

National R&D Planning Strategy and Budgeting System in Korea

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Abstract

Proposed increases to the Korean government's R&D budget should be discussed based on the merits of meeting efficiency and effectiveness criteria. The evaluation of the national R&D budget and related programs are performed in two areas: a system of R&D budget coordination and allocation, and a system of R&D program performance. This paper mainly focuses on the operational areas of the R&D budget evaluation system with a focus on their impact on efficiency and effectiveness. The core view point for a R&D budget evaluation system involves two directions: Firstly, to detail the relationships between the activities in the latter stage (ex. post) such as program surveys, analyses, and program performance evaluations, with the budget evaluation. Secondly, to oversee all R&D coordination and procedures a different perspective. Budgeting is generally known as a serial process of policy making, planning and executing. It is highly desirable for the budget to be allocated to, and spent by, specific programs as planned, and that each plan is aligned with a specific policy. As such, a strong relevance between the program structure and budget code system is integral to successful execution. It should be performed using a decision-making system that closely examines the link between policy and budget. It is also recommended that systematic relationships be maintained among budget coordination and allocation, performance evaluations of policy and program levels, and the program survey and analysis system, and that furthermore, their operational schedule should be reviewed comprehensively as one integrated system. The National Science and Technology Council is expected to play a major and practical role as the center of policy planning and should be supported by an objective and unbiased system which covers the overall process from policy making to program evaluation. Finally, increased utilization of contents, timely program survey and analysis, accurate scheduling of budget coordination and allocation, as well as diligent program performance evaluation, all contribute towards a more efficient and effective overall evaluation system.

1. Introduction

Strategic R&D planning and coordination and a budget allocation system in accordance with such a plan is the fundamental requirement for the enhancement of R&D effectiveness and efficiency. As taxpayer's money takes up a substantial portion of the national budget, strategic planning and coordination and budget allocation is important. In the case of Korea, the R&D strategic planning and coordination,

allocation and deliberation, and drawing up of the budget, as well as inquiries about, analysis of and evaluation of the programs has been carried out regularly since 1999, and has been continuously improved. Due to this ongoing evolution process there have been difficulties in the maintenance of consistency of operation due to several modifications of the relevant government organizations. Considering R&D as a series of continuous temporal steps, adherence to consistency at the national level is

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becoming increasingly important¹⁾. Effective and efficient deliberation, drawing up, and execution of budget are possible only when the association between policies and the budget is reinforced.

This thesis discusses the operation of the budget system with respect to the coordination, allocation and execution of the R&D budget. The subjects of the discussion are the R&D budget and programs. Jeong, Geun Ha and others (2005) generally define the inquiry, analysis and evaluation of national R&D programs, and the coordination, allocation and deliberation of the program budget as a comprehensive coordination. This thesis focuses on the coordination, allocation and deliberation of the budget, which is the first stage of comprehensive coordination (Yang, Hee Seung, 2004; Bark, Pyengmu, 2007). There are two new perspectives that need to be established. The first is to more closely link the viewpoints on inquiries, analysis and evaluation of R&D programs that are carried out in the second stage of comprehensive coordination to the preceding stage, and the second is to shed new light on the system of overall comprehensive coordination of this process.

In order to reinforce the linkage between policies and the budget, there is a need to view the approach to comprehensive coordination from different perspective, and, therefore, there is a need to partially supplement or improve the system's operation. For this purpose, in Section 2 we will examine the characteristics of the R&D budget system of Korea and the core changes it had undergone. In Section 3, inquiries into and analysis of R&D programs and program evaluation systems relating to, and focusing on, the coordination, allocation and deliberation of budgets will be examined in detail. Problems related to this will be pointed out and means of resolving such problems will be proposed. Lastly, the conclusion will summarize suggested areas of improvement, the proposals to achieve them, and then discuss the limitations and implications of the research

2. R&D Strategic Planning and Budget System

Figure 1 introduces the overall process of R&D strategic planning and coordination and budget allocation in Korea. The process of coordination and budget allocation commences with the preliminary coordination process and deliberation upon the submission of a request (proposal) for a budget by each ministry to the Ministry of Strategy and Finance (MOSF). The drawing up of a budget by MOSF reflects the opinion of deliberation related to the direction of investment and coordination and allocation as well as the results of inquiries, analyses and evaluations carried out annually. The MOSF draws up the final government budget proposal that includes the R&D budget (Figure 2).

In the case of Korea, 'Total amount of allocation in self-regulated drawing up(top-down)' system, in which the ceiling on the budget request proposal for each ministry is set in advance and then each ministry autonomously draws up their own budget on that basis commenced in 2004. The government's budget proposal including the R&D budget is then finally confirmed as the total budget for the following year through deliberation at the National Assembly, after having been confirmed as the government's proposal through the cabinet meeting and government-ruling party consultation²⁾.

Social issues related to the R&D budget are deciding the appropriate size of the investment and the fulfilling of social demands of investment performance (Lee, Jang Jae, 2004). Accountability in terms of the transparency and accuracy of the performance evaluation is a key issue. The government's budget has a close relationship with the national priorities, viewed from the perspective of the taxpayers. Since the government has the responsibility and authority for the planning and execution of the budget, there is a risk of the principal-agency problem and moral hazard.

1) Office of Science and Technology Innovation was dissolved due to the reorganization of government structure in 2008 with a portion of its relevant functions transferred to the Ministry of Education, Science and Technology (MEST) and other portions to the Ministry of Strategy and Finance(MOSF). Recent disputes on the inadequacies of the top management system related to science and technology policy making could impose greater difficulties in the maintenance of consistency.

