A Preliminary Feasibility Analysis of Regional Industry Promotion Projects

Chan-jun Kim, Jae-hong Jang, Ha-yul Song, Chang-uk Byeon, Ju-seok Lee

Chapter 1. Introduction

In pursuing various policies and projects, governments must make optimal choices. They must attempt to optimize the benefits of the same for all of society —in other words, serve the public interest. To achieve the maximum effect from projects under resource constraints, governments (and their decision-makers) must analyze and determine the feasibility or viability of projects and set their investment priorities accordingly. A preliminary feasibility analysis may be said to consist of the entire process of research and analysis in accordance with general pre-feasibility study principles, with many different forms of analysis for projects. While some projects are relatively fixed in format, such as in the construction sector (e.g., roads, ports, and railways), most projects, as in the regional industry sector, entail a "package" of various policy measures (e.g., infrastructure building, R&D, and human resource training), which makes a standardized methodology difficult to identify.

With regional industry promotion projects in particular, estimates of economic benefit during a preliminary feasibility analysis have different scopes according to project characteristics and actors, while difficulties with predicting and applying market changes, unclear prospects for future value, and "shadow prices" complicate attempts to identify a standardized and structured methodology.

While the aims of regional industry promotion projects may differ individually according to project characteristics and goals, their basic focus lies in promoting local economies by fostering regional industries, thereby increasing resident incomes and improving quality of life. Because the process of creating benefit is different for different regional industry promotion projects and their various policy approaches, not only benefit assessment methods but also the specific terms of benefit must be separately established. A particular difficulty lies in calculating not only direct but also indirect benefit when conducting a feasibility analysis for a regional industry promotion project. Accordingly, a suitable estimation methodology must be established for such analyses that reflect the nature of the project and the local conditions. This study examines preliminary feasibility analysis for fiscal projects to foster regional industries, looking at areas in the course of such analysis that require review or improvement. Its focus lies in offering an alternative methodology from an economic benefit standpoint for the suitability of the social discount rate and value added ratio and for policy support measures (infrastructure, R&D, and human resource training). In particular, it aims to offer an alternative economic benefit approach that captures not only the ripple effect on the market of policy measures (tasks) in infrastructure and human

resource training projects, but also the knowledge ripple effect and network effect that may be considered non-market goods in their enhancement of the cluster effect for local industries as a result of the measures in question. It also seeks to suggest possible approaches to improving preliminary feasibility analyses of regional industry promotion projects that take into account their characteristics and local conditions.

Chapter 2. The Concept of the Feasibility Analysis and an Examination of Economic Value (Benefit)

1. The Concept of the Feasibility Analysis

A feasibility analysis is a method of using net benefit (with costs subtracted) or a cost-benefit ratio to determine a suitable basis for project execution that serves as a standard when deciding or assessing policies. One of these standards for policy decisions is economic feasibility. By allowing for a determination of the extent to which a project has economic value, analyses of economic feasibility serve to aid in a more precise understanding of that project.

An economic feasibility analysis is a way of estimating the costs and benefits of a public project from a national (societal) standpoint and calculating its economic profitability in order to determine its feasibility. One of the chief means of analyzing economic feasibility is through a cost-benefit analysis, which may be useful in calculating efficiency through a comparison of benefits and costs – that is, when making decisions that involve the distribution of finite resources.

2. The Concept of Economic Value and Benefit

Economic value is a concept from welfare economics that may be defined as the currency value (willingness to pay) achievable from satisfaction based on preference and choice. The basic premise of welfare economics is that the goal of economic activity is to promote the welfare of the individuals who make up a society, and that individuals are the ones best capable of determining their own level of welfare in a given situation. In other words, the economic value of market goods, or of non-market goods and services, is based on the degree of satisfaction gained from the things that individuals desire – that is, their preferences and choices. The concept of a currency value of goods realized through these preferences and choices can be expressed in terms of "willingness-to-pay" (WTP) or "willingness-to-accept" (WTA). For public projects, "benefit" refers to all positive effects as a result of investment activity and should be understood from a macroeconomic perspective without questions of who the beneficiaries are. It also includes not only goods and services produced as a result of investment, but also external economies that are not traded on the market. Under this concept, benefits can be categorized as practical and financial, internal and external, direct and indirect, and tangible and intangible.

