

‘Innovation 25’

Creating the Future, Challenging
Unlimited Possibilities

Interim Report
— Executive Summary —

Innovation 25 Strategy Council

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*This is an English translation, in a format of an executive summary, of the interim report of the Innovation 25 Council that is written in Japanese, and may not, in part, be a verbatim translation of the original version. The Chair takes responsibility for any misinterpretation and translation in the English version.

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PREFACE

Message from Ms. Sanae Takaichi

Minister of State for Innovation

When I received the instructions for “Innovation 25” from Prime Minister Abe, the first thing that came to my mind was that I would like to address science and technology policies from the standpoint of citizens of Japan.

Our life in Japan today has benefited greatly from discoveries and ideas emanating from basic research, technology and development. Continuous efforts by scientists and corporations to transform discoveries into new products and services have made our lives richer and more convenient over the last 20 years. Various attempts to reduce costs, and continuously apply technology to best meet the needs of the market have made our lives what they are today. There is no question our quality of life is largely due to investment in and funding of science and technology, supported by public and private funding.

Citizens also have dreams and expectations for the future. Innovation and investment in science and technology and regulatory reform, initiated and pursued by the government, serve as a solid foundation to make these dreams of the people come true.

The government has the challenging task of initiating the development of a society where these future dreams and expectations of the people can be realized within an acceptable timeframe. “Innovation 25” is not a mere “dream” or “future prediction” we only talk about. It foreshadows the Japan we want to build, step-by-step, over the next 20 years.

The road ahead to realize this vision for Japan will not be an easy one.

Particularly as fostering innovation to create a new Japan will challenge and disrupt conventional wisdom and value systems that we have cultivated over a long time.

Innovation, by definition, almost always challenges the long-kept mindset and value system of a society, so it can create tension. The government is determined and dedicated to creating a better Japan through innovation. Innovation 25 will serve as the driving force in this journey.

Introduction

In order to realize the Abe Cabinet's new national image for Japan, known as "Beautiful Country", it is essential to maintain dynamic economic growth in the face of a declining population and an ageing society. It is critical to empower Japan's economy through innovation and an open attitude.

Noting that continuous innovation will drive growth and lead sustainable development for our common future, the Abe Cabinet pledged to formulate and execute a long-term strategy initiative for Japan, called "Innovation 25", with a view toward year 2025.

Under Ms Sanae Takaichi, Minister of State for Innovation, the "Innovation 25 Strategy Council", was set up. The Council met several times over four months, held many hearing sessions and has taken inputs and opinions from the scientific community, industry, and the public.

Based on this interim report with the cooperation of other council bodies and committees, such as the Councils for Economic and Fiscal Policy, for Science and Technology Policy, for Education Reform of the Cabinet Office, the Council plans to deliver its strategic policy roadmap Innovation 25 by the end of May 2007.

I. Forces at Work Surrounding Japan and the World in the Next 20 years

Major factors that will shape Japan and the world in the next 20 years include the following:

- 1) a declining population and rapid ageing in Japan
- 2) growth in Asia with pressing issues
- 3) further development of a knowledge-based network society
- 4) explosive progress of globalization

- 5) growth of the world population threatening the sustainability of humankind
- 6) climate change and environmental degradation
- 7) an increase in the divide between rich and poor nations, often called the “north–south disparity”.

II. Why is Innovation Important Now?

The world, including Japan, is stepping into a completely new and unexplored era, whether it is welcome or not. Can we resolve the unprecedented changes and issues of magnitude this new era bring with a conventional approach and mentality? The answer is definitely “No”. History tells us that a few decades of hard and persistent efforts with a completely new mentality and attitude are required for innovative breakthroughs to come to fruition. Unless we dedicate ourselves to changing our familiar ways of thinking and conventional attitudes, we can never create a bright future.

It is possible that, in the face of intensifying global competition, Japan may not continue to enjoy economic affluence. Rapid growth in Asia, China and India in particular, together with worsening environmental and energy problems in Asia and throughout the world, has created and continues to create global issues and problems for us to resolve. The seriousness of these issues makes it imperative for all of us to chart a course of action.

