

KOREA

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1. Introduction

Government-funded research institutes in the field of science and technology have made tremendous contributions to Korea's rapid socioeconomic progress and the development of S&T since the mid-1960s.

To the extent that scientific and technological knowledge increases and the influence of S&T on national and social development grows, government research institutes gain significance as they have to meet new challenges. However, in the midst of a global transition into a knowledge-based society in the 21st century, Korea's government research institutes are being criticized for their failure to respond to the rapid changes in the global technological environment.

In 1999, the enactment of the Act on Establishment, Management and Promotion of Government-funded Research Institutes set the stage for a massive

restructuring of the institutes. Currently the 26 government research institutes are under the wing of two research councils: the Korea Research Council of Fundamental Science and Technology which is affiliated with the Ministry of Education, Science and Technology, and the Korea Research Council for Industrial Science and Technology which is under the supervision of the Ministry of Knowledge Economy.

The KRCF supports 13 research institutes, including the Korea Institute of Science and Technology, which are involved in fundamental research. In 2008, the total number of staff at the 13 institutes stood at 4,660, with research scientists accounting for 67 percent and administrative and technical staff taking up the remaining 33 percent. In that year, the KRCF's annual budget was 1.61 trillion won, of which 42 percent or 669.3 billion won came from the government.

The ISTK also controls 13 government institutes, including the Korea Institute of Industrial Technology. On its payroll were 5,826 employees in 2008, of whom 4,478 or 77 percent were research scientists. Its annual budget was 1.84 trillion won, with government funding accounting for 28 percent or 506.8 billion won.

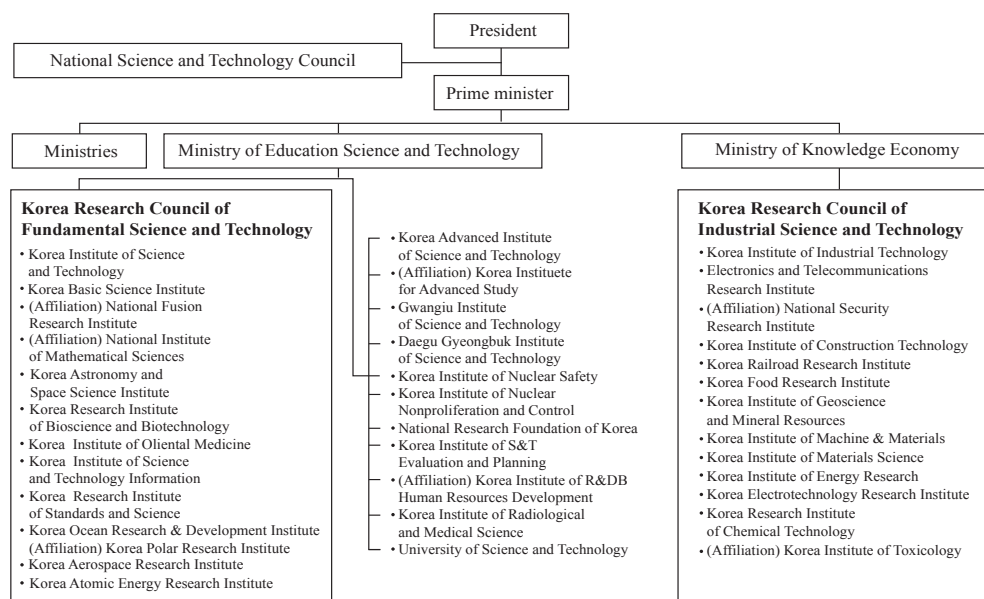


Figure 1 Current organization of the government-funded research institutes

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When combined, the two councils had 10,486 employees on their payroll in 2008 and their annual budget totaled 3.45 trillion won.

The current structure of the GRIs has caused a number of functional problems. The following sections will focus on six major aspects: research areas, research resources (organization, budget and human resources), legal personality, research performance, human resource mobility and the functions and roles of the research councils.

2. The status and functions of the GRIs

2.1 Research Areas

Two problems can be identified regarding research areas. First, large-scale “agenda-type” research projects are lacking in the field of basic science compared with advanced nations around the world. The share of basic research in the government’s total R&D budget stands at 24 percent. Of the research projects carried out by the GRIs, only 21 percent are related to basic research. These figures fall far short of those of other advanced nations, for instance, 44.2 percent in the U.S. (in 2007, excluding the national defense sector) and 45.3 percent in the U.K. (in 2006).