Chapter 3. Issues in Preliminary Feasibility Analyses for Regional Industry Promotion Projects

1. Regional Industry Promotion Projects: Current Conditions and Characteristics

Regional industry policies are designed to boost industry competitiveness and encourage local innovation clusters in major industries by promoting independent innovation capabilities through the building of infrastructure to serve as an industry base for local industry promotion and the planning and operation of policy measures in areas such as R&D and enterprise support. Characteristics of clusters include a heavily interdependent form of corporate production within a framework linking together specific or related industries, along with the distribution, communication, and sharing of interconnected networks and knowledge to a production chain in which value is added by information-producing organizations and customers.

In order to meet these goals and establish a local industry base, build industry clusters, and boost local industry competitiveness, policy measures are identified and implemented in areas such as infrastructure development (buildings and equipment), R&D, and enterprise support, with a focus on local strategic industries (representative or leading). A regional industry promotion project may be defined as a project (or policy approach) introduced to meet these policy goals.

2. Major Issues in Preliminary Feasibility Analysis for Regional Industry Promotion Projects

□ Scope and Nature of Benefits

The aim of regional industry promotion projects is to generate gains for a cluster, as opposed to direct benefits for specific projects. This is a key essential benefit of such projects, and its importance has been emphasized in many studies to date. The potential benefits of clusters are generated through economies of sharing and collaboration, which function as important drivers boosting the competitiveness of local industry. In spite of this, benefits from the creation of cluster gains have been excluded from the category of benefits in South Korea's current pre-feasibility studies due to difficulties in determining currency value.

When market incompleteness results in the observed market prices for inputs and outputs failing to adequately reflect societal value, it becomes necessary to compute the increase in economic welfare by using suitable conversion factors to convert the market price into an accounting (shadow) price. Externalities associated with regional industry promotion projects must also be incorporated into the feasibility assessment structure. While the effects of projects may involve positive (+) externality elements such as cluster gains, they are also likely to bring about negative (-) externalities in terms of the environment, society, and public health, among other areas. It therefore becomes necessary to calculate currency values for these ripple effects through the use of suitable techniques.

□ Scope of Value Added and the Value Added Ratio

Current pre-feasibility studies calculate benefit solely in terms of "directly computed added value," without taking ripple effects into account. In the case of R&D projects, benefit is calculated as the value added from R&D; ripple effects are not included. This gives rise to a problem of underestimation of benefits, as value added through spillover is ignored when benefits are defined only as the value added from production of certain items. In other words, it is preferable to include not only the value added created directly through the production of specific items, but also the value added created through the production of the intermediate goods used as inputs.

□ Social Discount Rate as Time Preference

One of the key parameters used in assessing project feasibility is the discount rate. It is the size of this discount rate that determines the value of discounted costs and benefits. Economic feasibility analyses produce different values for benefits over time and cost patterns according to how the social discount rate is adjusted. First among the important issues that can be raised with regard to the social discount rate is whether the currently applied rate is suitable. A second issue concerns whether the currently applied social discount rate is also appropriate for regional industry promotion projects. Because the social discount rate selected for South Korea was considered chiefly from an SOC standpoint, an examination of the social discount rate that takes into account the characteristics of regional industry promotion projects is also required.