Each one of us has to know our own strengths and weaknesses, strive to develop our potential to the fullest, and improve our productivity in order to sustain economic growth, even in an era of population decline. Integration and collaboration with the world outside and with differences in thinking outside our familiar territory is indispensable.

Environmental issues the world faces today, including global warming, give us the opportunity to advance Japan’s already world–class technology to an even higher level. These issues also allow us to take a step forward in developing a new international framework for collaboration. Ageing of Japan’s society can serve as a driving force to design new technologies and services that meet the unique needs of individuals. These efforts can lead us to a better and healthier

life, while boosting economic development even further. It is of paramount importance to view these issues as an opportunity, rather than a threat—we can deliver the benefits of science and technology originated in Japan to the world beyond. This period of intense competition for knowledge enables us to enhance the international competitiveness of our science and technology.

History tells us that progress in science and technology, such as that seen in transportation, medical care, and information and communication, has contributed greatly to reduce or eliminate various divides; whether they be regional, physical handicaps, age and/or access to information among individuals. We need further efforts to ensure that the benefits of technological innovation are delivered promptly to those in need, thus eliminating gaps among individuals. New treatments in medical care, for example, will ensure that those who are ill are given the same opportunities as those who are healthy. Progress in health care will enable elderly people to enjoy life as much as the young, without worrying about physical handicaps.

Innovation goes far beyond technology alone. It brings about comprehensive transformations that encompass the way people live in society. As such, it requires a completely new social system to be put in place. People and infrastructure are essential. Innovation is a key to productivity enhancement. It is also a key to strengthen the international competitiveness of Japan. Furthermore, innovation plays a vital role in making Japan's presence felt by offering new ways that we can contribute to the world as a nation. Above all, without innovation, the standard of living of people can never become better.

III. Key Concepts of Innovation 25

1. Innovation and the Society: Seizing the future

When we look back at the triggers that led to successful innovations, there are three common factors: insurmountably high goals that looked impossible to achieve, people with high aspirations and ambitions, and entrepreneurs who were determined to persevere with new challenges until fruition. Great successes and breakthroughs came only after much trial and

error, persistence and some luck. Our society as we know it today has been created and formed through innovations which began as creative ideas and, when combined with scientific knowledge, they transformed our social systems and institutions. These changes have further encouraged a series of subsequent innovations.

In the last 100 years, humankind has seen the fastest and the most dramatic changes in our history. Remarkable progress in transportation technology has reduced physical distance, and radical changes in information and communication technology (ICT) have enabled people around the world to share information instantaneously.

These changes have sometimes challenged and shaken our conventional wisdom, existing values, and societal norms that govern our lives and have been cultivated over many years. We must learn to live with the need to challenge and re-examine conventional wisdom. Globalization in the 21st century will proceed with many disruptions, but will not go back to the past.

Over the past 50 years, Japan has gone through several stages of change. We grew into a significant economic power in the world in a short period after World War II and then experienced the collapse of the bubble economy in the late 1980s. After suffering and struggling through roughly 15 years of economic stagnation or the “lost decade and a half”, Japan has now emerged to begin a new phase of economic development. We are now at a critical turning point: Japan is facing the new reality of globalization and further opening to the world. The key to this new phase is people with unique and exceptional talent who are often described as “nails that stick out” of a conformist society.

2. Globalization and the Role of Science and Technology

Unprecedented progress in transportation, information and communication technology such as satellite TV, computers and internet, brought us the “Global Age”. In this era, people, products, services and money move throughout the world very quickly. Revolutionary change in information and communication technology has also brought about fundamental change in

the way people think and the way the society works. We can find the impact of these changes in industry, the capital market, education and other aspects of the economy, to name a few.

In this context, the role of science and technology as the engine for economic growth has been recognized increasingly. International competition in the field of science and technology, whether it is for investment or among people, has greatly intensified in recent years. Many countries throughout the world have recently recognized the importance of innovation and have actually begun various initiatives to develop national innovation systems.