2) Refer to Seong, Ji Eun (2006), p.12 and Bark, Pyengmu (2007), pp.61-69

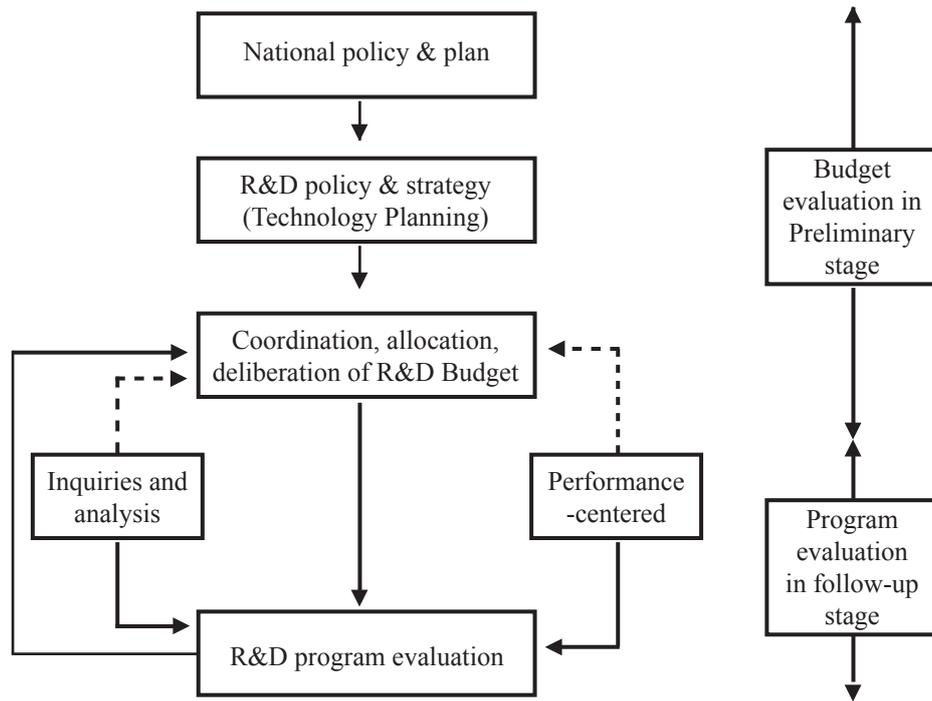


Figure 1 Preceding and Follow-up Stages of Comprehensive Coordination

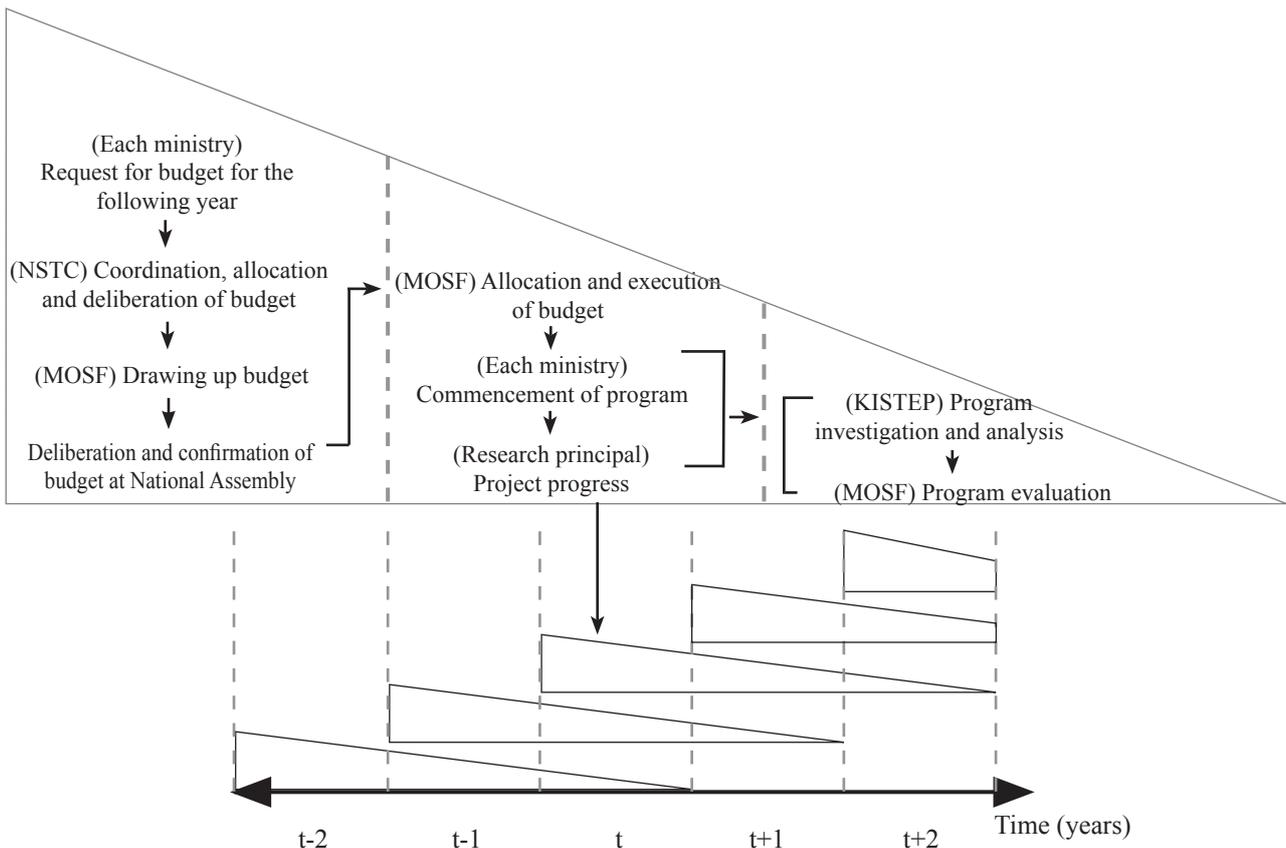


Figure 2 Comparing between cross-section and three year flow of R&D budget and program performance

Opportunity cost may arise from selection process, and therefore, the establishment of priority rather than the first-best choice could ultimately induce primary inefficiency. In the case of government investment, the crowding-out effect may affect the private sector investment.