Chapter 4. Economic Benefit Calculations for Preliminary Feasibility Analysis by Area and Related Issues

1. Estimating Economic Benefit

(1) Economic Benefits of Regional Infrastructure Support Projects

The infrastructure built in specific regions through regional infrastructure support efforts as part of regional industry promotion projects plays an important role in creating a base for regional industry development, by way of both R&D and general support in areas such as enterprise assistance, in order to foster strategic industries in those regions. Calculations of economic benefit in preliminary feasibility analyses for regional infrastructure support projects, however, do not adequately reflect facts such as policy aims, targets, and individual differences. The distinction between the benefits of infrastructure projects and those of R&D is not properly captured; indeed, the scope of benefits has been defined narrowly in comparison with the effects of infrastructure services. A particular issue that has been cited is the failure to take into account characteristics of space economies with external effects. For this study, overseas examples were considered as part of an attempt at an economic benefit calculation for infrastructure projects – which face limitations due to lack of data and estimation difficulties – based on an alternative methodology for estimating willingness to pay (WTP) among local enterprises. A contingent valuation method (CVM) based on multi-attribute utility theory (MAUT) was applied to projects in Gwangju and Daegu, among other cities,

to calculate WTP and economic benefit for infrastructure support projects. The estimation showed willingness by Gwangju- and Daegu-area enterprises to pay amounts of 2.39% and 3.51% of sales, respectively, for related infrastructure support services. In market value, this equates to economic benefits of KRW 79.5 billion and KRW 222 billion, respectively, while external effects, an important factor in space economies that has previously been disregarded because of estimation difficulties, were estimated to be 38.5% and 24.4% of total economic benefit, respectively.

(2) Economic Benefits of Regional R&D Projects

Because the levels, characteristics, and aims of R&D differ so widely, no uniform calculation methodology exists for R&D projects. Even when benefits are calculated for such projects, uncertainties exist due to the possibilities of project success or failure and lack of clarity on when the project results will materialize. For this reason, some debate persists over the credibility of such benefit calculations.

The benefits of R&D projects can be broadly categorized into knowledge ripple effects, market ripple effects, and network ripple effects. Consumer-centered benefit is the benefit that emerges from consumption of the final product(s) of R&D projects, and certain producer-centered benefits, namely under the market demand and sales approaches, represent the creation of value added through these projects. One problem with the aforementioned methodology, then, is that the information and network ripple effects are not reflected as benefits of R&D projects.

Accordingly, the social rate of return approach presented in this study can arguably be deemed one of the better-suited methodologies for calculating R&D project benefit, as it is capable of reflecting knowledge ripple effects in addition to market ripple effects from the producer's standpoint and has been tested to some extent with application to previous pre-feasibility studies. Other particular strengths of the social rate of return approach are the ability to calculate benefit for source technology and basic R&D projects with notably lower private rates of return, as well as the fact that knowledge ripple effects are a chief project goal in pre-feasibility studies at the local level. For this study, the benefit calculated from the ratio of sales to R&D and the result of social rate of return application were compared for a project in Gwangju to develop a complex for the production of one million automobiles. For the social rate of return, the value of 28% suggested by Mansfield (1977) was applied, with domestic technology assumed to represent 60% of the level in advanced economies. The resulting calculation of R&D benefit showed a benefit inducement coefficient of 2.755, or roughly twice as great a benefit compared to that found using the sales to R&D investment ratio.

(3) Economic Benefits of Regional Workforce Training Projects

The beneficiaries of workforce training projects may be categorized into related businesses and the workers educated through the projects. Benefits to businesses from these projects include the creation of additional value added as a result of improvements in worker skill level, while benefits to educated workers include the

improvement of personal capabilities through education. Obviously, the two forms of benefit may overlap, as the effect in terms of creating value added for the business through such projects depends on the improvement of personal worker capabilities.

Even when the resulting improvement in individual work capabilities does not have an immediate impact on the company's production activities, when workers' potential capabilities are enhanced, additional benefits may accrue that do not overlap with the business's value added. For this reason, benefits from workforce training projects may ultimately be classified in terms of "business" and "individual" aspects, where the business benefits are further classifiable into value added creation and reductions in personnel training and education costs. From an individual perspective, the improvement of personal capabilities may be viewed as a benefit.

