Institute for Public Policy and Business Research
The University of Kansas

An Evaluation Model to Determine
the Return on Public Investment (ROPI)
for the
Kansas Technology Enterprise Corporation

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November, 1992

Report No. 211

Acknowledgments

Table of Contents

List of Figures and Tables

Executive Summary

Researchers at the Institute for Public Policy and Business Research have created a system of Cost-Benefit Analysis for evaluating programs, projects, and agencies administered through the Kansas Technology Enterprise Corporation (KTEC). The research and development of the model was initiated by KTEC for the purpose of guiding KTEC activities at the planning and implementation stages so that these activities can most effectively support the overall goals of economic development efforts in the state of Kansas. This report describes a pilot implementation of this model in the form of a computerized system. It also describes future plans for an extension of this system which would evaluated KTEC activities after the fact.

The pilot system leads to an *ex ante* (forecasting) evaluation rather than an *ex post* (retrospective) assessment of results. The system determines the economic development impact of a given program, project, or agency by using a measurement referred to as Anticipated Return on Public Investment (A-ROPI).

The A-ROPI System is innovative and original in several respects.

- Existing Cost-benefit analysis systems are uniformly based on the "dollar is a dollar" assumption; for example, an additional dollar of income developed for a rich person is assumed just as socially valuable as an additional dollar for a poor person; and, all other economic development goals are ignored. In contrast, the A-ROPI system is based on a much more general set of economic development goals.

- The A-ROPI system requires these economic development goals to be determined by democratically legitimate representatives, rather by un-elected academic researchers.

- The system provides a sophisticated method for analyzing the economic development policy preferences of state legislators and other policy makers and incorporates the results directly into the Cost-Benefit Analysis. This method was tested using live legislators and other policy actors, and it works.

- Even though the system includes multiple goals, it boils them down into one single average result. The result is expressed in terms of an intuitively understandable "Return on Public Investment" (a ratio of the present value of benefits to the present value of costs). This averaging is accomplished by means of weights which measure the relative importance of the different goals to policy makers.

- The system does not assume that political goals remain constant over time. Instead, there is a provision for periodically re-examining these goals.

- The system includes an economic impact model which calculates Kansas economic development multipliers. These multipliers are used so as to estimate the indirect effects

of an economic development project. The economic impact model must be capable of examining a large variety of different economic development goals; therefore, the model is based on a Social Accounting Matrix (or SAM). The SAM framework provides a reasonably flexible framework for incorporating additional goals into the model from time to time.

In addition, the A-ROPI computer system design has a number of attractive features:

- The system provides a flexible means for defining economic development goals and preferences.

- The system is expandable. For example, it can conveniently be expanded so as to include additional economic development goals.

- The system is modular. For example, it can easily be interfaced to another model so as to incorporate alternate impact multipliers directly into the cost-benefit analysis.

- The system consists of a general framework, making it applicable to individual projects, to groups of projects, entire agencies such as the KTEC, or to a complete statewide program of economic development activities.

- The system encourages the generation of a data base of information for the purpose of comparing forecasts with actual program/project outcomes.

- The system serves to document the economic development efforts of KTEC.

- The system is implemented in an accessible spreadsheet format and runs on an IBM-compatible Personal Computer.

The system was used for two trial applications, which are documented in this report.

- One application examined the Anticipated ROPI for small project under KTEC's Applied Technology Matching Grant Program.

- The second application examined the Anticipated ROPI for one year of operation of a KTEC Center of Excellence.

- Both applications found that the programs under review had a strong positive effect on Kansas economic development. This result held whether it was denominated in terms of jobs, in terms of income, or in terms of weighted average of the two goals.

Finally, this report discusses proposed additional extensions of the system.

- The most important extension would be the development of a system to measure Realized Return on Public Investment (R-ROPI). R-ROPI would provide an *ex ante* (retrospective)

evaluation of actual outcomes of KTEC projects. It would provide a useful evaluation tool for KTEC.

- Continued refinements and improvements of the A-ROPI system are also needed. In particular, the systems should be expanded so as to handle additional goals; and the system should be improved so as handle more varieties of risk and uncertainty.

- The creation of an organized data base of the data generated by the ROPI systems would also be useful to KTEC mangers and policy makers.

1 Project Summary

Outline of Section

This section summarizes:

1. the history of the Pilot ROPI Project;

2. the sections of this report; and

3. the software and procedures developed during the Pilot ROPI Project.

Introduction to the Pilot ROPI Project and the Report

In June, 1991, the Institute for Public Policy and Business Research at the University of Kansas contracted with the Kansas Technology Enterprise Corporation (KTEC) to design, develop, and test an evaluation model. The study, referred to as the Pilot ROPI Project, was to provide KTEC with a method for assessing the impact of their programs and activities undertaken on behalf of the people of Kansas. Two elements of the evaluation model were to be developed:

1) Conversion of KTEC's program/project selection criteria into components of an over-all index of Return on Public Investment (ROPI), and

2) Development of a procedure to evaluate new economic development projects to determine if the project has the desired impact on the Kansas economy.

The ultimate goal of this study was to conceptualize a new method for evaluating projects for KTEC; therefore, it was agreed that the evaluation model would be developed dynamically, evolving and improving over time with feedback from the KTEC staff.