In the case of R&D, although the principal in the planning and execution of the budget on the surface is the government, it is frequently the case that the principal in the actual utilization of the budget is the researcher or research organization. They also participate in R&D planning at a national level on the basis of their expertise. Therefore, it is inevitable that disputes over whether the execution of the budget is in essence for benefit of the country or the research principals arise endlessly. In particular, it is quite possible that such disputes could develop into a social dispute if the goal of the government and research principal differ. Moreover, if R&D activities arising from the budget are focused on public interest and basic core technologies, the analysis or verification of economic and social benefits may become complicated by the economic conception period, high risk and a high level of competition³⁾. Therefore, the evaluation of the linkage between policy and performance generation is essential.

Reviews on plans to link performance with budget in order for full-scale introduction of performance-centered budget system began in 2003 (Seong, Ji Eun, 2006). In 2004, total amount of allocation self-regulated drawing up (top-down) system was introduced. In the case of R&D budget, efforts are being put in order to enhance the efficiency of coordination and allocation system through performance evaluation based on strategy, expertise and fairness (Park, Jeong Woo et al, 2004). In order to reinforce this strategy for the accomplishment of national R&D vision and goals, R&D budget coordination and allocation is being pursued on the basis of national plans with medium to long-term strategic planning. Such plans include the Basic Plan for Science & Technology, the National Innovation System (NIS) and the National Technology Road-Mapping (NTRM),

and an investment portfolio that considers the division of roles and linkage relationships with the private sector. An in-depth and permanent review system by the professional committee for each technology area is being reinforced through an expansion of the participation of diverse specialists from the private sector. Also the activation of the program evaluation and review and linkage system of budget was sought after through the increased exchange of members between professional committees for program evaluation and budget coordination. Emphasis is also placed on reinforcement of fairness and transparency for rationalization of coordination and allocation on the basis of substantiated performance evaluation by setting the objective standards aimed at closely linking the results of performance evaluation with the budget. and goals, R&D budget coordination and allocation is being pursued on the basis of national plans with medium to long-term strategic planning. Such plans include the Basic Plan for Science & Technology, the National Innovation System (NIS) and the National Technology Road-Mapping (NTRM), and an investment portfolio that considers the division of roles and linkage relationships with the private sector. An in-depth and permanent review system by the professional committee for each technology area is being reinforced through an expansion of the participation of diverse specialists from the private sector. Also the activation of the program evaluation and review and linkage system of budget was sought after through the increased exchange of members between professional committees for program evaluation and budget coordination. Emphasis is also placed on reinforcement of fairness and transparency for rationalization of coordination and allocation on the basis of substantiated performance evaluation by setting the objective standards aimed at closely linking the results of performance evaluation with the budget.

The national R&D program evaluation is carried out every year by applying the performance evaluation method in accordance with Article 12 of the Basic Law on Science and Technology, and Article 20 of the Implementation Ordinance of the same Law. Although

3) Refer to Bark, Pyengmu; Heo, Hyeon Hwoi (2008), pp.555-559

the unit of evaluation is already the detailed items in the R&D budget, if the corresponding R&D programs are in turn composed of a diverse range of subordinate projects, the individual subordinate projects themselves should become the units of evaluation⁴⁾.

Evaluation is carried out by categorizing into subject of specific in-depth evaluation and subject of in-house evaluation by the ministry. The MOSF carries out regularly scheduled in-depth evaluations and superordinate evaluations on long-term and large programs, redundantly coordinated and linked programs, and the joint programs of several ministries. Each ministry carries out in-house evaluation of performances in accordance with the characteristics of the program that are not the subject of specific evaluation for the corresponding year. As a form of superordinate evaluation, MOSF examines the appropriateness of in-house evaluation by providing standardized performance indices which can be used for in-house evaluation. For the issues that require coordination and consolidation in accordance with the evaluation results, specific options for the improvement of the details of the program are proposed to the comprehensive recommendation⁵⁾.

Performance-centered management is a concept that is applied to all performance evaluations as well as budget evaluations. Also important is the management or evaluation of R&D strategic planning, coordination and budget allocation, and overall performances obtained as the result of planning and execution of ensuing programs. Depending on the situation, although there is no problem with the execution of the program, problems may exist in the preceding stage such as the planning of policy and program or the coordination and allocation of the relevant budget. Currently, performance evaluation of the planning, coordination and execution of the budget is quite insignificant in Korea, and focus is being placed mainly on the

performance evaluation of program units. Even in the case of an in-depth, in-house, superordinate, and institutional evaluations in accordance with the recently improved system, it is difficult to find details of policy evaluation with concepts that have ultimately been mutually linked macroscopically and microscopically.