Second, it is hard to clearly differentiate the KRCF from the ISTK in terms of areas of research. Basic research accounts for 39 percent of the KRCF’s research activities, higher than 16.7 percent of the ISTK. But the gap has been narrowing. Some institutes under the KRCF are predominantly engaged in applied research. In the future, the KRCF needs to focus on basic research, including national agenda projects, while the ISTK needs to concentrate on development of industrial core technologies closely related to the industry and expand applied developmental research.

2.2 Research Resources

Research resources refer to organization, budget and human resource. Organizational problems stem mostly from rigidity. Organizational rigidity can be found not only in relations between the GRIs but

in relations between their departments. Due to the lack of financial resources for coordination at the research councils, most of the research institutes they support have certain limitations, particularly when they conduct convergence research. For instance, in the KRCF’s case, joint research projects accounted for only 11.5 percent of its research programs in 2008. Furthermore, the actual sharing of research equipment that can be shared with other institutes was very low. Therefore, it is necessary to explore ways to improve the organizational structure of the GRIs to make them more flexible. To be more specific, we may have to consider the possibility of dividing an institute into two parts -- a fixed research department that focuses on primary research areas and an open research department that can be easily reorganized (opened and closed).

The problems with the R&D budget can be narrowed down to insufficient government funding and the research councils’ lack of the authority in budget allocation. In 2008, government funding accounted for 40.49 percent of the KRCF budget and 32.7 percent of the ISTK budget. The low percentage of government funding makes it difficult for an individual GRI to carry out R&D projects in an independent and stable manner. In most advanced nations, federal funding accounts for a much higher percentage -- 90 percent for Japan’s RIKEN, 82 percent for Germany’s Max Planck Institute, 70 percent for the Helmholtz Research Centers and 75 percent for France’s CNRS.

Another problem is that in Korea’s case, GRIs tend to focus on short-term projects due to the one-year time frame that defines Korea’s budget structure. To overcome these constraints, we suggest that our budget system be changed to a three-year cycle and that the government funding be increased to 80 percent of the budget for government institutes.

When it comes to human resource management, the most serious problem is a lack of high-caliber human resources. Due to the strict control on the personnel quota by the Ministry of Strategy and Finance, it is difficult to secure talented researchers. The lack of flexibility in personnel management,

especially in recruiting and training talented researchers, substantially limits the inflow of talented people into research organizations.

Currently, the increase rate of research workforce at GRIs is lower than that of private research institutes. In 2007, the government institutes accounted for a mere 3.5 percent of the total research workforce in Korea. The job satisfaction level of the employees in the government institutes is also lower than that of researchers at universities and companies. As a result, the staff turnover at GRIs is higher than at university research centers.

Against this backdrop, it is imperative for the GRIs to find ways to secure highly talented researchers within their limited budgets. More importantly, the budget allocation system needs to be altered to partially empower the research councils or individual institutes to decide their personnel quota within their budget boundaries.

2.3 Legal Personality

Advanced nations use diverse legal forms for their research institutions. A research institute may or may not be given legal personality depending on its role. Making a GRI a legal person helps it maintain managerial independence and implement R&D projects in a more stable manner. However, it could hinder a GRI from cooperating with other organizations or enhancing organizational flexibility.

Given these two conflicting aspects, the legal personality should be used flexibly depending on the situation. For instance, it is more desirable to make a GRI mandated to carry out national agenda projects a legal person because it would help the institute push them in a stable manner. A large-scale research institute equipped with immense research facilities would also need a legal personality.

However, a more flexible organizational structure without a legal personality might be preferred for GRIs engaged in areas where convergence research is required or in basic research fields that require cooperative and joint operations with universities. Small-scale research institutes also do not need to be a legal person.

2.4 R&D Outcomes

Korea's GRIs have been showing a steady improvement in terms of the quantity of research outcomes. The number of scientific publications authored by researchers at state institutes increased noticeably from 1,210 in 1999 to 4,218 in 2008, a 247 percent jump. Among them, the number of publications in the SCI-listed journals also rose from 1,701 in 2003 to 2,443 in 2007.

The total number of patents registered by the GRIs fell from 1,198 in 2006 to 1,133 in 2007 before rebounding to 1,721 in 2008. In per capita terms, patent registrations changed from 0.42 in 2006 to 0.38 in 2007 and 0.56 in 2008.

Despite such a quantitative growth, Korea's R&D outcomes lag far behind those of developed nations in terms of quality. As a result, the global competitiveness of Korea's R&D capability remains relatively low. The average citation frequency of the publications authored by the KRCF researchers from 2003 through 2007 stood at 2.98, far lower than 10.52 for Japan's RIKEN or 12.42 for Germany's Max Planck Institute.