The first challenge for the researchers in designing the model was to ascertain the economic development goals by which a project, program, or agency could be evaluated in order to determine the Return on Public Investment (ROPI). This stage of the project is referred to as the Design and Pilot Implementation of the Policy Preference Elicitation Procedure. Design of this part of the project is based partly on Saaty's Analytic Hierarchic Process (AHP).

To ascertain the economic development goals to be used in the model, a survey was designed to capture the economic development preferences of the project's Steering Committee members. It was believed the preferences of the Steering Committee provided a better representative view of preferred economic development goals, as compared for example to the researchers' preferences. Through personal interviews, each member was given a list of ten economic development objectives and asked to choose the most important goal or objective through a method of pair-wise comparisons. The use of pair-wise comparisons allowed individual, personal preferences to be identified. It also captures information on the individual's qualitative understanding of the

development process. Even more significantly, this procedure helped determine the Steering Committee's preferences as a whole.

After all the responses were received, Personal Economic Development Weights were computed using the AHP procedure on the personal responses. This step determined the relative numerical importance placed on each goal by each respondent. Once completed, a consistency index was used to test the internal consistency of all responses. The results showed that all responses were reasonably, albeit not perfectly, internally consistent.

All responses were then averaged to obtain a set of Weights for Economic Development Goals for the Steering Committee as a whole. Three goals were identified as being the most important: jobs, income, and human capital. For the purposes of this study, the researchers decided to model only the top two most important goals: jobs and income. A more complete explanation and description of the Policy Preference Elicitation Procedure is provided in Sections 2 and 3 of the following report.

The second element of the Pilot ROPI Project consists of a procedure to evaluate new economic development projects. The researchers developed an Anticipated Return on Public Investment Procedure, or Anticipated ROPI Procedure (A-ROPI). A-ROPI is a system that performs a prospective Cost Benefit Analysis on a new project. Specifically, the A-ROPI Procedure measures the future benefits of a project, program, or agency as a rate of return, or Return on Public Investment (ROPI). The purpose of the Anticipated ROPI Procedure is to examine the degree of internal consistency between the projected development plans and the ultimate goals of economic development intended by policy makers, or in the case of this study, the goals of the Steering Committee.

To test the model, the Anticipated ROPI Procedure was applied to two cases: one small KTEC project and one KTEC Center of Excellence. A scoring device, or Scoring Module, was designed and used to collect the pertinent information on each case. Scores for the small KTEC project were obtained by pilot testing the instrument with a KTEC staff member, and personal interviews with a representative from the KTEC Center of Excellence provided figures for the second case. The Scoring results represent the direct effects of the small project and Center of Excellence.

To measure the total costs and benefits of a project, however, it is necessary to account for economic multiplier effects. The Economic Impact Module was developed with multipliers that forecast the total (direct plus indirect) impacts of a project or program. The scores for the small project and Center of Excellence were entered into the Economic Impact Module and the total impact of each case was generated. The results implied that both projects have a highly favorable effect on Kansas economic development goals. However, the activity turned up some questions about the Pilot A-ROPI model which will need to be addressed in future versions of the model. In particular, there appears to be a need to distinguish Keynesian "Pump Priming" benefits, which are likely to be available from almost any Kansas public expenditure program, from more specifically intended economic development effects.

The following report describes in more detail the theoretical basis for the ROPI Pilot Project and the methods used to design and develop the ROPI model.

Overview of the Project

Research on the ROPI Pilot Project began with meetings between the researchers and KTEC staff in June, 1991. In the beginning stages of the project, it was emphasized that close cooperation and interaction between the KTEC staff and researchers were critical to facilitate and guarantee the success of the project. For this reason, a liaison in the KTEC office and an administrative assistant in IPPBR were identified to help coordinate interactions between the two groups.

The first few months of the project were devoted to meetings between the researchers and KTEC staff; specifically, Marianne Hudson, Kevin Carr and Bill Brundage, for the purpose of obtaining a better understanding of how projects and programs are selected for funding and what criteria is used during the selection process. With this information, researchers were prepared to begin the design of the ROPI model.

The researchers met weekly throughout the project period to discuss the design and development of the evaluation procedure, or ROPI model. In these meetings, the theoretical basis for the model was discussed and established. During the course of the project, researchers met with the project's Steering Committee twice. The purpose of the Steering Committee was to provide the economic development goals for the model, and also to oversee the project's development.

Several presentations of the ROPI Pilot Project were made to the KTEC Board of Directors and the NASDA Management Review Team, and a Progress Report was submitted to KTEC in February, 1992.

Summaries of Sections

Section 2: Design of the Weight Evaluation Procedure
This section describes the theory and key components of the Weight Evaluation Procedure.

Section 3: Pilot Implementation of the Policy Preference Elicitation Procedure
This section describes the process and results of implementing the Policy Preference Elicitation Procedure.

Section 4: Design of the Anticipated ROPI Procedure
This section describes the key features and theory behind the Anticipated ROPI Procedure.

Section 5: Pilot Implementation of the Anticipated ROPI Procedure
This section describes an initial implementation of the Anticipated ROPI Procedure, modeling two economic development goals: jobs and income.

Section 6: Applying the Anticipated ROPI Procedure to a Small Project
This section describes a trial application of the A-ROPI Procedure to a small KTEC project grant.

**Section 7: Applying the Anticipated ROPI Procedure to Grants Received
            by a Center of Excellence**
This section describes a trial application of the A-ROPI Procedure to a KTEC Center of Excellence.

Section 8: Suggestions for Further Work

> This section reviews eleven suggestions for future enhancement of the ROPI model developed in this study.

