World Academy of Science, Engineering and Technology
International Journal of Computer and Information Engineering
Vol:6, No:11, 2012

Technology Trend and Level Assessment using Patent Data for Preliminary Feasibility Study on R&D Program

Seongmin Yim

***Abstract*—**The Korean government has applied preliminary feasibility study for new and huge R&D programs since 2008. The study is carried out from the viewpoints of technology, policy, and Economics. Then integrate the separate analysis and finally arrive at a definite result; whether a program is feasible or unfeasible. This paper describes the concept and method of the feasibility analysis focused on technological viability assessment for technical analysis. It consists of technology trend assessment and technology level assessment. Through the analysis, we can determine the chance of schedule delay or cost overrun occurring in the proposed plan.

***Keywords*—**Preliminary Feasibility Study, Technological viability, Technology Trend Assessment, Technology Level Assessment

I. Introduction

DUE to the huge budget size and complex characteristic of the R&D programs in Korea, the government has a burden of decision making for the investment of a new R&D program. The purpose of the feasibility analysis study is to demonstrate the feasibility of large-scale, long-term public investment R&D programs and also to enhance fiscal efficiency and productivity.

The programs which get through the feasibility analysis system acquire a qualification of a budget investment [1].

Preliminary feasibility study is carried for newly proposed government programs with concrete plans on technology development whose budget is over $50 million and whose government subsidy is over $30 Million. A total of about 70 preliminary feasibility studies on government programs have been conducted since 2008.

Seongmin Yim is with the Korea Institute of Science & Technology Evaluation and Planning, Seoul, Korea (phone: 02-589-2803; fax: 02-589-2274; e-mail: smyim@ kistep.re.kr).

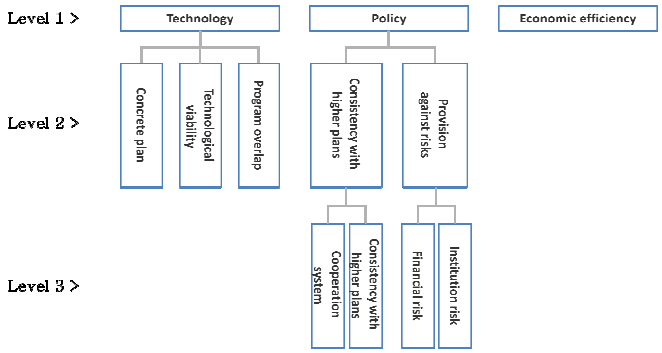

Fig. 1 The hierarchy of criteria in preliminary feasibility study

In a preliminary feasibility study on government R&D programs, 3 major criteria are applied; technological, policy and economic efficiency analysis.

Technological analysis is about the specific research plan of the program. Especially, to determine technological viability of the program, patent data analysis is adopted.

The objective of this research is to provide an opportunity to investigate the current technological viability analysis procedure using patent data.

The following of this research is divided into five sub-sections. First this research observes the present concept of cost estimation in feasibility studies and general concept of cost estimation. Then an improvement method is introduced followed by an empirical analysis. Conclusively, discussion of empirical analysis results is provided with the conclusion at the end of this research

II. Concept of Technological Viability Analysis

The effect factors of technological viability are appeared in a complicated way such as technology management and technology characteristic. The effect factor of technological viability from an angle of technological management is analyzed in the section of the appropriateness of the research plan. And the factor from an angle of technological characteristic is analyzed in the section of technological viability. Therefore, the meaning of technological viability is not absolute success or failure, but the chance of schedule delay or cost overrun occurring in the proposed plan as a result of the investigation about issues from the view point of the technology characteristic.

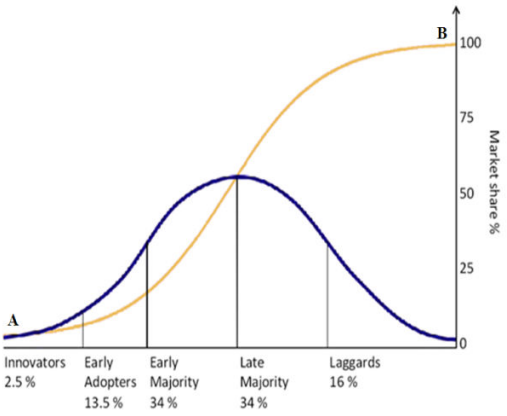

Fig. 2 S-curve by technology diffusion

Technological viability analysis consists of technology trend and technology level assessment.

Technology trend assessment is the analysis from the dynamic view about technology trend, the level of program's technical objectives, economic and social conditions for the occurrence of large-scaled technology development. The goal of technology trend assessment is to make sure its implications. The estimation of the program's position in S-curve by technology diffusion is adopted in the analysis. If its position in the S-curve is not appropriate for a large-scale investment like the position A and B in fig. 2, the result is to defer a new large-scale investment.

Technology level assessment is based on technology gap theory which means the advanced technology country and the underdeveloped technology country has a different productivity growth. Underdeveloped technology countries need to consider an imitation of technology by education and training but advanced technology countries have only way of creative R&D activity.