Table 1 is a representative case that implies such phenomenon, and summarizes the core key contents of coordination and allocation of the relevant budget the inquiries about and analysis of programs, and results of program evaluations with cases of programs pursued through the execution of the 2008 budget . The budgeting process was carried out in 2007 while the process of inquiries and analysis as well as program evaluation were carried out in 2009. Figure 2 implies that a single packaged process that includes the budget process and program evaluation process is carried out at the interval of every 3 years. Firstly, it should be noted that in Table 1 although the capacity of the subjects of coordination and budget allocation, and inquiries on and analysis of programs on the basis of the total budget is slightly less than 11 trillion Korean Won with 442 programs for budget and 486 programs for inquiries and analysis, only the programs with a total budget size of approximately 3 trillion Korean Won (80 programs), which is less than 1/3 of the total budget, are subjects of the elaborately segmented program evaluation⁶⁾.

Another discovery is that the contents of inquiries and analysis of executed programs (2009) have some differences in key features and directions of allocation of financial resources decided in the budget. The contents of decision-making in 2007 can be reviewed only in some cases. For example, the goals in terms of R&D investment size for the regional areas set in 2007 not only failed to be accomplished but, further regressed. However, such details are not being mentioned in any of the evaluation reports. In addition,

4) The recent detailed item unit has been revised into a program, a detailed program and a highly detailed program. However, the subject unit in operation can be changed by receiving the opinions of the corresponding ministry.

5) Refer to Bark, Pyengmu (2006), pp.71-75; Lee, Jeong Won; Lee, Gi Jong (2008), pp.603-608.

6) The size of subject of evaluation decreased because, in the case of the in-house and supraordinate evaluation, it was reduced to 1/3 through departmental consultation, and, in the case of the specific evaluation, it was changed from a check-list format to an in-depth format. Improvement of the program evaluation through reduction-oriented types of change in the subject of evaluation is interpreted as efforts to change the evaluation format concept from a vertical approach to a horizontal approach. Attention should be paid to how to pursue the programs excluded from the corresponding year of evaluation, and, how to link the issues of performance of budget evaluation.

Table 1 Comparison of contents of coordination and allocation, inquiries, analysis and performance evaluation related to national R&D programs pursued in 2008

Budget Evaluation (coordination, allocation and deliberation)	
Subject	10.8 Trillion Korean Won (442 programs)
Key features	<ul style="list-style-type: none"> • Strategically support national policy programs and public welfare areas: Aerospace development, Cope with climate change, Oriental medicine • Expansion of support for the area of new growth engine: Generation of future employment opportunities, Next-generation growth engine projects, Expansion of investment into core foundation technology in component materials • Assertive excavation and support for FTA related R&D requirements: Development of new drugs, Cultivation of high quality agricultural species, Environment-friendly cultivation technology • Coordination of redundant and excessive investment: University research center, Costly equipment, Nano-infrastructure, LMO area, Areas related to yellow-dust (Asian dust) • Settlement of system of deliberation of budget allocation among performances: Reinforcement of linkage between evaluation and budget, Reduction of product with similarity redundancy and inadequate execution performances, Analysis of technology, economy and policy validity of large capacity programs
Direction for allocation of financial resources	<ul style="list-style-type: none"> • Expansion of investment into basic research: 26.4% • Expansion of investment into regional R&D: 40.3% • Human resources development related programs: 9.9% • Total Roadmap technology area: Environment (4.7%), Basic science (4.4%), Universe, environment, astrology and maritime affairs (10.5%), Nano-materials (4.6%), Mechanical process (15.2%), Information and electronics (22.1%) • Establishment of stabilized research environment and reinforcement of specialization of government supported research institutes
Direction of future pursuit	<ul style="list-style-type: none"> • Preliminary feasibility study on new large capacity programs (more than 50 billion Korean Won) • Settlement of coordination and budget allocation on the basis of the weight of medium to long-term investment into technological areas of Total Roadmap • Enhancement of weight of results of performance evaluation to be reflected onto the budget
Time of decision-making	August 27, 2007 National Science & Technology Council → plans to pursue programs in 2008
Inquiries on and Analysis of the Project	
Subjects	11 Trillion Korean Won (486 projects)
Key results	<ul style="list-style-type: none"> • Socio-economic purpose: (implications) need for expansion of investment into aspects that are directly linked with global issues such as quality of life including environmental pollution, depletion of energy and health, and global warming • Principal of research execution: (implications) Need to increase mutually supplementary research productivity through reinforcement of fundamental and foundation research activities of universities and government subsidized research institutes, and reinforcement of cooperation amongst industry, academia and research institutes. • R&D stage: proportion of fundamental research at 25.6% (implications) Expansion of the base for fundamental research by expanding support for fundamental foundation research of universities and government subsidized research institutes, and for creative individual research • Region: (implications) Need to pursue customized R&D that is appropriate for regional features and continuous expansion of investment by reducing the proportion of regional investment (34.2%→31.1%) • Technology area: (implications) Need to occupy vantage point in core technology through expansion of investment into the area of low-carbon and green growth technology, and need to expand proportion of investment into areas including bioscience, energy and resources, which have substantial effect on creation of new industry.
Plans for future pursuit	<ul style="list-style-type: none"> • Enhancement of level of utilization of results of inquiries and analysis: Linkage service for the results of the previous years with other information within the NTIS after having reported the results at the National Science & Technology Council • Improvement of inquisition and analysis system: Improvement of system of inquisition and analysis items in accordance with reorganization of 2-dimensional categorization system, and provision of practical data for policy planning through in-depth analysis for each issue.
Time of decision-making	July 28, 2009 National Science & Technology Council→ Subject of programs that were pursued in 2008