Ideas, scientific discoveries and inventions alone are not innovations. Scientific knowledge needs to be developed to meet the needs of society, and to be transformed and translated to deliver economic and social benefits, in order to realize its full potential. In this way, scientific knowledge contributes to society at large. Formulating and building a common interaction field, or shared context, often called an “Ecosystem” for its interaction, dynamism and diversity, is the foundation of national innovation policy.

3. Opportunities for Japan’s Innovation Strategy

In the global age, continuous entrepreneurship and speedy decision making are critical, particularly in big corporations and large organizations. The highest priority is the development and implementation of an innovation strategy, based upon an objective assessment of the entity’s strengths and weaknesses. Innovation needs to be promoted strategically and recognize the needs of the people such that economic and social benefits are created. By “people” here we mean those who lead life, and not suppliers. People here are not limited to those in Japan or Japanese nationals.

Japan is known throughout the world for its strengths in manufacturing (in the broad sense of the term) and “environmental or green” technology such as that for clean energy. We need to further develop these strengths by offering these products and services to Asia and the world. Technology is

making the world smaller but at the same time, its market potential is increasing, sometimes beyond our imagination. Asia is the fastest growing region in the world and we need to recognize our advantage of being in the region.

By offering Japan's assets in science and technology, which have been built through the continuous efforts of industry and society, we can make a significant and unique contribution to the world. We hope that this type of contribution through science and technology, more so than economic success, will ultimately make the presence of Japan felt and foster trust in our country.

4. Challenges for Japan's Innovation Strategy: View of the World

In the global age, national boundaries do not limit our activities. In our effort to bring innovation to society, we must avoid limiting ourselves to Japan when identifying the needs of the people and society. In creating new values through innovation, the same principle holds true. We will overlook great potential and opportunities if we remain fettered by the value system currently prevalent in Japan. There are some universal needs that cut across the globe as well as specific needs unique to regions. We should open ourselves to these needs by striving to identify and meet them at both levels.

In order to translate scientific knowledge and technology to meet the needs of society at large, we need to build the most optimal "Ecosystem" beyond national borders. In this global ecosystem, dynamic interactions among the people—the buyers and sellers—will exchange knowledge, information and funds regardless of national boundaries or origins. In order to create a truly innovative society, national policies and corporate strategies need to be based upon internationally recognized scientific evidence, rather than being constrained by precedents. Science continues into new frontiers and knowledge expands accordingly.

5. Fostering Human Resources and Unique Talent – the Key to Innovation

Every organization, whether it is political or corporate, charts its course

based upon how people think, plan and behave. Thus, people are a critical ingredient for innovation. We need to identify those with the talent and skills for innovation so they can be developed. As noted previously, every innovation starts with people, high aspirations and persistence. In Japan, individuals who think creatively or “out of the box” are often called “the nail that sticks out (and must be hammered down)”. One approach to developing such people is to let the young live overseas and gain experience a variety of settings. As the younger generation encounters and accumulates different experiences, a more “open Japan” will materialize. This is a requirement to make the “Second Opening of Japan to the World” happen.

Advanced educational institutions, including universities, are institutions that have a significant role in realizing this goal. Universities are important as they provide opportunities and a place to compete and collaborate for the young generation with diverse backgrounds and fresh views, and free from the conventional wisdom. Graduate schools and research institutions are also required to adopt a global perspective.

Major issues facing the world over the coming decades include global warming or climate change, resources and energy, water and food supply, population explosion, and poverty—basic security for humankind. In the face of these challenges, we need to identify a future vision for Japan in a rapidly growing Asia and world. For this objective, fostering innovative people with a global perspective is an urgent task ahead of us.

IV. Japan 2025 through Innovation

In this section, we present an image of Japan in 2025, based on various studies conducted by scientists and scholars, surveys of public opinion and forecast reports on future science and technology. Some ambitious examples include the possibility to have medical check ups with one tablet while asleep, cars that clean the air while being driven, and the potential to reduce earthquake casualties through emergency response measures implemented within 15 seconds of a major earthquake occurring. Innovation is critical to achieving such ambitions.