Summaries of Computer Programs

Two computer programs have been developed as part of the ROPI model: 1) Scoring Module, and 2) Impact Module. The software programs, designed in LOTUS 123 Spreadsheets, are to be delivered to KTEC for implementing the model.

Several computer programs were either developed or used solely for the purpose of generating needed data for the model. For example, software programs were written for one-time usage to generate the SAM and Bridge Data. These programs are not part of the model to be delivered to KTEC. The software package GAUSS386 (Aptech Systems, Inc.) was used to generate the Prioritization Module of the model. It is not included in the software deliverable to KTEC because it is proprietary, not developed by the researchers. Of course this software can be independently purchased by KTEC at its option.

A1 | **Appendix**

Appendix 1.1: Pilot ROPI Flow Chart: Measurement of Return on Public Investment

Appendix 1.1: **Pilot ROPI Flow Chart**
Measurement of Return on Public Investment

PROCEDURE 1
Weight
Evaluation

PROCEDURE 2
Anticipated
ROPI

| Policy Preference Elicitation | | Prioritization | | | Scoring | | Economic Impact |

| Economic Development Goals | | Economic Development Weights | | | | | A-ROPI |
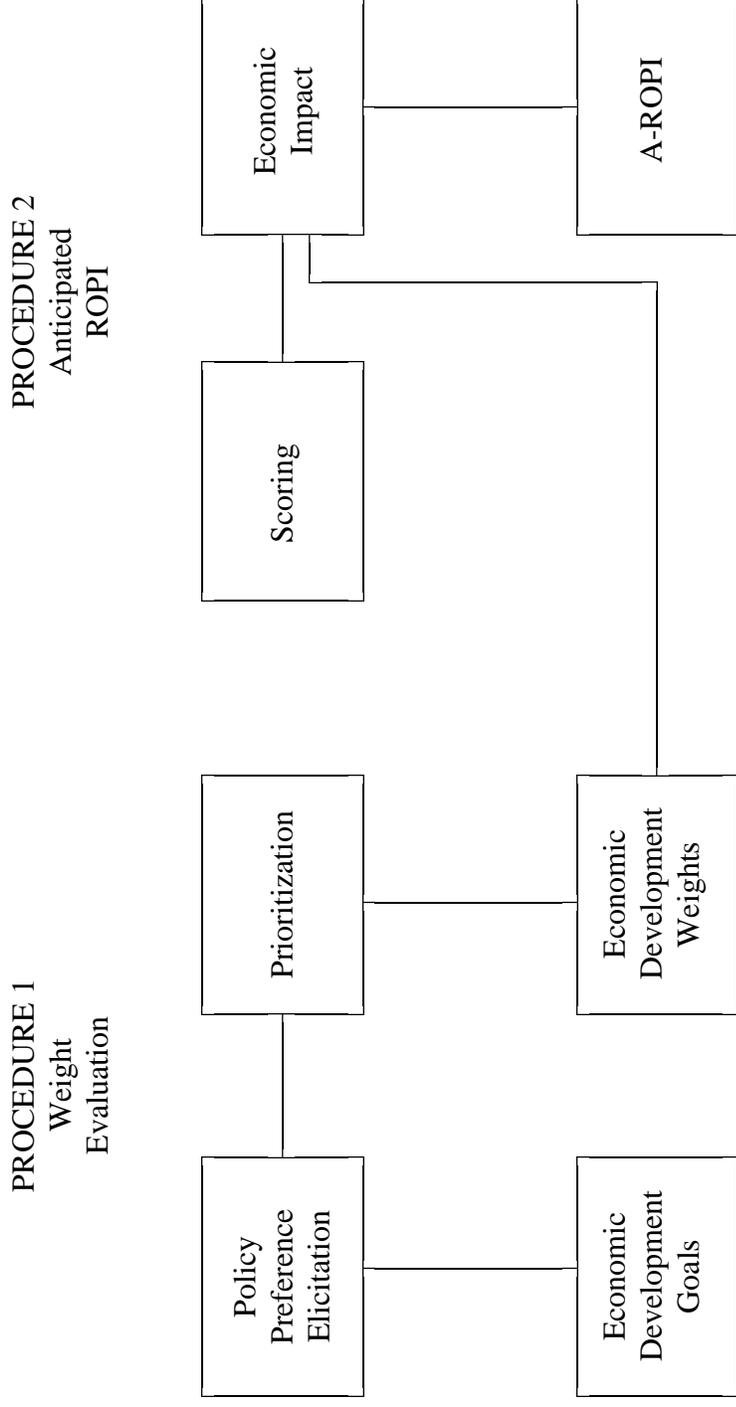
Note: Top row items are processes, bottom row items are data.

2 | Design of the Weight Evaluation Procedure

Outline of Section

The threshold problem in any evaluation effort is that of identifying the goals or objectives of the program under evaluation. This section provides an overview of IPPBR's approach to identifying the Goals of KTEC.

This section includes:

1. a brief review of the Analytic Hierarchy Process, or AHP;

2. a summary of the general types of goals that policy-makers are likely to intend when they authorize economic development activities; and

3. a description of how the AHP method will be used to refine this list to form a specific set of weighted goals to be employed for evaluating KTEC.

Introduction

The technology programs financed by KTEC are ultimately expected to lead to economic development. However, economic development embraces many—often conflicting—goals. For example, economic development goals may range from immediate wealth creation to developing technology infrastructure for future wealth creation. The different goals may lead to different choices among technology programs.