Table 1 Comparison of contents of coordination and allocation, inquiries, analysis and performance evaluation related to national R&D programs pursued in 2008 (cont'd)

Program Evaluation	
Subjects	3 Trillion Korean won (80 projects): <ul style="list-style-type: none"> • In-house/supraordinate evaluation: 2.1743 trillion KW (70 projects) • Specific evaluation: 820.4 billion KW (10 projects) • Government subsidized institutions: 35 government subsidized research institution (in-house evaluation), 4 government subsidized institutions (supraordinate evaluation)
Key results of evaluation	<ul style="list-style-type: none"> • (Specific evaluation) Public disclosure of details of qualitative evaluation as a program unit (4 short-term projects): Reports on 6 long-term programs are planned to be made at the National Science & Technology Council in December • (In-house/supraordinate evaluation) 21.4% of the 70 projects were found to be insufficient • (Evaluation of government subsidized institutions) 7 institutions among the 35 institutions that carried out in-house evaluation were found to be insufficient, all of 4 institutions that carried out supraordinate evaluation received judgment of being appropriate (minimum of 72.5 points and maximum of 90.6 points)
Utilization plan	<ul style="list-style-type: none"> • In-house/supraordinate evaluation: Reflect at the time of drawing up of R&D budget for 2010 • Specific evaluation: Check execution of measures for improvement of system → Reflect onto the guidelines for drawing up of budget proposal for 2010 in order for the projects that have not been executed to be abolished or its budget allocation reduced. • Evaluation of government subsidized institution: Reflect at the time of coordination of the annual salary of the head of the institution, and at the time of drawing up of budget for investment into institutions in 2010
Time of decision-making	September 17, 2009 National Science & Technology Council → Subject of programs pursued in 2008

Note: Refer to Figure 1 and Figure 2. Summary and comparison of National Science & Technology Council (2007, 2009 a and b).

details of the area of Total Roadmap technology, were emphasized in 2007 but not included in the inquiries and analyses of 2009. Instead, details on the area of low-carbon and green-growth technology, a new policy, are covered and expansion of investment into these areas is emphasized. Therefore, not even the fundamental evaluations of the performance of budget execution for technological areas, deemed key in 2007, were carried out. Accordingly, it is not a system that can be macroscopically linked with the results of budget execution.

3. Budget Coordination and Allocation Related Problems and Improvement Plans

Two core problems will be discussed, namely the system and proposed improvement plans. There is a focus on the characteristics of the currently implemented budget coordination and allocation and relevant inquiries and analysis, as well as the program evaluation system of Korea, and details of operation and results of the system. The First consideration is

linkage between strategic planning and the budget. The approaches to the process of budgeting and aspects of the structural system of programs in Korea are discussed. Then the connection between budget, and inquiries and analyses at the level of the budget system's operation is discussed.

3.1 Linking of Strategic Planning with Budget

Important issue is the linking of policy with the budget (Lynch, 1979). The drawing up of the budget is the final stage of planning that makes the plane concrete, and the optimal policy alternative is confirmed through the drawing up of the budget (Wildavsky, 1974). Since planning is the process of selecting the optimal alternative to accomplish the goal of organization, reflecting of goals by? the budget signifies the linkage between the planning and budget. Planning and budget are inseparably related and, because planning cannot be segregated from policy, budget and policy are connected with planning as the medium. Ultimately, linkage between planning

and budget signifies the linkage between policy and budget⁷⁾.

Firstly, in order for efficient linkage between policy and budget to be possible, an in-depth review of the current government organizational system is necessary. The core function of the NSTC should be seen as a science and technology related policy and R&D strategy relation functions viewed from the perspective of taking overall responsibility for the country's microeconomics⁸⁾. If so, policy-related functions must have the foremost priority, and functions such as coordination, allocation, evaluation and management, which are at the level of executive methods, should be subordinate functions. However, it is difficult to view the current organizational system for science & technology related decision-making to be a system that sufficiently reflects this. Given the characteristics of organizations, it is unavoidable that there are limitations in organic cooperation between organizations. Therefore, in order to overcome such limitations, a review of the organizational system and research for a way to reinforce the organic cooperative system between organizations is exigent. The linkage between essential policies and budget can be further reinforced only through such measures. Furthermore linkage between the planning and execution of budget, planning and pursuit of programs, and reflection of results of evaluation onto the budget in the future should be reinforced. To this end, means of establishing an organizational and administrative system of the government that can assure the mutually and disjunctively independent functions of MEST, NSTC, and MOSF should be additionally discussed in depth⁹⁾.

Passive participation of the relevant ministries at the time of establishing the Basic Plan for Science and Technology represents a specific problem at the stage of establishment and analysis of program plans in the budget process (Lee, Jang Jae, 2004). This is because the adaptation of the relevant ministries, in reality, relies on the NSTC for the establishment of the direction of and plans for future science and technology. This is insufficient. Due to this, there is lack of consistency between the establishment of the Basic Plan at the level of foremost national priority, and planning and execution of program at the level of individual ministry. Setting of the priority, coordination and allocation signifies that it undergoes review and deliberation in accordance with prescribed criteria in order to accomplish consistency between the fitness of the budget and policy determination. Execution of rational and efficient resource allocation and coordination functions for each program is strived for in this way. Setting a comprehensive priority of programs, reduction in budget inefficiency through the coordination, and pursuit of appropriate allocation and utilization must be possible in order to achieve the improvement and efficiency of the budget system¹⁰⁾. Enhancement of the practical operations of comprehensive coordination functions of the NSTC, and effectiveness of functions of the MOSF in the coordination and drawing up of the R&D budget are necessary (Table 2).