1. Long and Healthy Lives

For long and healthy lives, new innovations could deliver:

- Preventive medicine tailored to an individual's needs regardless of location
- Cures and treatments developed for three major illnesses, namely, cancer, cardiac infarction and stroke
- Regenerative medicine, advanced robots for nursing and treatments for Alzheimer's disease to reduce the number of bed-ridden patients, and to ease the burden on family members and other care-givers.

2. A Safe and Secure Society

Innovations can help us build a safe and secure society through:

- Advances in sensing and monitoring technologies that will enable children, and the elderly or handicapped to live a safe, secure and comfortable life
- Building materials that are equipped with self-repairing functions to extend the life of buildings and strengthen them against natural calamities
- Intelligent Transport Systems that will eliminate traffic jams and casualties from traffic accidents, and reduce carbon dioxide emissions logistics costs by better integrating cars, roads and cities
- An electronic card with security for personal identification to enable people to make routine payments.

3. Society with Diverse Work Styles

Innovation can contribute to a society comprised of diverse work styles by:

- Everybody, including those with small children, the elderly, handicapped and foreign-born, being able to choose and change jobs during their life based upon their ability and capacity in more flexible and open labor markets
- Free and flexible choices of career at different stages of life being made possible through advanced education systems catering for different stages of adult life
- A variety of work styles for handicapped, elderly and parents with small children becoming possible through promotion of a tele-work (work at home) system and homes located close to workplaces. Devices such as barrier-free, universal design equipment and auto-translating machines will enable work styles different from full-time work at the office. These

systems and devices will make collaboration with people outside of Japan easier and more accessible.

4. Society that Contributes Significantly to Resolving Global Environmental Issues

By 2025, innovation could see Japan become a society where:

- The public as well as the government and corporations make daily efforts to resolve environmental issues at the global level. These efforts will include radical reduction of the sources of global warming, efficient energy use, and waste and water management. Japan would lead the world by taking these initiatives.
- The public will be exposed to issues related to the natural environment and will take voluntary actions to save energy and implement the 3R's (Re-use, Reduce and Recycle) in everyday life. For example, grade schools will provide children with opportunities to learn about the environment and energy use. -Corporations will support such activities using multiple measures including paid-holidays for those undertaking such activities.
- Ongoing and ambitious efforts will establish Japan as a model of sustainability in the world. Abundant opportunities will be given to young people from Asia and elsewhere at universities and corporations in Japan so that they learn the skills to balance environmental, social and economic development in their home countries in a sustainable way.

5. Society that is Open to the World

Innovation will make Japan more open to the world by:

- Mutual understanding that will increase through more frequent communication between the public and people of other countries using devices such as auto translating machines. The Japanese people will have a better knowledge of, and appreciation for, people, technology, goods and services, tradition and culture of Japan. Our assets will be much better known and appreciated, as more Japanese share them with the rest of the world. More people from overseas will contact and interact directly with the Japanese public.
- Virtual reality technology that will enable the Japanese to get a real sense of the culture and historical heritage of other countries. The same opportunity will be provided to people outside of Japan to experience Japanese assets.

V. Basic Strategy for Promoting Innovation

We must clear numerous and formidable hurdles in technology, institutional structuring and the norms and unwritten rules of society at large to make this future vision for Japan a reality. The public also has dreams and expectations for Japan in 2025. These expectations cannot be met through a traditional approach. Breakthroughs are required in basic research and technological development, development of people with appropriate skill sets, and above all, a significant transformation in mentality of society. Only when they take place, will innovation happen. There are four basic premises of the strategy to attain this challenging goal.

1. Integrating and Promoting “Innovation in science and technology,” “Innovation in social systems” and “Innovation in human resources” (see **TABLE A**)
2. Changing our Mindset
3. Building Open and Universal systems
4. Developing Strategies Based upon the Views of the People of Japan and of the World.

