individuals regarded in their time as eccentric or geniuses started new industries. We must not let our industrial tall trees catch too much wind.

Where is the center of employment configuration? What types of employment will be available in a highly urbanized, aging society after the switch from secondary to tertiary industry has been completed? The focus of public works projects now looks completely different from what it used to look like in the 20th century.

The system that guarantees lifetime employment, seniority based wages, and large retirement benefits, has been pushed to the limit. A form of employment that provides progress commensurate with the amount of improvement an individual can make on his job is now being sought. Regardless of the structure of employment, aging and the falling birthrate are advancing rapidly. As noted earlier, it is projected that

Japan's population aged 65 and older will reach 30 percent in 30 years. To reiterate, the Japanese government must without delay adopt an immigration policy and countermeasures for the falling birthrate.

(7) Coexisting with Nature, Regenerating Nature

When we look back on the 20th century, the most regrettable development is the partial decline of the agricultural and fisheries industries due to the loss of nature and the subsequent adoption of a misguided conservation policy. We need to reflect on the fact that although it had been widely known since the Meiji period that Japan is a resource-poor country, too much importance was attached to industrialization. What is Japan's food policy? Arguing over only the degree of self-sufficiency is meaningless as an actual form of crisis control unless this is counterbalanced by a discussion on energy and other related subjects. A huge budget is being allocated to promoting a policy of increasing the number of foreign tourists to Japan. But how much of the natural resources and cultural assets that epitomize what is uniquely Japanese have we managed to preserve? From the standpoint of food resources, including fisheries resources, there are many problems we must address.

Coexistence with nature is a major theme in our effort to meet the demands of both the environment and the economy. A review of the afforestation policy under which a huge number of Japanese cedar were planted (40 percent of all forests in Japan are man-made forests, 50 percent of which are Japanese cedar) will require a review of the basic forest and natural environment policy. Similarly, in addition to using cedar that has been cut down to line city sidewalks, a large amount of natural materials should be used for building houses and for improving people's living environment, thus enabling people to come into contact with nature and providing an urban environment surrounded by it. At present, most of the 75 percent of Japanese who live in urban areas live in such an extremely artificial environment that you can't help wondering how city living must be affecting the children. For the children, everything around them they see and touch on a daily basis is man-made. The things human beings take from nature and bring to the city (e.g., Japanese cedar lining for sidewalks, a society where as much wood and other natural material as possible is used in building houses), a high quality dwelling environment, and a dwelling environment filled with nature, give human beings comfort and peace of mind. These constitute an important part of children's environments, in which there is a genuine human touch.

However, the actual situation is that everywhere you go, whether in the countryside or in the back streets, all the roads are paved with concrete. Restoring nature to its original state, an environment surrounded by nature where you can enjoy living in comfort knowing that everything is safe and secure – these as well as securing food and water resources are areas where science and technology can make significant

contributions. It is precisely because the urban population exploded that the natural countryside aroused the interest of so many people. Thus the countryside will offer new living space to many urban dwellers. A new lifestyle, opting for a slow life, will also become possible. At any rate, industrialization, urbanization, and a life that sacrificed even the family, are what made our existence one of acquisitiveness. Were we happy then? An opportunity has arrived to consider what we need to do to change this way of life.

Returning to Nature, Living with Nature, Systematic Regeneration of National Land and Restructuring of the Living Environment

(8) Regenerating National Land and Regions

There is a serious problem with societies hit by rapid aging and decreasing population: regenerating national land and regions. During the period of population increase, large parts of the suburbs were developed and many urban dwellers moved there. But these suburbanites are getting older and a considerable number of them are moving back to the inner city, resulting in depopulation and the collapse of community life in many such suburbs. On the other hand, the inner-city districts are faced with two major problems: (1) preparing for a large-scale natural disaster; and (2) the issue of renewal of infrastructure built during the period of high economic growth. Meanwhile, in many local areas, the rate of aging is already near 40 percent. Consequently, in addition to the difficulty of maintaining the same standard of living as before, residents of these local areas are faced with making certain that their lives are safe and secure in a way different from the challenge urban dwellers are facing. For example, neither urban planning nor the urban landscape was designed with the medium- to long-term in mind, thus leaving the impression that while destroying the old, the new was being built without forethought. By no stretch of imagination can we regard this as a cultured way of creating comfortable urban areas. Power lines should be installed underground. Urban structure and urban planning that require repeated road excavations can only undermine Japan's scenic resources. Local districts making special efforts to make their cities attractive and protect nature are good places to live and good places to visit. To spread this pattern throughout the country will require not only urban and regional redevelopment but also redevelopment of national land.

Regenerating national land and regions is a major theme in human science and social sciences, which have traditionally taken human habitation patterns as their subject of study. It is also a subject of study in science and agronomics related to the natural environment, as well as in engineering related to the transportation and communication that supports national land and regions, and in medicine, which cures and gives reassurance to patients. Thus, regeneration of national land and regions is a comprehensive problem. It cannot be addressed by merely arguing that regions losing

population should be returned to their natural state. To be able to present a new admirable image of Japan by gathering together multidisciplinary wisdom is a huge challenge to learning, culture, art, science and technology in their entirety.

(9) Development of the Information-Communication System

It is widely acknowledged that the information-communication system will be critical in various aspects of life in the 21st century. The hardware is the information infrastructure. In Japan, the development of super-fast Internet connection (so-called broadband) and the establishment of the backbone that serves as the country's low-cost trunk line will reduce the regional information divide and support regional self-reliance. At the same time, broadband connections will link local communities in Japan to the wider world via the information available to anyone connected to the Internet. In this way the information superhighway will provide the basis on which the reformation of Japan will be achieved. Cooperation with Asia will of course require people-to-people exchanges, but in fact, much of it will presumably rely on an information infrastructure and Japanese science and technology will play a significant role in upgrading that infrastructure. On the other hand, it is not widely known that, even in this globalization age, a considerable part of Japan's information infrastructure is closed to the outside world. Adopting a more open-minded policy that will give preference to the beneficiaries of the digital age, the Japanese people, will be essential if Japan is to gain the trust of the international community.