What needs to be considered in the stages of formation and execution of policy is that the ultimate role of the national R&D program in principle is to supplement the R&D activities of the private sectors

7) Refer to Yoon, Seong Shik (2003), p. 183

8) The role of NSTC is to coordinate the planning of key policies and R&D of science and technology, and program and science & technology innovation related industry policies, human resources policies and regional technology innovation policies, and to deliberate and confirm issues on setting of direction and coordination of budget allocation and efficient operation of R&D programs being pursued by each ministry. However, it is determined that it would be difficult to be in charge of realistic microscopic economic policy or management. Moreover, as the policy coordination and planning officer of MEST (formally the Ministry of Science and Technology) is in charge of the administrative function of the management committee, and the Presidential advisor for Education, Science and Culture is in charge of the administrative functions of NSTC, there could be problems in consistency, fairness and appropriateness of actual works.

9) The Office of the Cabinet is in charge of the Comprehensive Science & Technology Council of Japan. System of permanent secretariat is composed of total of approximately 100 staffs by broadly appointing personnel from within and outside of administrative organization such as the industry, academia and government including officer in charge of policy and deliberation from the Office of the Cabinet. Officer in charge of policy who belongs to the Office of the Cabinet without inter-departmental interests will be appointed as the personnel in charge of the secretariat (official website of Comprehensive Science and Technology Council of Japan).

10) Refer to Yang, Hee Seung (2004) and Jeong, Geun Ha et al (2005), p.202-203.

Table 2 Process and Problems in Budget

Budget Process	Problems	Solutions
Establishment and analysis of the Basic Plan	<ul style="list-style-type: none"> • Passive participation of relevant ministries • Inadequate mutual linkage between the Plan for each key part and total amount plan 	<ul style="list-style-type: none"> • Reinforcement of coordination functions of NSTC • Neutralization and specialization of the status of the Secretariat
Establishment and execution of policy	<ul style="list-style-type: none"> • Dualization of principal of establishment and principal of execution of policy • Inadequacy in presentation for specific linkage of budget • Issues of redundancy and possibility of insufficient performance • Difficulties in strategic utilization of limited resources 	<ul style="list-style-type: none"> • Categorization of systematic policy functions and goals • Establishment of linkable budget items for each detailed program
Examination and evaluation	<ul style="list-style-type: none"> • Inadequacy and inaccuracy in the performance information data • Lack of understanding on and application of performances • Inadequate linkage between details of examination and analysis with budget system • Difference in the subject of and perspectives in evaluation 	<ul style="list-style-type: none"> • Permanence of examination and analysis function for R&D • Emphasize policy (ministerial) evaluation • Reinforcement of research and analysis of the project level productivity • Coordination of expansion of budget schedule

through efficient allocation of R&D resources, and to strategically induce the progress of science and technology at the national level. However, because each ministry is pursuing the programs that they directly needs, problems of redundancy in the areas of execution and insufficiency of performance, as well as issues over the strategic utilization of limited resources have been raised continuously¹¹⁾. The future direction of programs currently concentrated in the area of advanced technologies, are problematic due to gray areas surrounding allocation of resources to areas that are weak nationally, those that prepare for the future and??? those where the private sector are reluctant to participate. Therefore, the fact that the budget system must be seen from the macroscopic perspective of a national system must not be overlooked. Rather than having interest only on designing policies and budgets that aim to accomplish the specific goal and purposes of ministries, a balanced coordination and allocation must be accomplished from a wider perspective in order let the innovative system evolve effectively.

The problem confronted at the stages of evaluation is that although the processes of program evaluation and budget are being executed through the participation of specialists, analysis and evaluation of performance is not easy because there is no sufficient performance information¹²⁾. As the determination of

efficiency of R&D centered-around performance often differs according to the subject of analysis, there is a need to approach the issue by firstly conceptually segregating it in spite of the mutual connectivity.

The efficiency issues of government R&D performance have been approached from the perspective of programs viewed mainly at the meso-level thus far. However there has been a lack of interest in, discussions on, and effort to connectedly analyze and evaluate both the macroscopic level, specifically the effectiveness of government policy, and the microscopic level, specifically the enhancement of the productivity of projects considering characteristics of the areas and each of the stages (basic, application and development) of research. This arises from the fact that although tasks to be pursued in accordance with policies and planning are presented in advance through systematic planning stages and processes, there are limitations on the enhancement of the actual effectiveness of those policies closely linked to performance because there is no presentation of a specific and definitive budget connection of them afterwards (Lee, Gi Jong, 2002). In addition, the definition of highly diversified and different performances and the settlement of a proper understanding of their performance reconciled with both the dimensions of the evaluation and the characteristics of subject itself

11) Refer to Kim, Jae Young et al (2002), pp.114-117.

12) Refer to Byeon, Soon Cheon et al (2006), p.98; Korea Institute of S&T Evaluation and Planning (2008), pp.17-19

are still needed.

3.2 Structural System of Programs

Problems occur primarily at the linkage between policy and budget because the strategic allocation of finance is not being realized due to an insufficiency of segmentation and systematization of policy tasks reflected in the budget structure, leading to an insufficiency of analysis and evaluation. In order to improve this, policy functions and goals must be categorized systematically, by budget code (items) for each detailed program endowed, and problems of inequality of budget size for each program resolved¹³⁾. Furthermore, the connection between the plans for each key area and to the overarching plan must be reinforced. Efforts to secure the system through linkage between the policy goals and program are accomplished by systematically by linking the basic science and technology plan and total budget necessary (Total Science & Technology Conference, 2008). For this purpose, there is a need to pursue a program of systematizing the policy goal of the Basic Plan and connecting it to the relevant programs in detail. A series of such efforts by themselves will enable the reinforcement of the R&D execution strategy and coordination, and budget allocation.