The problem of choosing among economic development goals (and in turn choosing among technology programs to be funded by KTEC) is exacerbated by two other factors: scarce resources and multiple constituencies. If there were unlimited resources, no choices at all would be required with respect to goals or technology programs, and all programs could be funded. However, in reality resources are always scarce, and therefore trade-offs have to be made among the many goals of economic development. In other words, relative weights need to be assigned to each of the economic development goals. Furthermore, members of different constituencies tend to prefer different goals. Some may prefer to emphasize development of human resources, others may prefer wealth creation, still others may prefer technology innovation for its own sake. Therefore, some procedure is needed so as to distill a wide range of diverse and conflicting preferences into a single unified set of weights.

Because of the two factors—the existence of multiple goals and the varying preferences of different constituencies—assessing the Return on Public Investment (ROPI) is not a straightforward computational exercise. The assessment process must address several key questions: How should one define the general goals which are to be pursued? How should one define the various relevant

constituencies whose preferences are to be taken into account? How should one elicit or measure the range of preferences within and across constituencies? How should one prioritize the goals given the differing preferences among constituencies?

In this section we describe our procedure for deriving the Economic Development Weights. First, we provide a quick overview of the relevant literature. Second, we outline the major philosophical premises on which our procedure is based. Third, we summarize how we arrived at a list of ten economic development goals for further consideration. Fourth, we propose a specific procedure for deriving the economic development weights. Finally, in the next section (Section 4) of this report, we illustrate how we pilot-tested our procedure.

Literature Review

Our search for material focused on two major areas: economic development and analytic decision approaches. The development literature was scanned to derive a broad set of goals that are generally accepted to fall within the scope of the term "economic development." This became the starting point for the list of economic development goals used in our procedure. Search for analytic decision approaches yielded an extensive set of works on the Analytic Hierarchic Procedure formulated by Saaty [1980]. The procedure has been employed in numerous settings including large private, governmental and international concerns (for an annotated bibliographies, see Golden, Wasil and Harker [1989] and *European Journal of Operational Research* [1990]).

Philosophical Premises

Our procedure for arriving at the economic development weights is based on several crucial premises:

1. A sharp distinction should be drawn between the general goals which are shared by all economic development programs in Kansas, and the more specific goals which are adopted by KTEC, for example in KTEC's strategic plan. It is KTEC's unique role to encourage technology transfer in particular, rather than economic development in general. However, from the point of view of policy-makers and taxpayers it is very important to evaluate KTEC's effect on economic development *in general* (as well as its effect on technology transfer in particular). The ROPI approach can be applied to goals at any level of analysis, but this report deals only with the most general goals of economic development. The purpose is to provide an objective evaluation of KTEC against ultimate goals which are shared by all Kansas economic development programs.

2. The general goals of economic development should be determined not by the researchers, but rather by a body that is representative of the electorate and its different constituencies. The researchers' task is to devise a procedure for eliciting the goals preferred by the different members of this representative body.

3. At the same time, researchers should actively rather than passively assist in the formulation of an initial list of goals. Researchers should base this starting point on discussions with policy-makers, as well as on a review of literature in the policy analysis of economic development.

4. The priorities or weights assigned to these various goals should be determined by a representative body, and not by researchers.

5. The priorities among goals are likely to shift over the years, and hence the procedure must be flexible enough to accommodate shifting priorities.

6. The procedure should be anchored in sound economic theory.

Based on this reasoning, we surveyed the literature to derive economic development goals, and we settled on the Analytical Hierarchy Process as a means for deriving the Economic Development Weights. The overview of this procedure is flow-charted in Appendix 2.1.

Economic Development Goals

From our literature research, as well as from IPPBR's previous experience with economic development policy in the State of Kansas, we obtained an extended list of economic goals, many of which are overlapping. Appendix 2.2 lists this extended set of economic development goals. It was clear that no decision procedure could realistically handle so many overlapping goals at the same time. Hence, we decided to cluster the many goals into meaningful groups so as to reduce overlaps and redundancies.

A major motivation for clustering the goals stems from the technical requirements of the Analytic Hierarchic Procedure. This procedure requires that each respondent perform pair-wise comparisons. The process becomes unwieldy as the number of goals increases. For example, if the number of goals is 10, the total number of comparisons required is 45, whereas if it is 15, the number is 105. So as we move from 10 to 15 goals the number of comparisons increases from 45 to 105.

The clustering procedure resulted in an initial list of ten goals:

A. Job creation
B. Increasing the monetary standard of living
C. Maintaining or increasing the non-monetary quality of life
D. Benefitting ordinary people
E. Benefitting disadvantaged people
F. Benefitting rural areas
G. Making physical investments
H. Making investments in human capital
I. Encouraging a spirit of technological innovation
J. Encouraging entrepreneurial spirit

Although the above goals are reasonably self-explanatory, we have provided more complete descriptions of them in Appendix 2.3.

The Role of Economic Development Weights in the Measurement of ROPI

The overall goal of this project is to design a tool for measuring the net benefits and costs of an economic development program. The tool is specifically referred as "Return On Public Investment" (or ROPI). ROPI is a measure of the productivity of an economic development program, expressed as a rate of return. But because there exist many different goals of economic development, there also exist many conceptually different rates of return that could be measured. We will explore how these various rates of return can be measured in Sections 4 and 5 below.

