How Can Industrial Technology Policy Enhance Innovation?

Outline of Interim Report by Industrial Science & Technology Policy Committee, Industrial Structure Council

By Terunobu YAMAUCHI

Introduction

As limited resource/energy supplies and environmental constraints pose serious problems on a global scale and financial woes shake the world economy, Japan needs to build its future upon science and technology that can ensure sustained development of its economy and society. From this standpoint, the Industrial Science and Technology Policy Committee of the Industrial Structure Council, an advisory panel to the minister of economy, trade and industry, mobilized the wisdom of industry, academia and government to discuss specific prescriptions and finalized an interim report in August 2008. Noting that R&D strategy is changing as research targets become specialized and elemental technologies needed for the development of new technologies get increasingly complicated, the report said Japan's R&D system needs to be shifted from the conventional one aimed for improvement of technologies and depending on its own technologies to a new concept-driven and open-innovation one. It also said Japan should aim to become a technology-oriented nation by making a full use of its high science and technology capability and by leading the world in pursuing technological solutions that can address such challenges as carbon emission reduction, reducing risk to health, and maintaining social safety and security. Here is an outline of the interim report.

Challenges Facing Japan's Industrial Technology

1. Japan's Status as Technology-oriented Nation in Crisis

Resource-poor Japan has grown to become the world's second-biggest economic power as a processing, trade-oriented industrial nation that has imported natural resources and produced and exported products since the days of its postwar rehabilitation. However, its economic prowess has eroded in recent years. In terms of per capita GDP, Japan fell from third in 2000 to 19th place in 2007. Its international competitiveness sank to 24th in 2007 from top in 1993 in the annual rankings by the International Institute for Management Development (IMD). The contribution of total factor productivity to GDP has been flagging since around 1990. Today, Japan ranks lower among the major industrialized powers in terms of R&D efficiency *(Chart 1)*.

2. Crisis Factors in Business Cyclical & Structural Terms

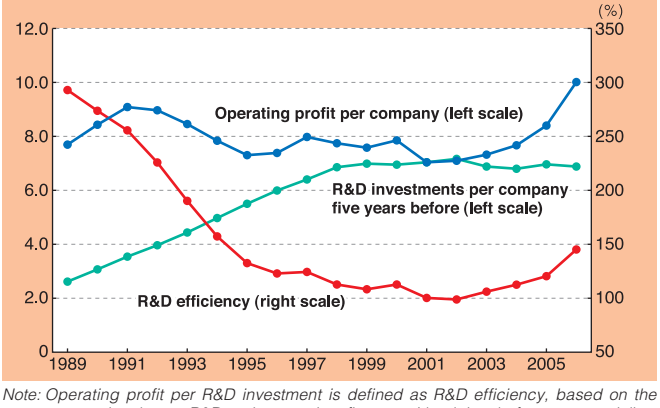
A recent poll of major Japanese companies suggest that around 70% of them plan to cut their R&D investments in fiscal 2009 as compared with fiscal 2007 amid the recession triggered by the world economic crisis. Reduced R&D spending may greatly undermine the nation's attempt to turn innovation into an engine for economic growth.

Accelerated movements of manpower and goods and the progress of information technology stemming from digitalization and networking have made increasingly sophisticated and complicated the challenges associated with socioeconomic systems that support personal and industrial activities. At the same time, new technology seeds have also become sophisticated and complicated in keeping with the progress in basic science, such as the development of material technology and biotechnology. This requires companies to carry out their R&D investments in a swift and proper manner to meet the dramatic changes in market trends. The rise of "catch-up type" producers in East Asia and the fall of prices due to cutthroat competition require Japanese manufacturers to evolve their business not merely through the conventional product development but under new integrated systems incorporating all processes from total image design and combination of elemental technologies and products to maintenance and operations.

The Japanese manufacturing sector has been structured, as typically seen in the auto and electronics industries, to set target models of end products and services and hone its competitive edge by improving and upgrading elemental technologies. It is becoming more important for manufacturing industries to create new demand beyond their conventional business models that can be a traction engine for future economic growth.

CHART 1

R&D investments by Japanese manufacturers

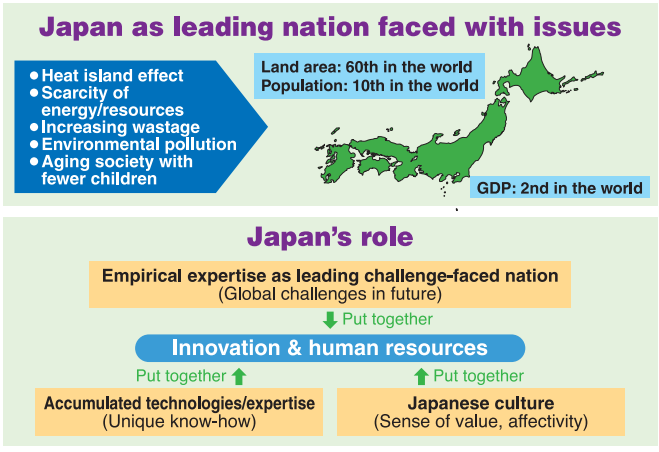


Note: Operating profit per R&D investment is defined as R&D efficiency, based on the assumption that an R&D project requires five years' lead time before commercialization. It was calculated in nominal terms under the formula given below.
R&D efficiency = operating profit per company in the five-year period starting from the relevant year/R&D spending per company in the five-year period starting from five years before the relevant year