Evaluation of R&D budget is actually carried out by the Specialization Committee and Budget Deliberation Meeting for each technological area of the NSTC. Therefore, whether there is concordance between the categorization of committee on technological areas, structure and system of program, and structure of budget items (code) is an important issue. However, it is impossible to clearly and definitively categorize each of individual programs from the perspective of their specific technological areas practically since the currently implemented individual programs are highly interweaved in terms of technological areas, R&D

stages, and type of research institution.. As a result, there is a fundamental problem of the effectiveness and viability of coordination and allocation of a deliberate budget among the program units This is because the structure of the budget items do not realistically coincide with the categorization system bodies, such as committees or the categorization system for program evaluation and coordination and budget allocation that the NSTC is dealing with at the moment. In order to supplement this, the composition of specialists in the specialization committee for each technological area must be broadened, alleviating leaning towards specific areas without special reason by maintaining macroscopic and balanced viewpoints¹⁴⁾. If, in reality, it is difficult for the technological specialists and non-technological specialists to work within the same committee, then it would be possible to consider composing and operating more detailed committees for each function where the viewpoints or functions are independently different from each other even though the subject area is the same¹⁵⁾. In addition, the structural system reorganization of the program that has been attempted experimentally at the level of some of the ministries must be made to maximally coincide with policy and budget, and the system of planning and execution of budget at the level of all the ministries¹⁶⁾. Such efforts need assertive changes in the awareness of NSTC and MOSF, and the specialized functions and knowledge of Korea Institute of Science and Technology Evaluation and Planning (KISTEP) on inquisition and analysis of research and development programs must be utilized fully (Hyeon, Jae Ho 2006).

3.3 Budget and Program Evaluation, and Inquisition and Analysis Schedule

In order for relevant ministries and principal institutions of R&D to assertively accommodate the

13) Ministry of Knowledge Economy (formally the Ministry of Industry and Resources), Ministry of Information and Communication, and Ministry of Education, Science and Technology (formally the Ministry of Science and Technology) have attempted the partial reorganization of the existing program structure (Ministry of Knowledge Economy (formally the Ministry of Industry and Resources)), (2005). However, the series of such works is not at the level for which the endowment of a systematic budget code could be expected due to the limitation that these are done from the perspectives of each individual corresponding ministry rather than being founded on the direction of policies or strategies at a national level (Hyeon, Jae Ho, 2006).

14) Refer to PREST (2000); Lee, Jeong Won; Lee, Gi Jong (2008), p.595.

process of coordination, deliberation, and drawing up of the budget, it is important to apply the same criteria from the guidelines for the initial drawing up of budget until the evaluation stage following project execution. In drawing up the budget for the following term, it is also important to establish a realizable system for drawing up the budget by considering future-oriented goals while at the same time applying the same criteria to each ministry and program. For this purpose, schedules and systems that can verify whether policy instructed as a guideline at the beginning of the term has been reflected in each program must be established. A comprehensive, strategic and detailed review and analysis of the results (performances) of coordination, allocation and execution of budget in compliance with the basic direction of investment set out two years previously (t-2 years) must also be executed.

From the perspective of single-year accounting, schedule for the relevant activities fall in the period from January to December of every year. In addition, since deliberation and confirmation of budget for the following year is made by the end of December at the National Assembly, relevant preliminary works in general needs to be completed in the first half, and from the positions of MOSF, all budget related preliminary works must be completed before September at the latest. Two-stage works including delivery of guideline for advanced total amount of allocation and review and deliberation on follow-up self-regulated drawing up in accordance with the execution of the total amount of allocation self-regulated drawing up system must be completed by the end of August at the latest. During the same period, inquiries, analysis and evaluation on programs for each ministry will be carried out. NSTC, MOSF, MEST and KISTEP, and more than 20 relevant central ministries and institutions participate in this program.

The current schedule of deciding the size of the total amount to be allocated by the end of February of the corresponding year, and making an in-depth

deliberation decision on the detailed request and plan for budget by the end of August needs to be slightly adjusted or supplemented. In order to confirm the size of the total amount to be allocated as soon as the new year starts, there is realistically only January available, which leads to a concern over whether effective details can be deduced. Therefore, details of works related to the latter half of the previous year (mostly after September) and details of works during the period from March to June of the following year must be supplemented and improved. It is recommended to pursue the following: 1) carry out reviews and analysis of the extent of linkage between the policy and budget; 2) carry out in-depth analysis on the extent of concordance between budget deliberation guidelines and outcomes of deliberation(t-2 year), and the extent of concordance between the results of deliberation confirmed in the t-2 year and results of budget executed in the t-1 year (including program performances); and 3) review and analyze the extent of reflection and concordance of the results of execution in the t-1 year on the budget deliberation guidelines for the t-2 year in the latter half of the previous year, and between March and June of the corresponding year (Figure 2). Execution of these three tasks are necessary because there must be policy and budget related review and analysis for the performance-centered evaluation and management of policy and budget in advance, and because a rational and effective budget system can only be established and settled when the policy direction and details of deliberation guidelines for the future are confirmed based on feedback provided by the system's previous outcomes.