In an evaluation method such as Cost-Benefit Analysis, it is assumed that a single, unified goal can be defined for public policy. The role of the Economic Development Weights will be to assist in constructing such a unified goal. In particular, the various rates of return will be distilled into a single weighted average rate of return using the weights.

Deriving the Economic Development Weights

The procedure that we use to derive Economic Development Weights requires inputs from several sources and several computational steps. The procedure is described briefly below. The Analytical Hierarchical Procedure is clearly a key to the derivation, and for this reason we expand upon it further.

The Weight Evaluation Procedure

The Weight Evaluation Procedure refers to the manual, software, and activities for determining the Economic Development Weights to be used in measuring the weighted average ROPI. It includes a Policy Preference Elicitation Module and a Prioritization Module. An initial version of this procedure, described in the next section (Section 4), was developed during the Pilot ROPI Project.

The Preference Elicitation Module

As we noted earlier, economic development means different things to different people. This does not merely mean there are many goals of economic development, but that people differ in the degree to which they prefer various goals. Hence, some weighing of the ten goals becomes necessary to determine ROPI. The Policy Preference Elicitation Module gathers the information needed for determining these weights from a body of representatives.

The Representative Body

One way of weighing the goals would be to query every taxpayer as to his/her preferences. However, the costs of such a procedure would be enormous and prohibitive. Another way is to select a body to represent the will of the people. The issue of who should represent the taxpayers or voters is not within the scope of this report, since we judge this ultimately to be a political question rather than one of procedure. Although we will provide some recommendations in section 8, here we will assume that such a representative body will be created for the purpose of eliciting the weights assigned to economic development goals. We also assume that this body is politically legitimate.

The Analytical Hierarchy Process

We proposed to elicit preferences from the Representative Body using Saaty's Analytic Hierarchy Process (AHP). The approach involves presenting members of the representative body with a scale on which they provide comparisons among all pairs of the ten economic development goals enumerated above. Saaty suggests that the a nine-point scale be constructed for pair-wise comparisons among goals. A score of 1 would suggest the two goals (A and B) are of equal importance, whereas a score of 9 means one goal is absolutely important. Appendix 2.4 reproduces Saaty's scale; we employed a variant of it for eliciting pair-wise comparisons. The output of this procedure is a matrix of pair-wise comparisons for each respondent.

The procedure requires in-person interviews so that respondent's queries can be answered. In the next section we describe the survey form we have designed for use in eliciting the pair-wise comparisons.

The Prioritization Module

The prioritization module involves deriving each respondent's priorities among the ten economic development goals based on the pair-wise comparisons obtained from the previous step. In technical terms, this requires the derivation of Normalized Eigenvalues from the matrix of pair-wise comparisons obtained from each respondent in the previous step. The eigenvector component corresponding to each economic development goal is a number between zero and one; this number represents the best available quantitative estimate of the relative importance the respondent places on the corresponding economic development goal. The eigenvector components are normalized so that the weights sum up to 1.

Since the representative body consists of many individuals who are likely to have different preferences, the normalized eigenvalues are averaged over the respondents to obtain the economic development weights for estimating ROPI. We will assume for simplicity that members of the Representative Body are assigned equally weighted votes, but the procedure can accommodate unequally weighted votes without any difficulty. The resulting vector provides the weights for economic development goals; in turn this becomes the basis for estimating ROPI.

Summary: Policy Preferences and Measurable Economic Impacts

The ROPI project has developed an entire conceptual framework, referred to as Goal Mapping Assumptions, to bridge the gap between verbal expressions of the policy preferences of various political constituencies, on the one hand, and measurable economic impacts, on the other. This framework includes: the means of selection used for members of the Representative Body; the choice of the initial Economic Development Goals used in the Policy Preference Elicitation Module; the use of the Analytic Hierarchy Process to develop Weights in the Prioritization Module; the choice of Proxies that stand for the Goals (described in Sections 4 and 5); and the use of a weighted average rate of return (ROPI) as a measure of the degree of success in achieving the Goals.

These assumptions amount to an interrelated set of value judgements. These value judgements must be accepted by policy-makers before policy-makers can rely on the results of any particular

ROPI measurement. We believe, however, that these particular value judgments are in fact widely (though not universally) acceptable to present-day policy-makers. They are assumptions about what decision-making process should be followed, rather than assumptions about what goals or outcomes should be achieved. These main value judgements amount to the principle of representative democracy, combined with the ideal of rational decision-making based a utilitarian analysis of ends and mean.

A2 | **Appendixes**

Appendix 2.1: Overview of the Weight Evaluation Procedure
Appendix 2.2: Expanded Economic Development Goals
Appendix 2.3: Final Economic Development Goals
Appendix 2.4: Saaty's Intensity Scale