This skill improvement effect as a result of workforce training projects may be classified into qualitative and quantitative aspects, both of which are difficult to quantify in monetary terms. Perhaps the most rational approach to analyzing this effect from a variety of perspectives (including its qualitative and quantitative aspects) would be to use the conjoint analysis method from non-market good value estimation. This analysis showed a marginal willingness to pay (MWTP) of KRW 69.4 for a 251% qualitative improvement in individual capabilities; this means that if a worker is currently at 50% of the level of the country's top technicians, businesses are willing to pay around KRW 3,470 per year to increase his or her technical ability to the highest domestic level. In terms of quantitative improvements in individual skill, the MWTP for a worker to acquire one additional duty beyond those he or she presently

performs was found to be KRW 2,638.27 per year.

2. Social Discount Rate

It is generally accepted among academics that the social time preference rate (STPR) presents the best-suited parameter for establishing the social discount rate. Since the 2000s, the major advanced economies have responded to the global economic downturn and decline in the interest rate on government bonds with a continued decrease in the social discount rate, which is typically set at around 3–4%. In South Korea, by contrast, a rate of 5.5% has been applied.

The period since the late '00s has seen notable declines in South Korea's market interest rate, government bond interest rate, and potential growth rate, with the prospects for a short-term recovery seen as exceedingly slim. If greater value is assigned to promoting intergenerational equity, increasing the potential growth rate, and increasing investment in environmental preservation from a long-term perspective, a reduction in the social discount rate to around 3% appears acceptable. It would appear more advisable, however, in view of the financial burden that an abrupt change would entail and the potential confusion in terms of the suitable time distribution of investment, to first reduce it to around 4%. In the case of R&D investment-centered regional industry promotion projects, it appears advisable to apply a common social discount rate, but to show greater preference to underdeveloped regions when distributing policy resources, in the interest of greater interregional equality and social cohesion.

3. Calculating Value Added Scope

(1) Value Added Scope

Pre-feasibility studies for R&D projects in South Korea typically limit the scope of added value produced through R&D to the unit project dimension when calculating benefit. As this does not take into account the ripple effect for the industry as a whole, it excessively restricts the category of benefit, thus giving rise to issues of underestimation. A variety of intermediate inputs are needed for "specific items produced through R&D," and the value added "induced" for the intermediate input sector may also be seen as a "direct" benefit, as it represents inputs induced in advance for an item's production rather than an inducement effect through after-the-fact inputs of "specific items produced through R&D." Accordingly, the creation of value added induced through intermediate goods inputs should also be established as a direct benefit for regional industry promotion projects, given that their primary goal lies in fostering regional industry.

(2) Examining the Value Added Ratio

Because a project's benefit is estimated in terms of value added rather than the total amount of production from the project's execution, it is necessary to establish applicable value added ratios for the industries in question. First, it should be clarified what is meant by the concepts of "value added" and "value added ratio." As a concept, value added is defined differently in different fields,

which means that a decision must be made as to which statistics to adopt as a basis.

An inter-industry table takes into account not only intermediate inputs for a specific industry but also those for related industries. One subsequent benefit of an inter-industry table with an input and demand structure is that it is possible to give sufficient consideration to effects of other industries rather than only the one. As a rule, the inter-industry table should therefore be the standard when applying the value added ratio.

Chapter 5. Ways to Improve Preliminary Feasibility Analysis for Regional Industry Promotion Projects

Pre-feasibility studies for construction projects typically consist of three main areas: an economic feasibility analysis, a policy analysis, and a general assessment. Examinations for R&D projects include the additional area of technical analysis. Because construction projects are structured with standardized economic analysis methodologies, those analyses alone may be used to investigate a project's feasibility. In contrast, R&D projects are characterized by a lack of structure, uncertainty of outcomes, and effects of a potential and indirect nature. Moreover, a number of factors prevent adequate assessment of preliminary feasibility through economic feasibility analysis alone, including the difficulty of determining project scale in advance, differences in anticipated effects for individual projects, and the frequency of situations in which alternative means of intervention exist. It is for this reason that the additional area of technical analysis is applied when examining feasibility.

