



## **Preface**

# **Government-funded Research : Objective-oriented or Knowledge-oriented ?**

Shojiro. ASAI

*Hitachi Ltd.*

The Japanese government funds most university research, all national laboratories, and some pre-competitive research in industry. With the enactment of the new Science and Technology Basic Act and the accompanying Science and Technology Basic Policy, there has been in recent years a considerable increase in government research spending. Many issues have been raised as a result, in particular, regarding the guidelines for government-funded research. As spending increases, criticism from the general public has inevitably increased as to whether taxpayers' money is being spent properly. There are two different approaches for spending government research funds; one is for definite objectives for the betterment of society, the other is for gaining knowledge in science and technology. I believe it is important to prioritize objective-oriented research rather than knowledge-oriented research.

Looking back in history, the clearly-defined objectives of establishing navigation gave rise to the modern system of knowledge of planetary movement and classical dynamics. A search from a national interest for natural resources resulted in a systematic theory of natural history, called Darwinism. Thermodynamics and early quantum mechanics were driven during industrialization by the need for better control of steam engines and steel furnaces. Discoveries and applications of bacteria, vitamins, and antibiotics are the results of efforts to maintain the hygiene of soldiers in the battlefield. The view that discoveries precede applications is valid in some cases, but not in many important historic breakthroughs.

At present, Japan is faced with a whole range of problems of security, the environment, energy, food, health, communications, and global economic competition. Government research funds should be used more appropriately to provide solutions to these problems. There are two major barriers to be overcome. One is the bureaucracy where highly segmented sections of government departments devise projects within their isolated territories of administration. The other is the tendency among those who conduct government-funded research to propose research topics that are highly knowledge-oriented: the approach is to seek funding but avoid criticism of the results. It is therefore very difficult to launch projects with clear-cut objectives and sufficient impact to solve important national problems in these times of rapid change. Instead, a great many projects are born that are not necessarily coordinated for providing fundamental solutions.

The process of systematically identifying topics for research starts by prioritizing major problems of national interest and breaking them down into minor, mutually related

problems, and continues down to the physical level. The word 'minor' here does not imply lower significance but indicates that problem-solving at lower levels of the hierarchy provides means of tackling problems higher in the hierarchy. For example, with such issues as the environment and transportation (of things and information alike) high up in the hierarchy, we can identify, for example, issues such as satellites, networks, image recognition, databases, sensors, analytical instruments, and materials. Goals set for solving and understanding problems of primary importance are related to goals of research at various levels lower in the hierarchy. Roadmaps and timelines need to be worked out also. Speaking of research in new solid-state devices, for example, goals are set in relation to the goals and roadmaps set for computers, communications, control, medicine, environmental sensing, and so on. Research on super-conducting devices, for example, should be directed not towards super-computers all at once, but towards magnetic and electromagnetic sensors (even for very special purposes in medicine or astronomy) so that a foothold is secured for incremental progress.

Government research must not be a pork barrel. Those who take funding from the government must pay back by contributing to solving national problems. Failures are permitted but not all the time. My view is that, roughly speaking, eight to two should be a reasonable ratio between objective-oriented research and knowledge-oriented research.