Appendix 2.1:   Overview of the Weight Evaluation Procedure

```
┌─────────────────────────┐      ┌─────────────────────────────────┐
│  Create a REPRESENTATIVE│      │  ┌───────────────────────────┐  │
│  BODY to choose the state│     │  │   Generate EXTENDED       │  │
│  development priorities  │      │  │ ECONOMIC DEVELOPMENT      │  │
└─────────────────────────┘      │  │        GOALS              │  │
           │                     │  └───────────────────────────┘  │
           │                     │  ┌───────────────────────────┐  │
           │                     │  │   Cluster the GOALS        │  │
           │                     │  │   into a manageable        │  │
           │                     │  │        number             │  │
           │                     │  └───────────────────────────┘  │
           │                     └─────────────────────────────────┘
           │                                   │
           └──────────────┬────────────────────┘
                          │
              ┌───────────────────────────┐
              │   Revise the ECONOMIC     │
              │   DEVELOPMENT GOALS       │
              └───────────────────────────┘
                          │
              ┌───────────────────────────┐
              │        Apply the          │
              │ PREFERENCE ELICITATION    │
              │       MODULE              │
              │  (based on the ANALYTIC   │
              │   HIERARCHY PROCESS;      │
              │        Survey I)          │
              └───────────────────────────┘
                          │
              ┌───────────────────────────┐
              │        Apply the          │
              │  PRIORITIZATION MODULE    │
              └───────────────────────────┘
                          │
              ┌───────────────────────────┐
              │ ECONOMIC DEVELOPMENT      │
              │       WEIGHTS             │
              └───────────────────────────┘
```
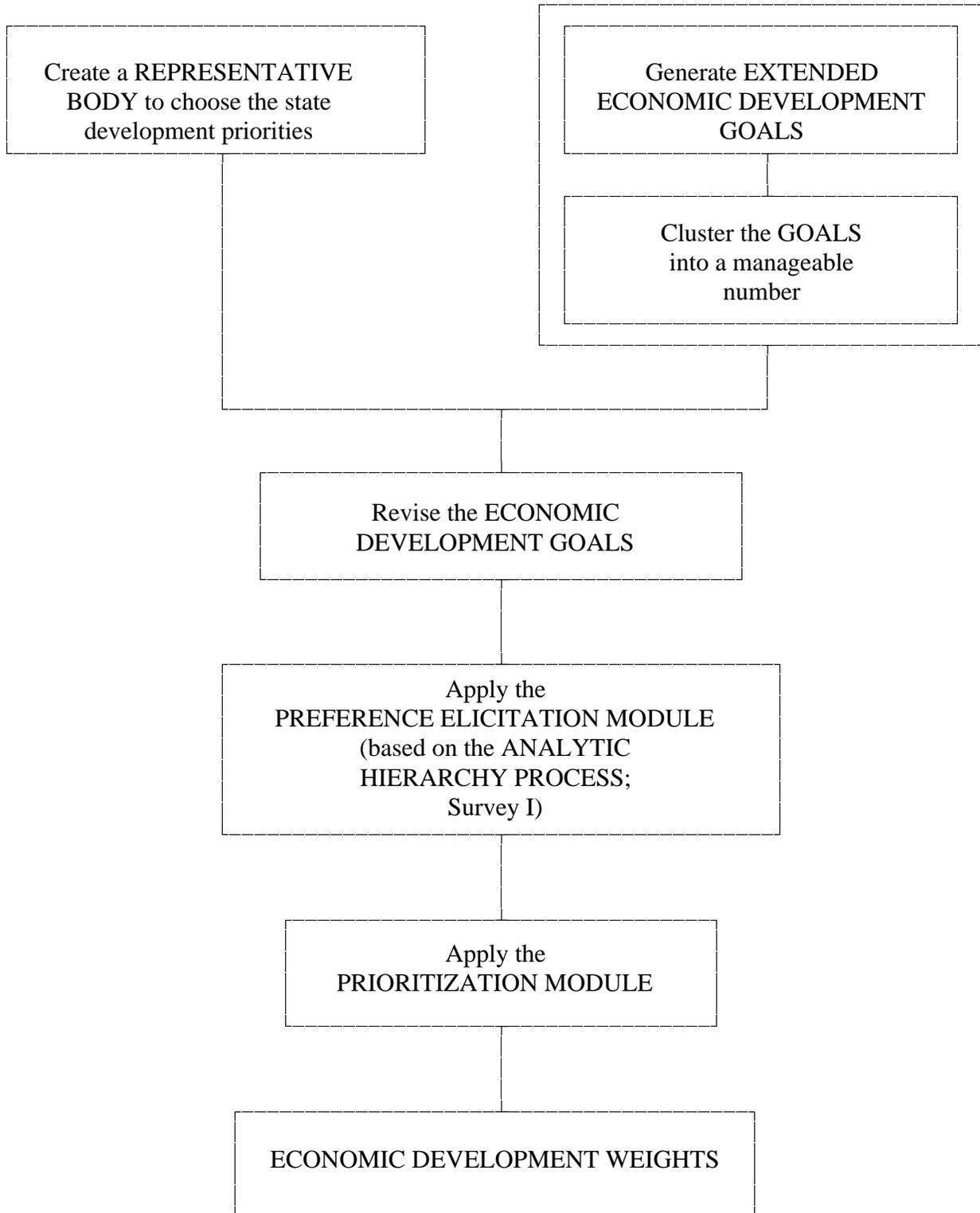
Appendix 2.2:   Expanded Economic Development Goals
Note: The phrase "contributions of project/program to ... of Kansas" is assumed in each item.

I.   FINAL OR ULTIMATE GOALS

("Final" as in final causes or final demands or overriding values; however, each of these "final" goals has short run as well as long run components)

A.   AGGREGATE GOALS

1.   Jobs.

1a.   Total new jobs and opportunities for self-employment
       (filled by existing Kansans during construction and steady state)
1b.   Total reductions in Kansas gross out-migration.