Source: Data processed from statistics contained in "Science & Technology Survey Report," Ministry of Internal Affairs & Communications

CHART 2

Image of solution-type R&D projects



Source: Extracted from data presented during lecture by Hiroshi Komiyama, former president of University of Tokyo

Direction to Follow, Policies to Pursue

1. Maintaining & Increasing R&D Investments

Curtailment of R&D investments – the seed of future growth – in times of recession can lead to a loss in the capacity of growth that innovation may bring about after a business recovery. The interim report stressed the need for the government to: (1) support the private sector's enthusiasm for R&D investments and (2) take steps to prevent R&D personnel in the private sector, now in temporary surplus, from being scattered and lost.

Government R&D investments in fiscal 2008 totaled the equivalent of 0.83% of GDP. Japan's ratio was lower at 0.79% in fiscal 2005 than 1.08% for the United States, the world leader. Referring to a slowdown of private-sector R&D investments amid the recession, the report said the government should hold fast to the 1% target it pledged under its third Basic Plan for Science and Technology.

The report also pointed to the importance of tax incentives and other measures to encourage companies to maintain and step up R&D spending by the private sector. The National Institute of Advanced Industrial Science & Technology (AIST), an independent administrative agency, has been accepting researchers on secondment from companies in the form of temporary staff for joint research with the private sector. The report called such arrangements important in preventing the dissipation of R&D personnel and their knowledge.

2. Shifting to Exit-oriented National Technology Strategy

Under the 3rd Science and Technology Basic Plan, government R&D investments have been primarily funneled into four priority technology areas. Their purpose should be shifted to one aimed at finding solutions needed to build future social systems *(Chart 2)*. The report mentioned three specific points to be addressed in this process: (1) strengthening exit-oriented R&D programs that cover everything from basics to applications, (2) reinforcing interfaces that connect basics to applications and development, and (3) strengthening basic science and technology capabilities as a source of innovation. It also stressed that the traditional system of inter-agency budget partitioning should be amended so that various ministries in charge of industries can work together to promote exit-oriented basic research devoted to specific targets. Basic research is not only to pursue knowledge. It can unfold potentialities that may lead to future innovation. The report said the government needs to watch global developments in science and technology, and see that its policy portfolio contains a specified amount of such research.

3. Strengthening Exit-oriented R&D System

As seen in Silicon Valley in the United States and at IMEC in Belgium, open innovation is in progress with the participation of international R&D staff and entities. The report said Japan should pursue a national policy to strengthen an open innovation-type R&D system where companies, universities, research institutes and various other entities can strategically "compete" and "collaborate" with each other beyond their institutional boundaries. It said competition grows intensive in the open innovation environment, requiring Japan to positively respond to standardization strategies so that it can stand at an advantage in such competition. At the same time, it urged the government to promote the sharing of interface information to encourage the participation of numerous R&D entities so that innovation can be pushed ahead by a broad range of players.

4. Developing Human Resources, Ventures & Regions to Support Exit-oriented R&D Systems

Faced with complicated and sophisticated problems to be solved, companies need to engage in specialized and complicated R&D programs. They need to find sophisticated and practical-minded personnel who can lead such programs to a success. The report said the open innovation environment makes it imperative to nurture producers who can fashion products and services by effectively combining each of the excellent elemental technologies available to them and foster technical talent who can be active in the boundary domains. Noting that the growing popularity of life science, nanotechnology and robotics is making civil engineering, electrical/electronic appliances, machinery and chemistry relatively unpopular, it stressed the need to foster specialists in the latter areas who are in constant demand in a wide segment of industry. It also pointed to the need to stem the ongoing disengagement of younger generations from engineering studies.

The report said it is important to bolster R&D venture businesses, set up open innovation opportunities at R&D institutes to help technical talent move from one place to another more easily, accelerate the entry of newcomers through the release of more external interface information and make a better use of untapped R&D results retained by the state and businesses.

5. Reinforcing Virtuous Circle of Innovation & Social Needs

The report stressed the need to create a virtuous circle of innovation-based solutions bringing benefits to the general public. It said the government should promote an innovation policy aimed to strengthen the linkage between R&D programs and social issues and needs. From this viewpoint, it said, solutions to social issues and economic benefits ought to be made visible through pilot program-type R&D projects, adding that the ground for closer collaboration should be in place to see newly developed technologies put to practical use in society.

Examples of pilot program-type R&D projects

*Intellectual Café (launched in fiscal 2007)

This provides a forum where knowledge and technologies from different fields can fuse together to shed light on new policy issues.

*Innovation Policy JAM (organized on July 2-4, 2009, by AIST)

This was an online chat where opinions expressed by more than 100 specialists on government innovation policies were summarized and analyzed.

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