Regional industry promotion projects (hereafter "regional projects") are considered part of the current national R&D effort, with feasibility analyses conducted in accordance with the pre-feasibility study system for that effort. At the same time, the pre-feasibility guidelines currently being applied for R&D projects are limited in their applicability to regional projects due to the different characteristics of R&D projects and regional projects. In this case, it becomes possible to gain a clearer understanding of regional project characteristics through analysis from a regional project standpoint.

The importance of regional industry has typically been emphasized on the basis of research insights regarding clusters. In past industrial policy, the concept of "regions" was considered merely in terms of their being potential sites of industry placement. Over the years, however, with various studies on clusters resulting in such clusters being formed around specific regional units, demonstrating the potentially greater outcomes of a regionally centered industrial policy approach, regional industrial policy has come to occupy a key role in industrial policy. The reason for the growing perceptions of the importance of industry clusters lies in their being a key source of competitiveness, as represented by the cumulative profits that they generate from their establishment in regions economically and geographically contiguous to industries founded on elements of comparative advantage.

From this cluster-based approach, national R&D efforts and regional industry promotion projects have a number of distinctive characteristics. First, they are similar in being considered representative atypical projects with unclear causal relationships between inputs and outputs in terms of logical structure, where benefit

becomes difficult to quantify through structured methods. In the case of regional industry promotion projects, however, resulting benefits take many different forms, with profits from clusters (an area of particular emphasis in regional industry) playing a pivotal role in boosting regional industry competitiveness. In that sense, they are distinct from national R&D efforts, which are focused on producing innovations. Second, national R&D efforts encompass both basic science research and applied research, with consideration extended to both the generation of scientific knowledge and industrial outcomes. As a result, a relatively broad range of indicators have been applied to assess performance, including SCI, intellectual property rights, and economic feasibility of science and technology. R&D for regional industry promotion projects, on the other hand, is focused chiefly on applied research, with an emphasis on industry performance beyond the generation of scientific knowledge.

Third, due to differences across regional industry clusters, the extent of anticipated benefits from investment and the expected time of their materialization may differ. Regional projects must therefore be planned and implemented in ways optimal for their conditions, based on careful analysis of the characteristics, stage of development, and development direction of the various industries in the region. From this standpoint, preliminary feasibility analyses for regional projects, unlike those for R&D projects, must be rooted in a specifically regional industry-oriented perspective. Fourth, regional projects typically consist of various sub-projects such as those related to infrastructure, pure R&D, human resources training, and enterprise support services. Each of these sub-projects

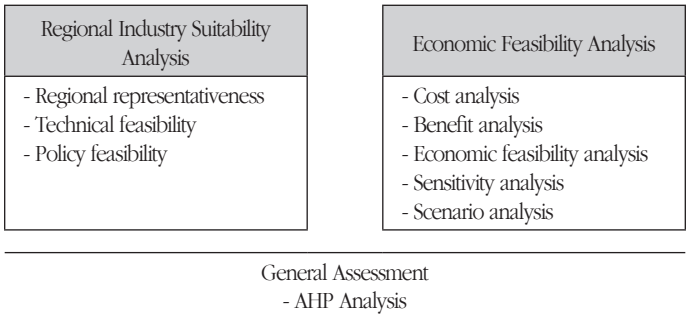
entails different channels of benefit generation, which means that different benefit calculation methodologies may be applicable. Because no standardized methodology has yet been developed, different researchers have arrived at vastly different economic feasibility analysis findings. For this reason, an R&D project pre-feasibility system based on the area of technical analysis may not function adequately for regional industry promotion projects.

Because of these distinctive characteristics of regional industry promotion projects and national R&D efforts, it is advisable to apply different systems when conducting a preliminary feasibility analysis. The (regional) industry analyses found in current pre-feasibility studies for R&D projects are essentially basic examinations for the analysis of basic data or evaluations of technical and/or economic feasibility. In particular, they are not treated as an independent category in general assessments, which results in a failure to adequately reflect the characteristics of industry promotion. Yet a careful analysis of regional industries and assessment of their suitability for projects are vital to producing the comprehensive feasibility evaluation and balanced conclusions that are the aim of preliminary feasibility studies.

