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# Technological Analysis Questionnaire for Preliminary Feasibility Study on R&D Program

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***Abstract*—**The Korean government has applied preliminary feasibility study for a new R&D program over about $50 Million since 2008 as a part of official process in budget planning. The investigations of technology, policy, and economics are carried out separately to arrive at a definite result: whether a program is feasible or unfeasible. This paper describes the concept and check-points related to technological analysis from a preliminary evaluation's stand-point. First of all, the fundamental concept of technological analysis in evaluation systems such as Program Assessment Rating Tool (PART) by Office of Management and Budget (OMB) and Evaluation Methods by Department of Energy (DOE) in the United States, the Green Book in the United Kingdom are reviewed. After the review, customized questionnaire for technological analysis are developed. Conclusively, limitations and further research directions are provided.

***Keywords*—**Preliminary Feasibility Study, R&D Program, Evaluation System, Technological analysis, R&D Logic Analysis.

## I. Introduction

THE Korean government has a burden of decision making for the investment of a new R&D program due to the huge budget size and complex characteristic of the R&D programs. The purpose of preliminary feasibility study is to demonstrate the feasibility of large-scale, long-term public investment of R&D programs and also to enhance fiscal efficiency and productivity. Once a national plan for a specific science & technology area is set up, a government department makes a program proposal for carrying out the plan. For the programs which ensure feasibility by the preliminary feasibility study acquire a qualification of a budget investment [1].

Preliminary feasibility study is carried out for newly proposed government programs with concrete plans on technology development whose budget is over about $50 million and whose government subsidy is over about $30 Million [2].

In the preliminary feasibility study, three major criteria are applied; technology, policy and economic efficiency analysis. Especially technological analysis is related with the specific research plan of the program. The objective of this research is to provide an opportunity to investigate a customized standard questionnaire to check appropriateness of the research plan from a technological point of view.

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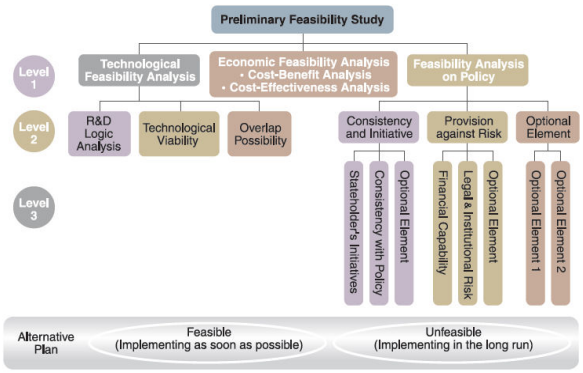


Fig. 1 A general procedure of feasibility analysis

## II. Relevant Frameworks

Technological analysis consists of sub-criteria such as R&D logic analysis, technological viability, and overlap possibility. R&D logic analysis is about planning process, program goal, specified sub-plan, organization System. Concrete and organized plans are highly evaluated. A method of program logic model which disassembles a program into input, activity, output, outcome, and impact is used to understand the concept of the program.

The following frameworks are particularly relevant to R&D evaluation; the Program Assessment Rating Tool (PART), Evaluation Methods of Department of Energy (DOE) in the United States, and the Green Book in the United Kingdom.

### *A. Program Assessment Rating Tool (PART)*

The Program Assessment Rating Tool (PART) is a diagnostic tool which was used to assess the performance of Federal programs and to drive improvements in program performance from 2002 to 2008. The PART is designed to provide a consistent approach to assessing and rating programs across the Federal government by U.S. Office of Management and Budget (OMB). PART assessments review overall program effectiveness, from how well a program is designed to how well it is implemented and what results it achieves. The PART is a series of questions that assess different aspects of program performance. Each PART is divided into four sections; Program Purpose & Design, Strategic Planning, Program Management, and Program Results/Accountability [3]. In this research, three sections except Program Results/Accountability are examined to prepare a standard questionnaire for R&D preliminary feasibility study. Table I shows the key questions of PART assessment.