2.   Standard of living.

2a.   Total new income (current) or wealth (present value of income), received by existing Kansans
       -i.   monetary income or wealth
       -ii.   fringe benefits and in-kind values or quality of jobs
2b.   Total new tax revenues, less new government expenditures required to hold services constant
       -i.   received by Kansas state government
       -ii.   received by Kansas local government units
2c.   Total value of amenities less disamenities of success
       -i.   maximizing the value of the positive amenities which result from growth
       -ii.   minimizing the costs of crowding and pollution which result from growth.
       -iii.   minimizing other negative effect on environment and social costs of the project
2d.   Total net benefits received by non-Kansans
       -i.   jobs, income and/or wealth received by in-migrants
       -ii.   jobs, income and/or wealth received by non-Kansans
       -iii.   new tax revenues less expenditures of non-Kansas governmental units

B.   INTENSIVE AND DISTRIBUTIONAL GOALS

3.   Benefitting ordinary people.

3a.   Jobs: Total new jobs by type (filled by existing Kansans)
       -i.   semi-skilled
       -ii.   technical and skilled
3b.   Standard of living
       -i.   median wage level
       -ii.   median quality of jobs
       -iii.   total new income (current) or wealth (present value of income) (received by existing
               Kansans) for
               - poor and working class households
               - middle income households
               - wages and salary workers

4.   Benefitting disadvantaged people

4a.   Jobs
    -i.   minimizing the unemployment rate
    -ii.   total new jobs and self-employment by type (filled by existing Kansans)
        - minimum wage
        - semi-skilled
4b.   Standard of living
    -i.   minimizing percent in poverty
    -ii.   total new income (current) or wealth (present value of income) (received by existing Kansans) for poor and working class households
    -iii.   aggregate net benefit to the worse off: additional income less additional taxes should be positive

5.   Benefitting rural or impacted areas

5a.   jobs by region
5b.   standard of living: total new income and/or tax revenues by region where the germane regions are:
    -i.   rural areas
        - Western Kansas
        - Central and Eastern Kansas
    -ii.   poor urban areas

6.   Reducing inequality

6a.   across households
6b.   across regions

7.   Reducing job and income risk and uncertainty

7a.   reduce unemployment and underemployment rate in Kansas
7b.   create a diversified economy which stable over the business cycle
7c.   emphasize development of jobs with limited involuntary layoffs

II. INSTRUMENTAL OR INVESTMENT GOALS
(That is, goals which are really just means for accomplishing goals like the previous ones over the long run.)

8.   Physical investments

8a.   private means of production
8b.   government productive infrastructure
8c.   public amenity infrastructure

9.   Human capital investments

9a.   skilled technical labor pool
9b.   professional/managerial labor pool
9c.   entrepreneurial and innovative spirit

10.   Organizational/social capital investments and financial market infrastructure development

10a.   self-sustaining network of technological skills and activities
10b.   formation of collective strategies
10c.   creation of a public and governmental environment conducive to doing business in Kansas
10d.   creation of active local capital markets for:
       - seed, venture, development, mezzanine, expansion capital

Appendix 2.3: Final Economic Development Goals

A.   **Job creation**: increasing the total number of new jobs in the state, as well as opportunities for self employment.

B.   **Increasing total money income and wealth**: increasing the real income received by Kansans, and also the tax base in Kansas.

C.   **Maintaining or increasing the non-monetary quality of life**: reducing pollution and crime, protecting the environment, and increasing the quality of government services.

D.   **Benefitting ordinary people**: creating new and better middle-income jobs and other opportunities for Kansans.

E.   **Benefitting disadvantaged people**: creating more and better jobs likely to be held by poor people.

F.   **Benefitting rural areas**: increasing real income in rural counties in western, central and eastern Kansas.

G.   **Making physical investments**: putting new and productive buildings and equipment in place, and also building roads, sewers, communications links, parks, and public buildings.

H.   **Making investments in human capital**: enhancing the skill and education level of people in Kansas.

I.   **Encouraging a spirit of technological innovation**: increasing the number and quality of workers devoted to introducing technological improvements in Kansas.

J.   **Encouraging an entrepreneurial spirit**: increasing the number and success rate of new business projects in Kansas, especially those which diversify the economy.

Appendix 2.4:   Saaty's Intensity Scale

Intensity of Importance	Definition	Explanation
1	Equal importance	Two activities contribute equally to the objective
3	Weak importance of one over another	Experience and judgment slightly favor one activity over another
5	Essential or strong importance	Experience and judgment strongly favor one activity over another
7	Very strong or demonstrated importance	An activity is favored very strongly over another; its dominance demonstrated in practice
9	Absolute importance	The evidence favoring one activity over another is of the highest possible order of affirmation
2, 4, 6, 8	Intermediate values between adjacent scale values	When compromise is needed
Reciprocals of above nonzero	If activity i has one of the above nonzero number assigned to it when compared with activity j, then j has the reciprocal value when compared with i	A reasonable assumption

Source: Saaty [1980, p. 52].

3 | Pilot Implementation of the Policy Preference Elicitation Procedure

Outline of Section

This section describes:

1. the Pilot ROPI Project Steering Committee;

2. the survey form used for applying the AHP procedure so as to measure Kansas *Economic* Development Weights;

3. the Weights which resulted; and

4. various tests of internal consistency we applied to these data.

Introduction

In this section we describe the results of our initial effort to quantify the economic development goals intended by policy-makers in the state of Kansas. The preliminary results show that the three leading goals, jobs, income, and human capital development, are considered about equally important. Benefitting ordinary people is considered about two-thirds as important as the leading goals, while the remaining goals are considered about one-half as important.