Another concern with current pre-feasibility studies is that benefit may be underestimated when crucial categories such as profits generated by clusters are omitted from the economic feasibility analysis due to difficulties with calculation. The limits of economic feasibility analysis should therefore be addressed through assessment of a project's suitability to regional industries. The nature of regional projects is such that the feasibility of a given project is difficult to assess without detailed examination of its characteris-

tics with regard to regional industry. As what constitutes "regional" and "industrial" characteristics will differ across various regional projects, a category of "regional industry suitability" is necessary as a key item, in contrast with the analytical framework currently applied for pre-feasibility studies on R&D projects. The basic structure for preliminary feasibility analysis for regional projects should therefore follow the format in Figure 1. This structure provides a means of analyzing regional industrial characteristics in greater depth and improving the quality of the feasibility analysis. As a system for preliminary feasibility analysis of regional projects, it differs from the current pre-feasibility analysis system for R&D projects in several regards. First, because many different innovation factors besides R&D operate in the growth of the regional industries targeted by regional projects, a more integrated and comprehensive examination is required in terms of regional industrial policy; accordingly, the category of "regional industry suitability" has been strengthened substantially. Second, technical analysis and policy analysis, which serve as major categories in the R&D project system, have been incorporated in the regional project system as sub-categories of regional industry suitability. This is based on the determination that it is more advisable to restrict technical analysis to pure R&D projects alone and consider policy analysis within the category of regional industry suitability rather than as an independent item. It should also be noted that while the role of policy feasibility in current pre-feasibility studies is very weak—regarded as a "catchall" for areas not included in either technical or economic feasibility—its scope here has been greatly increased.

Figure 1. Framework for Regional Project Preliminary Feasibility



Chapter 6. Conclusion: Findings and Future Tasks

1. Findings

The aim of this study of preliminary project feasibility analysis for the promotion of regional industry was to examine areas in such analysis that require review or improvement and suggest an alternative approach. Its focus was on offering an alternative methodology regarding social discount rate and value added ratio suitability and policy support means (including infrastructure, R&D, and human resource training) based on an economic benefit approach. In particular, the study examined alternative means of economic benefit calculation that capture not only market ripple effects from infrastructure and human resource training efforts and policy measures (projects), but also knowledge ripple effects and network effects, which may be viewed as non-market goods in their enhancement of the cluster effect achieved in regional industry through various policy measures. It also presented a possible

approach to improving preliminary feasibility analysis for regional industry promotion projects that takes into account their distinctive characteristics and local conditions. The key findings are as follows.

First, this study offered an alternative or supplementary methodology for calculating economic benefit from the standpoint of cluster-generated profits. Current pre-feasibility studies have omitted calculation of the non-market value that may be produced through infrastructure building in terms of the economic benefits of infrastructure projects based on the market approach (sales approach) due to the difficulties of estimation with regard to regional industry promotion projects. In other words, by focusing their calculations of economic benefit from regional industry promotion projects on the value added that is directly produced, they have failed to consider the ripple effects that correspond to non-market value.

If, on the other hand, economic benefits from infrastructure building projects are interpreted from the standpoint of services used by enterprises, the value added from infrastructure efforts may be interpreted as use value from the perspective of the consumer (enterprise). While it is not related to immediate production of value added, the contribution to generating value added in an uncertain future may be viewed as non-use value. In those terms, the current study is significant in applying the multi-attribute utility theory contingent valuation method (MAUT-CVM) to calculate not only immediate value added but also non-market value (benefit) generated from the improvement of corporate value added potential by direct effects, network effects, and knowledge ripple effects that are not reflected in current pre-feasibility studies.