VI. Policies to be Implemented in the Short Term

National government policies requiring immediate action to launch the “Innovation 25” strategy are listed below with additional details provided in **TABLE B.**

1. Global Environmental Issues as a Driver for Economic Growth and International Contribution

Environmental and energy issues will increase in significance as efforts continue to promote world economic development. Clean energy, green technology, nanotechnology and biotechnology developed in Japan should serve as the main drivers for economic growth. This will provide Japan with

an ideal opportunity to contribute to the resolution of these global issues.

2. Doubling the Investment for the Next Generation (including investment for the younger generation and expanding ICT use)

As people are critical to continuous innovation and the source of competitive advantage in the fields of science/technology and education, they need to be the focus of policies. Currently the emphasis is on goods manufacturing. Doubling investment for the next generation is also important. Productivity will improve if the current emphasis in ICT investment is shifted from hardware to software and systems.

3. University Reform

Universities throughout the world are in the midst of a dynamic transformation. Japan's universities would benefit from the provision of additional places for foreign students. By promoting collaboration and healthy competition among students from various backgrounds and nationals, universities will serve as a place to create and develop new talent and knowledge.

4. Investment Increase for Science and Technology to Ensure the Innovation 25 Strategy Delivers Real Value

Successful implementation of the Innovation 25 strategy will require investment in basic and advanced science and technology research. Efficient systems and infrastructure will need to be developed to transform new scientific and technological knowledge into new innovative products, services and markets that will benefit society. As innovation inherently involves risk of failure, investment schemes and funding practices appropriate to manage the risk is critical.

5. Innovation Review — Regulations, Social Systems, Norms and Rules

Review of long-standing regulations and rules is needed in the face of globalization, declining population and the ageing of Japanese society.

These regulations and rules served the original purposes for which they were enacted, but need to be examined from the objective of promoting innovation. Basic criteria for the review need to include an assessment of whether existing regulations and rules encourage innovation, and/or whether they promote the international competitiveness of Japan in the global age.

6. Internal Government Mechanisms to Make Japan the World's Leading Nation of Innovation

Comprehensive mechanisms are needed to integrate the three areas of innovation addressed in this strategy: science and technology, our social system and human resources. Sustaining innovation over the next 20 years to make Innovation 25 a reality will require persistent effort. Japan will become an innovative nation by 2025 only if top-down measures cutting across existing ministries and organizations are established, and if the people continue to persevere with the "Plan-Do-Check-Act" (PDCA) cycle.

Based upon the report of this Council due at the end of May 2007, government guidelines will be formulated and policies will be implemented immediately to make Japan an innovation-driven nation.

TABLE A: Integrating and Promoting “Innovation in science and technology,”
“Innovation in social systems” and “Innovation in human resources”

1. Innovation in Science and Technology

To achieve innovation in science and technology we will need to:

- Encourage a diversity of basic research and invest in high-risk research projects with potential for significant benefits.
- Create research bases and programs which attract the great minds of the world.
- Enhance research capabilities through better management by universities and research organizations including reform of effort management and improve the global competitiveness of university education and research.
- Promote new projects that integrate research on the life sciences, IT, engineering, the environment, energy and service science.
- Enhance domestic, regional and international “ecosystems” between basic research and markets for interactive collaboration among different domestic and global industries of different fields.
- Promote international scientific and technological collaborative projects led by Japan to address major global issues such as environmental and energy problems.
- Encourage further international development and standardization of intellectual property rights.

2. Innovation in Social Systems

To achieve innovation in social systems we will need to:

- Strengthen efforts to create innovation in service industries to improve wellness and enrich quality of life.
- Create systems with “safe-harbor” rules for new, high-risk businesses to encourage entrepreneurship and speedy innovation.
- Build new systems to encourage innovation by, for example, establishing specially designated zones without regulations, and using government procurement to initiate demand for innovation.

- Establish funding and investment incentives that support challenges and new ventures.
- Reform social systems for a new way of working with multiple employment opportunities to encourage workers to continue to take challenges according to their ability, experience and qualifications without discrimination based on gender, age, and other factors.
- Implement policies to promote and induce a diversity of business practices and activities that are open to the world.
- Implement policies that invigorate regional communities, for example through a larger regional system (the so-called “*Dou-Shu-Sei*”), rather than the current prefecture system.
- Promote research on social systems that is conducive to innovation.