III. Application of Patent Data

A. Technology Trend

In preliminary feasibility study, data mining technique using patent data is applied for assessing technology trend. Applicant-patent portfolio analysis is based on technology growth by technology diffusion and approximate in time series using the relation of the applicant and patent. The stages of technology development are divided into five groups; embryonic period, growth period, maturity period, decline period and revival period.

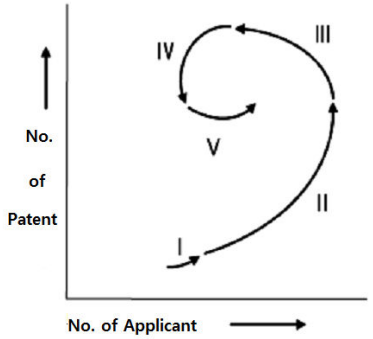

Fig. 3 Applicant-patent portfolio analysis

Region I is the embryonic period of the advent of new technology and the number of applicant and patent are slowly increased. Region II is the growth period of intensifying competition and the number of applicant and patent are rapidly increased. Region III is the maturity period of partial cull and the number of patent is retained and the number of applicant is retained or decreased. Region IV is the decline period of the advent of alternative technology and the number of patent and applicant are decreased. Region V is the revival period of rediscovery of usefulness and the number of patent and applicant are changed to be increased.

According to the applicant-patent portfolio analysis, a few innovators apply for a new R&D in the embryonic period, then early adopters or early majority develop the R&D result. After that the R&D result is diffused to late majority and finally the laggards adopt. Using the analysis, a new large-scale investment is deferred for the technology positioned in embryonic period or decline period.

B. Technology Level

In preliminary feasibility study, the advanced technology stage is supposed to have only way of growth by creative R&D activity based on technology gap theory. So the higher level of advanced technology gets more positive result of the analysis.

Cites per patent(CPP), technology strength(TS), patent family size(PFS) indicators using patent data is highly used in technology level assessment.

Cites per patent(CPP) is a mean value of citations received by a specific patent class from subsequent patents [2]. CPP indicates the technological impact of patents. High CPP value is often associated with important innovations, which are key to future development in technology innovations [3].

Technology strength(TS) is a quality-weighted portfolio size, defined as the number of patents multiplied by current impact index. Using Technology Strength we may find that although one country has more patents, a second may be technologically more powerful because its patents are of better quality [4].

Patent family size(PFS) is the number of international families (foreign patent applications) for a specific patent class divided by the total number patents for all classes [5]. A class with high value of PFS means that this class may have be competitive in market share of emerging global market compare to other classes.

By the calculation of the indicators using patent data, the

technology level of countries or groups can be analyzed and the higher value of CPP, TS, and PFS indicators is received positive evaluations for a new program investment.

C. Case Study

The objective of a new large-scale R&D program was a localization of core A-technology products. Technology trend using applicant-patent portfolio analysis showed that A-technology was poisoned in growth period of intensifying competition and the number of applicant and patent are rapidly increased in both U.S and Japan. Technology level using calculation of cites per patent(CPP), technology strength(TS), patent family size(PFS) indicators showed that U.S and Japan dominated comparing with other countries in TS and Korea was in a low level in both CPP and PFS, which mean Korea was associated with few important innovations and technologically less powerful.

Technological viability analysis in preliminary feasibility study was concluded that it was a proper time to facilitate the investment in the technology field but for the localization of core technology, the investment was deferred because of a chance of schedule delay or cost overrun occurring in the proposed plan.

IV. Conclusion

In Korea, preliminary feasibility study is applied to demonstrate the feasibility of large-scale, long-term public investment R&D programs and also to enhance fiscal efficiency and productivity. Technological analysis is for the specific research plan of the program and patent data analysis is adopted to determine technological viability of the program. Technological viability means that the chance of schedule delay or cost overrun occurring in the proposed plan as a result of the investigation about issues from the view point of the technology characteristic. Technological viability analysis consists of technology trend and technology level assessment.

Technology trend assessment is the analysis from the dynamic view about technology trend, the level of program's technical objectives, economic and social conditions for the occurrence of large-scaled technology development. Using applicant-patent portfolio analysis, a new large-scale investment is deferred for the technology positioned in embryonic period or decline period.

Technology level assessment is based on technology gap theory which means the advanced technology country and the underdeveloped technology country has a different productivity growth. By the calculation of the indicators using patent data, the technology level of countries or groups can be analyzed and the higher value of CPP, TS, and PFS indicators is received positive evaluations for a new program investment.

References

[1] Y. B. Lee, J. Hwang, "A Study on Correlation between Elements of AHP for Government R&D Programs," Proceedings of the International Symposium on the Analytic Hierarchy Process, 2011.

[2] P. Reisner, *A machine Stored Citation Index to Patent Literature Experimentation and Planning*, Proceedings of Automation and Scientific Communications Annual Meeting 1963(American Documentation Institute, 1965)

[3] M. P. Carpenter, F. F. Narin and P. Woolf, *Citation Rates to Technologically Important Patents*, World Patent Information, 3(4), 160–163, 1981

[4] U.S. Department of Commerce, *The New Innovators - Global Patenting Trends in Five Sectors*, 1998

[5] D. Harhoff, F. Scherer, and K. Vopel, *Citations, Family Size, Opposition and the Value of Patent Rights*, Research Policy, 32(8), 2003