Second, an economic value analysis based on consumer utility was applied to calculate economic benefit from human resource training projects. The typical beneficiaries of human resource training projects can be broadly classified into enterprises and the workers who receive training. The benefit to enterprises lies in the creation of further value added as result of improvements to employee skill levels, while the benefit to the worker lies in improvements to personal capabilities through education. For this study, the effects of corporate value added creation and personal skill improvement were established as categories of benefits, and the value estimation approach for non-market goods used in calculating economic benefit for atypical projects was applied as a reflection of the public-service character of human resource training projects. The offering of the conjoint analysis method as an alternative approach to value estimation and a related case study analysis may also be viewed as contributions of this study.

Third, a methodology was presented for reflecting knowledge ripple effects in addition to market ripple effects from the producer's standpoint in estimating the benefits of R&D projects. The existing market demand approach and sales approach may be limited in their capacity to reflect knowledge ripple effects at the regional level as a characteristic of regional industry promotion projects. This study offered the social rate of return approach to address the need to reflect knowledge ripple effects as well as market ripple effects from the producer's standpoint to compute economic benefit from R&D.

Fourth, the social discount rate, the scope of value added, and the value added ratio were examined in terms of economic feasi-

bility (cost-benefit) analyses. Items related to the social discount rate and value added can have important implications in regional industry promotion projects. Current pre-feasibility studies restrict the social discount rate and added value to a standardized amount (5.5%) and scope. If differences in the social discount rate according to regional characteristics are factored in, it may be possible to provide a more accurate reflection of the economic benefits of regional industry promotion projects.

Finally, suggestions were offered for improving preliminary feasibility analysis for regional industry promotion projects. As a variety of innovation factors besides R&D operate in the regional industry growth targets of regional projects, possible improvements were suggested to reflect the need for more integrated and comprehensive examination from a regional industrial policy standpoint.

2. Future Tasks

While this study offered some significant findings, it also leaves a number of matters for future research. First is the identification of economic benefit items for infrastructure building and human resource training projects (including enterprise support services). To ensure the accuracy of economic benefit calculations for infrastructure building projects, an attempt was made to reflect not only the creation of value added for supported enterprises from a use value standpoint under the market approach, but also improvements in value added creation potential through cluster effects in terms of non-use value, network effects, and knowledge ripple effects. The identification of more detailed categories of benefit for cluster ef-

fects and network effects is an issue for future research to address.

Second, continued efforts should be made to develop and explore methodologies for determining the economic benefits of regional industry promotion projects. This study presented MAUT-CVM, conjoint analysis, and the market rate of return approach as means of incorporating both use value and non-use value for infrastructure building, human resources training, and R&D projects. Such methods may represent a more advisable and feasible approach, rather than an optimal one, for calculating the economic benefits of the policy tools used in regional industry promotion projects. At the same time, they also present limitations as economic benefit methodologies. For example, it is also necessary to conduct a prior examination of the occurrence of consumer-centered benefits that cannot be calculated through the social rate of return approach when identifying categories to calculate the economic benefits of R&D projects, and to perform separate calculations for any consumer-centered benefits that are present. Second, social rates of return should also be calculated for different regional units (metropolitan cities, regular cities, and provinces) and industries and applied to the R&D efforts in regional industry promotion projects.

Third, social discount rates must be calculated for different regions. This study examined the need and potential ideas for a different approach to calculating the social discount rate to reflect the particularities of regional industry promotion-related projects. Future research is also needed to calculate social discount rates on this basis for different cities, provinces, and metropolitan areas. Regional underdevelopment and related factors should be taken into

account and examined when calculating regional social discount rates.

Finally, research is needed on the need to calculate a shadow price rather than a market price when estimating costs, and on the appropriateness of costs. Shadow prices, which are calculated on the basis of social opportunity costs, are a key part of cost computation. For example, while it is necessary from a financial analysis standpoint to use market-based personnel expenses when calculating employment costs, shadow prices should be considered in economic analyses because of the advisability of taking social costs into account. Consideration should further be extended in cost computation to costs associated with value added generation. While it may be possible to absorb a certain production scale through existing personnel and capital in cases of ongoing production based on successful commercialization of R&D, etc., anything beyond that production will require investments of capital and labor, which will need to be computed as costs.