In addition, the number of the papers posted in the world's three biggest scientific journals -- Nature, Science and Cell -- was only 12 in 2007 and six in 2008, accounting for a mere 0.57 percent and 0.15 percent of the entire publications issued by the GRI researchers. More worrisome is the small per capita number of scientific papers -- 1.36. This places Korea's GRIs at the bottom of the ladder among research institutions in advanced nations.

The imbalance between input and output is also very serious. In 2008, the government's R&D budget totaled 10.94 trillion won. Of this, 1.38 trillion won or 12.6 percent was injected into the KRCF research institutes, while 1.32 trillion won or 12.1 percent went to the ISTK research institutes.

However, the output of the GRIs does not match the input. In 2007, the total number of SCI-listed papers published by Korean researchers stood at 25,494. Of these, papers authored by the KRCF researchers accounted for 2,443 or 9.5 percent of the total. Worse yet, the KRCF research institutes

registered 1,133 patents in 2007, taking up a mere 0.9 percent of the 123,705 patents registered in Korea that year.

To attain better R&D outcomes, it is necessary to reform the present GRI systems concerning evaluation, compensation and operation. We suggest 10 action plans as described in Figure 2 to improve the performance of the GRIs.

2.5 Human Resources

Compared with research institutes in advanced nations, the Korean institutes show a very low mobility of human resources. To a significant extent, the government's control of the personnel quota impedes the inflow of new workers into the GRIs. For example, the share of new workers in the total work force at the KRCF institutes stood at 3.5-3.6 percent for the past three years, which is only one-third the average level of research institutes in developed nations.

In addition, personnel exchange remains at a low level. In 2007, exchange of regular researchers between the state research institutes and universities

amounted to only 6.2 percent of the entire researchers at the two research councils combined. In addition, temporary dispatch of researchers from the government research institutes to other organizations involved only 9.1 percent of the entire researchers at the two research councils in 2008. Inter-GRI personnel exchanges were limited to seven researchers.

In advanced nations, GRIs are closely linked to universities through various channels. Through these links, they can not only promote active exchanges of human resources but attain flexibility. They also operate a flexible recruitment system that offers diverse career paths to high-caliber researchers at various levels from young researchers to prominent scientists.

Korea needs to improve human resources mobility to attract talented researchers from around the world and promote open R&D based on cooperation among the industry, academia and government research institutes. For this, the government needs to improve the job security of individual researchers, introduce a global talent recruitment and utilization system, diversify career development paths at the GRIs and revamp the current legal and institutional framework.

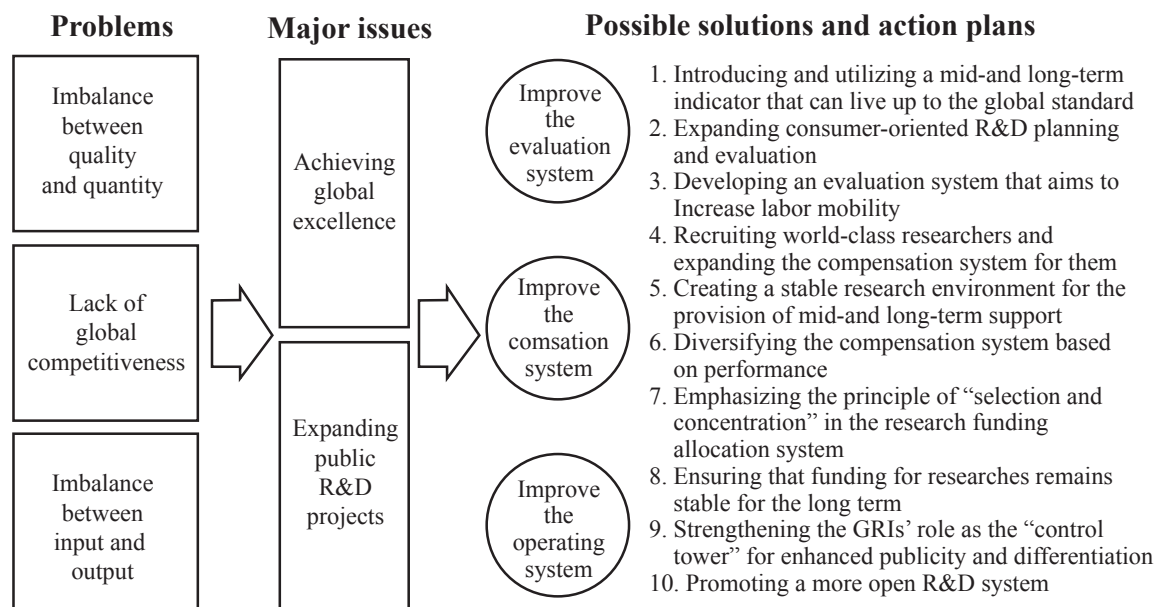


Figure 2 Major problems, issues and challenges of research performance

2.6 Functions and Roles of Research Councils

Back in 1999 when the research council system was first introduced, its primary objectives were to allow cross-ministerial utilization of the GRIs, to increase research productivity through close cooperation between industry, academia and research institutes and to implement regular restructuring for the future development of the GRIs.