In order for the extent of linkage between and the concordance of policy and budget, analysis of the effective execution and performance of the budget, and the preliminary and ex post facto significance of that performance analysis and evaluation in accordance with program execution and tasks should be accomplished broadly and accurately. Execution and utilization

15) The term "non-technological specialist" refers to people who are experts in national R&D program or budget -related areas from perspectives other than specific technological area. For example, middle or higher level decision makers in industries, experts in areas of policy, finance and accounting, economics and management with abundant experience in national R&D related planning, strategy and evaluation are deemed to be non-technological specialists.

of more advanced inquisition and analysis is more important than other issues. Therefore, the currently implemented inquisition and analysis needs the supplementation of two aspects. The first is to enable utilization of inquiries and analysis to be available at all times. As in the case of Council for Science & Technology Policy (CSTP) of Japan, regularization and embodiment of the NSTC in monthly units and the introduction of a system that completes inquiries and analysis for the coordination, allocation and deliberation of the budget in the first half of the fiscal year should be considered. Secondly, contents directly associated with the budget process must be added. There is a need to seek a means of including the inquisition and analysis of contents that can allow a review in detail of the policies and strategies at the national supraordinate level, and the basic directions that the budget itself is pursuing. Contents of analysis that compare and assess the extent of concordance with directions of policy and budget deliberation guidelines, and macroscopic contents specifically and in phases must be provided. For this purpose, improvement of contents to be contained in and an execution schedule for the inquiries and analysis is necessary. Although there is a realistic difficulty of temporal disparity, it appears to be recommendable to expand and convert the currently implemented inquisition and analysis system into a dualized system for program evaluation and budget. Establishment of an analysis system and provision of contents that realistically supports the budget process must be accomplished, and may be achieved by the following. Firstly, an in-depth analysis of the deliberation among the technological area and ministry, and research principal should be carried out. Secondly, a policy and strategy should be established, and an analysis of whether there has been a substantial accomplishment of its contents such as preliminary planning works should be undertaken. Thirdly, a microscopic and macroscopic comprehensive analysis centered-around the national R&D system by the expansion and deepening of the scope and contents of the analysis to the core of the individual program and project should occur

4. Conclusion and Policy Proposal

The system in Korea related to national R&D budget and programs has undergone a succession of changes and evolution. Segregation of coordination, allocation and deliberation of function (NSTC) and drawing up of function (MOSF) has been established for budget-related decision-making processes, and the relevant support system (KISTEP) has undergone a repetition of unified progress. In addition, the program evaluation system has established a system for in-house and supraordinate evaluation, specific evaluation and evaluation for government subsidized research institutions by introducing the concept of performance evaluation.

Comprehensive coordination thus far has the tendency to concentrate on overall activities centered on the annual unit. This is on the premises that policy and budget are effectively linked through the reinforcement of planning and budget. However, evaluation of coordination, allocation and drawing up of the budget, and the outcome of programs, and the results of a comparative review of the inquiries and analyses of programs pursued in 2008 imply that the contents and directions intended by policy and budget can substantially differ from those of the results of overall programs. There is a need to accept the implication that emphasis should be placed on a comprehensive coordination taking place as a series of processes over an period of three years, rather than just on an annual basis, as illustrated in Figure 2. It can also be seen as pointing out the need to improve and supplement the inquiries and analysis, as well as the program evaluation system.

Improvement of the budget system should firstly be approached from the viewpoint of linkage between policy and budget, and, in addition, there is a need to approach from the perspective of connectivity between budget schedule, schedule and contents of inquisition and analysis. Drawing up of the budget is the final stage of planning, and the optimal policy alternative is confirmed in the drawing up of the budget. For effective linkage of policy and budget, it is a prerequisite to establish an organizational and administrative system of government that can

guarantee a mutually disjunctive independence function of the department in charge of operation of MEST and NSTC, and the establishment of an organically cooperative system with MOSF that is in charge of drawing up the budget. There is a need for improvement to the system of establishment and analysis of program planning, formation and execution of policy, and the examination and evaluation stage. For this purpose, budget items must be established to enable a systematic policy function, categorization of goals and the linkage of each detailed program. In addition, there is a need for the permanent establishment of an inquisition and analysis function for research and development.

It is important to apply the same criteria from the guidelines for initial drawing up of budget to the stage of evaluation following the execution of the program. There must be a sufficient schedule and system that examines whether the guidelines for the drawing up of budgets and the direction of coordination and allocation has been reflected in the case of each program. Additional supplementation of contents that are directly helpful in the budget process by enabling full time utilization of inquiries and analysis is required. For this purpose, it is recommendable to develop the currently implemented inquisition and analysis system into a dual system for program evaluation and budget process. Establishment of an analysis system and the provision of contents that practically support the budget process by enabling a macroscopic and microscopic comprehensive analysis centered-around the R&D system must be accomplished.

The limitation of this research is that it is relying on the comparative analysis of a single case package with a focus on programs in 2008 rather than a diversified and broad empirical study, which is a preliminary work for the establishment of an elaborate system for the enhancement of efficiency of the budget system. In addition, there is also the risk that the fact that the year 2008 was the boundary point for changes in the Korean government system may make it difficult to generalize the implications of the case study. Obviously, it is possible to paradoxically present the assertion that the maintenance of consistency at such a time could be more important.

In addition, there could be inaccuracies and biases in the conclusion or pointing out of problems due to other reasons. Inadequacies in the specific contents of the proposed improvements and a lack of verification of the true possibilities could also be seen as a major limitation. These are the aspects for which supplementation is necessary in future research.

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