Furthermore, the activities of various business enterprises and people will become intimately tied to the information-communication system, so Japan will create knowledge as value generated through its use. How well the information-communication system is able to support people's activities will become important, but on the negative side is the global issue of the safety and reliability of information disseminated through the system. To be able to build a reliable information system, in addition to resolving the technological issues, a scheme for effectively using the legal system and the power of the public sector will be essential. The creation of an information system as a true asset is a challenge the world is looking to scientists and researchers to solve, and we have great hopes that in this area Japan will be able to build a system that will serve as the model for the rest of the world.

Japan's information-communication system is highly dependent on information provided by government offices under the mass media's "press club" system. In this sense, the Japanese system is unique, or, shall we say, absurd. Indeed, there are many problems that will have to be solved if it is to function in a way befitting a democratic society. This is an important issue, particularly for realizing the dream of making Japan a truly democratic society as stated in (2) above. We Japanese should look at the world as it is; people throughout the world should know the actual condition of Japan. In this

way, a live information cycle will emerge somewhere between the two, thus giving birth to many independent-minded individuals. Building a society consisting of such individuals should again be the first step taken to building a relationship of trust between Japan and the Asian countries.

An information infrastructure is important precisely for this reason. Reports on Japan published by the foreign media are not as widely known in Japan as one would expect. In the age to come when various new methods of distributing information, including the “blog,” will spread worldwide, Japan’s information-related policies are especially inward looking and apt to be bureaucrat-led. This is a great challenge for Japan.

At the Science Council of Japan, in the 2002 “Japan Perspective,” this point is especially emphasized. In other words, the things discussed in the Japan Perspective include building a society that moves in accordance with the information flow and cycle, supported by science and a decision-making process based on that information flow and cycle, and by the social role and responsibility that scientists take in the direction prescribed by the Japan Perspective.

(10) Energy and the Environment

The energy policy is the linchpin of the global warming issue. Japan, a resource-poor nation, is making various efforts to reduce its dependence on fossil fuels by developing alternative energy sources, including nuclear power, hydraulic power, minihydro, and hydrogen. In the 21st century, we will, above all, be asked to further diversify the composition of energy sources we will actually use. These efforts will greatly reduce the amount of waste in energy consumption that occurs in various human activities, and also reduce the amount of power consumed in our daily life. This essentially entails the restructuring of our sense of life’s values, and the rethinking of how we should live our lives. In tackling the issues at hand, it is important to provide a Japanese perspective as one of the most advanced countries in the world and also as a possible model for Asian countries.

The conventional long-term fossil fuels and nuclear energy policies strategically lacked the political vision and will. The national energy policy was carried out under a separate budget earmarked in the special account and other accounts independent of the general account. Considering the urgency of the global warming issue, the important thing is to formulate a common national energy policy in accordance with a medium- to long-term outlook, and to conduct both basic and applied research which systematically and strategically develops science and technology aimed at the formulation of a common policy.

And the same time, with regard to energy, production, disposal, the environment, and so on, it will be necessary to investigate and cost a design for different levels of energy policy – domestic, regional, and global. For these different levels of energy policy, including environmental issues, the important points of view to consider are, among other things, dependence on foreign energy sources, the nation's dignity and trust, and risk hedging as a nation. Energy policy is not only a domestic concern. The problem of the relationship between energy and the environment has to be addressed from the perspective of an entire region. People are eagerly waiting for civil society to make a move based on a strong principle of international politics and leadership. A glimpse of that has begun to appear.

Japan started looking for ways to resolve environmental issues – greenhouse gases, the water environment, soil contamination, waste treatment, and recycling – before any other Asian country. Many of these problems, however, still remain in Japan. Global sharing of technologies related to the environment has not advanced very far. One huge factor responsible for this is the difference in the points of view and priority that countries give to environmental issues. The important thing is to incorporate into science and technology policies a shared awareness of environmental issues with Asian countries, collaborative projects, technological transfers, and human exchanges involved in all these processes.

The key words for the science and the science and technology policies running through all of the 10 items related to the national targeted missions discussed above are:

Human society's sustainability; that is, the harmony between environment and economy.

To reiterate: all national policies, including science and technology policies, are in keeping with the age of globalization in the 21st century, are based on solid and broad understanding of the international situation, and have a long-term perspective. Their design and execution must be advanced in the spirit of cooperation on the national, regional and international levels.

IX. Summary: Principles of Japan's Science and Technology Policy

The above discussion is summarized in the summary and figure at the beginning of this paper. Development of human resources is the bedrock of all the policies – the way society ought to be and the challenges Japan faces. The weight that science and technology will have will differ from one item to the next. However, by taking into consideration the weight for each challenge discussed in each of the 10 items, we have indicated the outlook for meeting the timetable and our conclusions regarding the

strategic policy that should be adopted for meeting each of the 10 challenges regarding the national vision and the targeted missions adopted to realize that vision.

In this paper we examined trends in the world and the image of Japan, using conditions in Japan and international society as backgrounds. We also examined the national vision and the targeted missions from 2006 until 2020, supported by the development of human resources, as well as the three 5-year plans that will be implemented to reach the 2020 goal. By highlighting the future national vision while the Japanese people and concerned parties are deep in thought, it is possible to put national policies in their proper perspective. Herein lies the fundamental principle underlying the Third Basic Science and Technology Plan. The design policy must be formulated in line with that principle.