However, the research council system has failed to live up to the expectations. The two research councils have been the target of criticism because they fall short of their peers in advanced nations in terms of institutional performance and capacity.

The ultimate aim of the research councils is to help GRIs enhance their expertise and become top-notch institutes. For this, it is necessary to create a new value chain. The research councils need to create a more flexible environment for the management of the research institutes. For this, the government should grant the research councils the authority to restructure the institutes under their wing and adjust their budgets.

The governance systems of GRIs in advanced countries differ widely. We can categorize them into three types -- research council, ministerial supervision and mixed type. In the U.S., most public research institute are under the supervision of government agencies. In Germany, the federal Ministry of Education and Research takes overall responsibility for science and technology policy. Under it are four research councils that carry out public research. In the U.K., most of public research is conducted by the seven research councils under the Office of Science and Technology in the Department of Trade and Industry. In Japan, there are two big government research institutes -- RIKEN under the Ministry of Education, Culture, Sports, Science and Technology and the National Institute of Advanced Industrial Science and Technology under the Ministry of Economy, Trade and Industry. Other ministries also operate small-scale research centers. In France, public R&D programs are undertaken by the nine public research institutes called the Public Scientific and Technical Research Establishments which are under the supervision of the Ministry of Higher Education and Research.

These institutes are managed in diverse ways. For instance, some are under the direct supervision of the government and others take the form of a special legal entity. But most public research institutions are operated free from government intervention and control.

The GRIs in the U.S. are under a dispersed management system, while in Germany, each research council is independent. The seven research councils of the U.K. are run by the RCUK Executive Group, composed of the government, academia and industries. In Japan's case, RIKEN and AIST, both an independent administrative entity under two government ministries, manage their institutes autonomously. In France, the state research institutes independently undertake various R&D projects under the supervision of the government. They place a high priority on maximizing research outcomes and securing excellence based on a strict and fair evaluation system.

Third, the GRIs in advanced countries are granted different types of legal personality depending on their status and role. In particular, most of the research centers in the field of big science, such as aerospace and nuclear power, act as a legal person since in these areas, independent management and stable implementation of national agenda projects are important. To be more specific, the countries in mainland Europe, such as France and Germany, tend to grant their public research institutes a legal personality, while the common-law countries such as the U.S. and the U.K. do not. In the case of Germany, the research institutes under the Helmholtz Research Center and the Leibniz Association assume a legal personality.

Fourth, when it comes to budget procurement, the government's contribution to the total budget of state research institutes reaches 80-90 percent in most cases. The research institutions that focus on national agenda projects are given autonomy and responsibility in management. In the U.S., federal government agencies provide most of the research funding for the government research institutes, which is then distributed under a project-based system.

In Germany, all of the funding for the government research institutes comes from the federal government,

but it is the research councils that make specific decisions about how to allocate and execute the funds. In the U.K., the Office of Science and Technology allocates its budget to the seven research councils, which then redistribute the allocated budget to the actual research scientists. In Japan, government contributions account for 87 percent of RIKEN's budget and 76 percent of AIST's. France's publicly-funded research institutions also secure most of their funding from the central government.

3. Conclusions

We have analyzed the status and functions of the GRIs in Korea and the operations of those in advanced nations. Based on our findings, we can summarize the major policy issues and future tasks as follows. First, the roles and functions of the GRIs need to be redefined based on the four broad policy directions -- pursuing world-class competency, ensuring flexible management, promoting independence

and responsibility in operation and creating a stable research environment within the institutes.

Second, in order to translate the general policy directions into specific strategic objectives, we need to tackle the three tasks -- improving operational efficiency, redefining the roles of the research councils and reshaping the governance system involving the government, research councils and the institutes.

Third, to enhance the efficiency of the GRIs, we need to address two tasks -- the adjustment of the functions and roles of the institutes and a shift toward longer-term and larger-scale research projects. Refining the roles of the research councils call for a clearer differentiation of the two councils and improving their capability to manage the research institute. A governance reform needs to focus on making GRIs more customer-oriented, open and public-spirited.