3. Innovation in Human Resources and Creating Innovative Minds

To innovate our human resources we will need to:

- 1) Encourage cultural diversity and people who think creatively by:
 - Giving more opportunities for direct contact and interaction with non-Japanese, from an earlier age (at grade school, for example).
 - Shifting from memory-based to thinking-based learning and education, and reinforcing science and mathematics education at primary and middle schools.
 - Increasing experience-based learning so that students are exposed to and can appreciate the true value of world-class experts, goods, technology, culture and traditions.
 - Empowering teachers and enhancing continuing education and training.
 - Providing more opportunities for international exchange and home-stay programs at middle and high schools.

- 2) Foster people with broad knowledge, expertise and professionalism by:
 - Ensuring students attend cutting-edge science and technology courses, with on-site experience, by the end of high school.
 - Reforming university education by eliminating the distinction between arts and sciences at entry with a more flexible entrance policy.
 - Strengthening undergraduate level education (measures include more emphasis on liberal arts education, a dual-major system at the

undergraduate level and a dual-master system at the graduate level. These measures will encourage students to acquire a broader knowledge).

3) Build a society and community friendly to high-caliber experts from abroad by:

- Fostering an independent mindset and entrepreneurial spirit by exposing students to a diversity of job and career opportunities, for example, through internships at an early stage of school life.
- Developing programs and systems for continuing education with universities.

TABLE B: Policies to be Implemented in the Short Term

National government policies requiring immediate action to launch the “Innovation 25” strategy are listed below.

1. Global environmental issues as a driver for economic growth and international contribution

Major actions required

- Promote technological collaborations and transfers and joint international research and verification programs for global environment issues (e.g. develop effective measures to implement through ODA etc.).
- Foster world class leaders in the global environment area.
- Accelerate international expansion of environmental technology including international standardization.
- Implement effective policies to promote environment-related businesses.
- Promote environment-based diplomacy.

2. Doubling the investment for the next generation (including investment for the younger generation and expanding IT use)

Major actions required

- Expand the opportunities for young people to have international interactions.
- Provide opportunities for middle and high school students with their counterparts in Asia.
- Expand overseas exchange programs for university students and academics.
- Expand scholarships and other measures to encourage creative and entrepreneurial challenges for young people.
- Enhance science and math education.
- Expand IT use and application for improvement in productivity (e.g. develop an open and universal IT infrastructure).

3. University reform

Major actions required

- Promote internationalization at undergraduate and graduate schools and

faculties.

–Increase international competitiveness in education and research at universities.

–Review the distinction between the arts and sciences in university entrance examinations and undergraduate schools and faculties.

–Enhance research capabilities after reviewing current funding systems, including the allocation of funding and distribution.

–Enhance educational capabilities of universities so that they include continuing education for the community and general public.

4. Investment increase for science and technology to ensure the Innovation 25 strategy delivers real value

Major actions required

–Fund a diverse base of fundamental scientific research which is required for innovation in the next 20 years and provide financial support to young researchers with leadership potential.

–Review current screening processes for innovation including breakthrough technology research, develop mechanisms to transfer scientific knowledge so that the benefits are realized more quickly, and establish government–initiated stimulation programs to trigger initial demand for new technologies.

–Encourage frontier, cutting–edge research.

–Promote research and development investment in various corporate sectors.

–Provide mechanisms for interactions between the academic and corporate sectors that cut across traditional disciplinary and organizational boundaries.

5. Innovation review—regulations, social systems, norms and rules

Major actions required

–Review regulations and rules that encourage “service innovation”.

–Review regulations to improve the efficiency of physical distribution, logistics etc.

–Implement policies to create social systems and infrastructure that will accelerate and reinforce innovation (such as special regulation–free zones).

–Review regulations and rules related to employment so that they encourage entrepreneurship and innovation.