

Economic Evaluation Methodology Review on KAERI's Recent Projects

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1. Introduction

In technology utilization, economics evaluation is helpful to R&D program managers by giving them economic information needed to improve the usefulness of their projects. Moreover it can help them to communicate to others participants keeping all of them value-oriented minded through the whole development process. In this context, KAERI(Korea Atomic Energy Research Institute) has been performed economic evaluation on recent some projects. So, in this study, it has been made brief reviews on KAERI's economic evaluation methodology to its recent some projects of which evaluation we engage in, especially PEFP(Proton Engineering frontier Project) and SMART(Small Medium advanced Reactor): Methodology comparison and their pros and cons.

2. Methods and Results

Economic evaluation method should reorganize R&D projects' intangible benefit as well as monetary profit into something measurable in monetary terms. Typical economic measures used to express overall monetary effects are net present value, annual value, benefit-cost ratio, and internal rate of return or, better, the adjusted internal rate of return. These traditional methods are focused on evaluating monetary and measurable outcomes owing to the future benefit of developing technology.

However, the traditional methodologies above have not been properly considering indirect effects of the developing technology. Many of R&Ds in the public sector are generally dealing with foundational work for strengthen its nation-wide R&D potentiality: This means that in such R&D fields, some alternative evaluation methods are necessary. Actually, in the recent a few years, some of KAERI's project we took part in adopted such methods and led to good understanding many kinds of stockholders inside or outside of KAERI. Our procedural strategy for adopting proper methodology for a R&D project is as below.

2.1 Procedural Strategy for Proper Evaluation Method

Table I summarizes four sequential steps to help us get started with answering important questions of choosing a proper, or even best, evaluation method(s) to meet developing technology's specific need.

Table I: Summary Steps for Selecting Evaluation Method for R&D Project

Step1	Analyze developing technology's project scope, purpose, target user & market, and other kinds of specific data of the project.
Step2	Identify which phase of technology life cycle the developing technology falls on.
Step3	Understand the developing technology's strategy for user program, marketing or commercialization and other kinds of technology diffusion strategies.
Step4	Select proper evaluation method among the possible methodology pool.

As project life cycle goes on, much of uncertainty is usually gone away and proper evaluation methodology moves from vague & qualitative to clear & quantitative one; Severity of economic uncertainty around the given developing technology is a key element to select proper evaluating methodology for it. So, step 2 and 3 play a key role.

2.2 Consideration on Technology Life Cycle

Table II corresponds to six distinct phases of the R&D life cycle we assumed for our recent projects. For example, possible evaluating methodology for the beginning stage, such as CVM(Contingent Value Method), starts a lot of uncertainty. So, it basically overcome such limit and show alternative way of expressing future value: intangible 'benefit' converted into 'willing to pay amount'. In this reason, our recent project, PEFP, adopt this method.

Table II : Technology life cycle we assumed for nation wide facilities such as PEFP, SMART

(1) R&D design & plan	Research facility stage
(2) R&D progress management	
(3) direct or indirect spillover of the developed technology starts	
(4) Market acceptance of technology starts	Production Facility stage
(5) : Industrial utilization & commercialization starts	

Why we use a variety of methods? The short answer is that it actually needs a variety of methods to answer different types of project management questions. The methods provide their answers using different units of measures, and the desired unit of measure is an important factor in choosing among the methods. For example, In the evaluation in the research facility stage as above table, the best method is dealing with comprehensive value, not considering specific market situation. But, later production facility stage, more specific and quantitative evaluation data is necessary such as present-value net benefits or rate of return on investment.

2.3 Procedures and Methodology of our Recent Evaluation

Table III summarizes our evaluation procedure used for KAERI's recent projects we involved.

Table III: Procedure of Evaluation Used for KAERI's Recent Projects

Method Used	PEFP	SMART
Survey	√	√
Expert panels Review	√	
Econometric		
- Conjoint analysis	√	
- CVM		
System Dynamics	√	
Net Present Value[3]		√
Option Theory[3]		√

2.4 Considering Technology Life Cycle

With our experience so far, summarized as above Table III, we propose combination of the evaluation method(s) and its evaluation purpose.

Table IV : Our Proposal for Proper Combination of the evaluation method(s) and its evaluation purpose(s)

Relevant Questions	Methods for Answering	Value Category
What effect has the project has on national or local benefit ? (PEFP)	CAM CVM[4]	Socio economic value
What are the spillover effects for consumers and producers in the target industry and in other industries? (PEFP) (SMART)	IO[4,5]	Socio economic value
In detail, which part of benefit driven by the developing technology are expected to contribute to total value?: Value Earning Process	System Dynamics [4]	Use Value with uncertainty

(PEFP)		
What are the realizable benefits and costs of the facility (SMART)?	NPV	Use value
How to consider the project risk and benefit after first plant? (SMART)	Option theory	Use value with risk

3. Conclusions

The aim of this study is to provide a starting point for managers to become aware of, identify, and access the best evaluation methods for their needs especially in the public R&D Sector. The project manager is most interested in the the result of an evaluation study, but there are other "stakeholders" who also may be interested in evaluation results. To reach at the understanding of possible stakeholders as many as possible, to address their specific needs, and to communicate with them in terms of value, proper evaluation methodology for the R&D projects is necessary, considering not only its generic characteristics but also its R&D life cycle and evaluation purpose.

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