Fourth, the development of the research institutes in the future will have to take three stages -- structural reorganization, management innovation and finally, value realization.

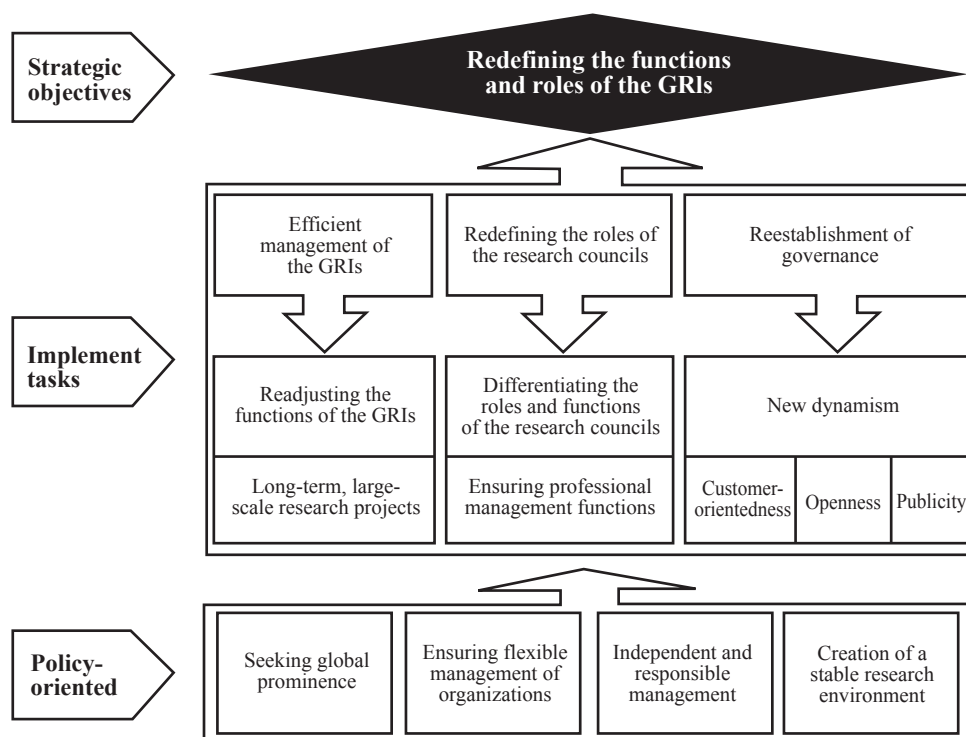


Figure 3 Major policy framework

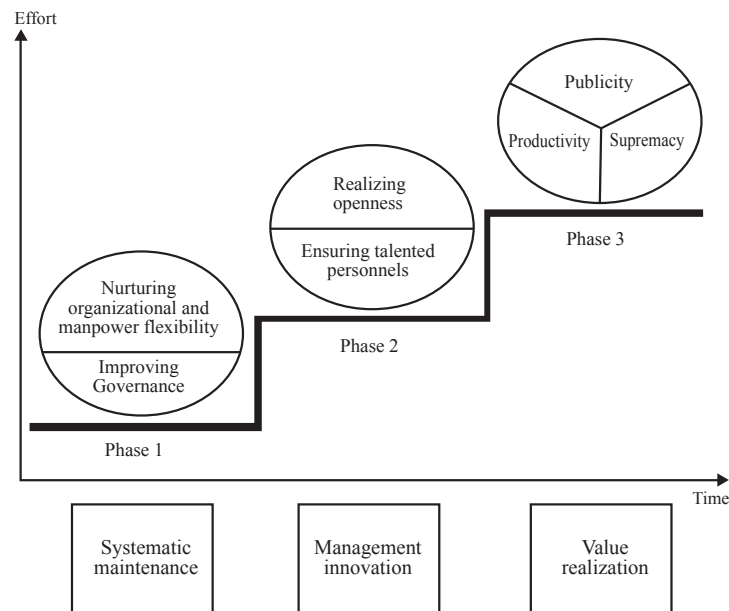


Figure 4 The future development paradigm for the GRIs

To revitalize government-funded research, we suggest the following three recommendations. First, the current system needs a dramatic overhaul to achieve internationally recognized research outcomes.

Second, to address the problems facing the current system, it is necessary to consider the following strategies: improving resource distribution, pursuing large-scale research projects, building a more open and

innovative system, reforming the governance structure and enhancing the roles of the research councils.

Third, reform of the government research institutes involves two aspects - software and hardware. We need to start by reforming the software side, that is, ensuring a more efficient use of the human resources and then gradually improve the hardware side and reform the governance structure.