TABLE I
KEY QUESTIONS OF U. S. PROGRAM ASSESSMENT RATING TOOL (PART)

| Section | Key Question |
|---|---|
| Program Purpose and Design | - program purpose<br>- existing problem, or need<br>- redundant or duplicative<br>- logical design<br>- design of intended beneficiaries |
| Strategic Planning | - long-term performance measures<br>- ambitious targets and timeframes<br>- annual performance measures<br>- baselines for its annual measures<br>- partners commit to goals<br>- independent evaluations<br>- budget request tied to goal<br>- resource presented in budget<br>- correct its strategic planning deficiencies |
| Program Management | - performance information<br>- accountable for cost, schedule and performance results<br>- procedures to measure and achieve efficiencies and cost effectiveness<br>- collaborate and coordinate with related programs<br>- financial management<br>- correct its management deficiencies |

*B. Department of Energy (DOE) Evaluation Methods*

U.S. Department of Energy (DOE) introduces managers to a variety of methods for evaluating R&D programs. It identifies four phases of program performance cycle; 1) Design/revise, plan, select, budget, 2) Make R&D progress, review processes, achieve outputs, 3) Disseminate outputs, achieve interim outcomes, 4) Commercialization, market acceptance, energy savings, energy security, other outcome s and impacts [4]. In this research, only the first section is examined to prepare a standard questionnaire for R&D preliminary feasibility study. Table II shows the key questions of DOE's relevant questions.

TABLE II
KEY QUESTIONS OF U. S. DOE EVALUATION METHODS

| Section | Key Question |
|---|---|
| Designing/ Revising, Planning, Selecting, and Budgeting | - relevancy and timeliness of the program<br>- defined partners effort<br>- expected technologies to be delivered<br>- selection process of the technologies<br>- relation between planned activities and objectives<br>- innovativeness level<br>- possibility of working of the technology<br>- appropriateness of cost estimation<br>- expected benefits |

*C. Green Book*

The guidance of Green Book is designed to promote efficient policy development and resource allocation across government in the United Kingdom in July 2011. It identifies five phases of program performance cycle; 1) Justifying Action, 2) Setting Objectives, 3) Option Appraisal, 4) Developing and implementing a solution, and 5) Evaluation [5]. In this research, only 'Setting Objectives' section is examined to prepare a standard questionnaire for setting objectives and targets. Table III shows the key questions about objectives in Green Book.

TABLE III
KEY QUESTIONS FOR SETTING OBJECTIVES AND TARGETS IN GREEN BOOK

| Section | Key Question |
|---|---|
| Setting Objectives | - What to achieve<br>- What are objectives and outcomes<br>- adaptable similar objectives<br>- consistent between objectives and strategic aims<br>- relation between objectives and outcomes<br>- measurement of objectives and outcomes<br>- progress monitoring<br>- critical success factors<br>- SMART(Specific, Measurable, Achievable, Relevant, and, Time-bound) target |

## III. CONCLUSION

Government R&D programs are aggregation of diverse activities with uncertainties and latent or indirect effectiveness. As long as R&D preliminary feasibility study is an official process for government budgeting, a standard guideline to maintain the consistency and promote the efficiency is to be prepared [6]. As a part of an effort, R&D logic analysis, one of the key elements in technological feasibility analysis part, is subdivided into four sub-sections; 1) Proper Planning Process, 2) Proper Objectives, and 3) Proper Logistics. Each sub-section has assessment questionnaire based on three relevant frameworks for R&D evaluation. And also about 60 cases of R&D preliminary feasibility study from 2008 to 2011 are examined to help prepare a standard questionnaire.

TABLE IV
ASSESSMENT QUESTIONS FOR R&D LOGIC ANALYSIS IN PRELIMINARY FEASIBILITY STUDY

| Sub-section | Assessment Questions |
|---|---|
| Proper Planning Process | - participation of unbiased and diverse professionals<br>- priority for selecting technology<br>- technological demands investigation |
| Proper Objectives | - appropriate definition of existing issues and problems<br>- annual performance measures<br>- design of intended beneficiaries<br>- relation between existing problems and program objectives<br>- specific, measurable, realistic objectives<br>- efficient management system considering program's objectives |
| Proper Logistics | - specified and appropriate activities<br>- activities' alignment with program goal<br>- specific, measurable, attainable, realistic and timely performance-indexes<br>- time sequence among the activities |

As the preliminary feasibility study on government R&D program is still in an initial stage, a few improvements are expected as a further study; standard guidelines with specification of each question's meaning, linkage effect between the questions, and qualitative ratings criteria for answering the questions.

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