The Steering Committee

KTEC established a steering committee to oversee and guide the Pilot ROPI Project; this committee was used to provide a sample of Kansas policy-makers for the pilot test. The committee members consisted of legislators, private sector business executives, and one university professor. Names and affiliations of the Steering Committee members are listed in Appendix 3.1. The committee was briefed about the project and agreed to act as the Representative Body of individuals for deriving economic development weights. This facilitated a pilot test for the policy preference elicitation module.

The Survey Form

IPPBR designed a special survey form for policy preference elicitation (Appendix 3.2). The initial survey form focused on the ten economic development goals derived from all the goals we had identified during the literature search (Appendix 2.3). However, it was intended that these goals could be modified over time by the Representative Body. The survey was designed to be administered orally by a knowledgeable researcher. It was assumed that the interviewees were knowledgeable about economic development programs, and that the goals would be further discussed and explained in the course of the interview.

Overview of the Pilot Test

Each participating member of the steering committee was interviewed by a member of the ROPI project team using the survey form. Out of ten members, we received usable responses from eight members. Each interview lasted from twenty to forty minutes. Most respondents did not advance any additional economic development goals for consideration. One respondent advanced one additional goal (improving the business climate), without providing any preference information on it. One respondent provided preference ranking information for an additional goal of investing in technology hardware.

Data Confidentiality

In order to encourage an honest disclosure of personal opinions, steering Committee members were informed that their individual preferences would not be revealed. Although the range of individual preferences uncovered by the survey is described in Appendix 3.3, we have not associated individual names with individual preferences.

Results

The matrix of responses from each Steering Committee member was analyzed to derive that respondent's Personal Weights (i.e the Economic Development Weights he or she preferred). Technically, this analysis consisted in finding the normalized eigenvector corresponding to the largest eigenvalue of the matrix. According to the AHP model, these numbers should represent the best available weights for representing the policy preferences of each respondent. Appendix 3.3 presents the normalized eigenvectors for each respondent.

The responses were also tested for internal consistency using a consistency index suggested by Saaty [1980, pp. 51ff]. The detailed results are presented in Appendix 3.4. All of the respondents were reasonably, but not perfectly, consistent in their responses. This result is quite typical in applications of Saaty's AHP method.

Diversity of Preferences

The Personal Weights (normalized eigenvectors in Appendix 3.3) differ considerably over the respondents. Appendix 3.5 presents the dispersion measures across preferences. This suggests that even among the Steering Committee members, who were selected based on an interest in economic development, there is considerable diversity regarding economic development goals.

Selection of main goals for Pilot ROPI

We used a simple averaging of the responses to obtain a weighing of the economic development goals for the Steering committee as a whole. As displayed in Appendix 3.6, jobs, income, and human capital development were the three most important goals, as judged by the participating committee members. These three goals have nearly equal average weights, and all three were well ahead of the fourth place (benefitting ordinary people).

Because of limitations in research time, in the subsequent sections of this report we chose to concentrate on modeling the two top goals, jobs and income. These two goals had (at least marginally) higher weights than human capital development. As it happens, these two goals are traditionally accepted and studied in many economic impact models, which somewhat simplified the modeling effort.

Implications for the evaluation model

It is noteworthy that the top economic development goals chosen by members of the Steering Committee are generally somewhat removed from the specific strategic goals that KTEC emphasizes. Conversely, goals which are closely related to KTEC's distinctive mission of technology transfer were ranked relatively low (Technological Innovation ranked 6th; Entrepreneurial Spirit ranked 7th). This result does not appear to reflect any lack of support for KTEC among members of the Steering Committee. On the contrary, several members have expressed strong support for KTEC. Instead, this result probably shows that the members took our instructions quite seriously when we asked them to focus on the ultimate goals of Kansas Economic Development programs, rather than on the particular goals of the KTEC program. In other words, Kansas leaders seem to be concerned with improving the job opportunities and prospects of Kansans. Technological innovation is also important, but its importance is as a means to that end.

It follows that the economic model used to evaluate KTEC should try to incorporate causal links between goals of this type. In particular, the model should measure the extent to which technology transfer leads to jobs and income in Kansas. This relationship is a cutting edge issue in empirical economics, partly because there are several different links between technology and jobs. Some links can be anticipated with reasonable accuracy at the time a new project is approved; examples include the numbers, skills, and wages of persons who will be hired by the project. Other links can be difficult to identify, except possibly in retrospect; one good example is the tendency of a technological innovation at a given place to encourage additional innovations at the same place in the future. This suggests a distinction between anticipatory evaluation and retrospective evaluation; this distinction plays an important role in the next section.

A3 | Appendixes

Appendix 3.1: Pilot ROPI Steering Committee Members
Appendix 3.2: Survey Form for the Representative Body
Appendix 3.3: Eigenvectors for the Eight Respondents
Appendix 3.4: Results of the Preference Consistency Test
Appendix 3.5: Dispersion Measures Across Preferences
Appendix 3.6: Average Weights and Ranks

Appendix 3.1: Pilot ROPI Steering Committee Members

The members of the KTEC Pilot ROPI Project Steering Committee were:

Dave Kerr
Kansas State Senator (R)
Hutchinson

Janis Lee
Kansas State Senator (D)
Kensington

Bob Mead
Kansas State Representative (R)
Pawnee Rock

Dave Heinemann
Kansas State Representative (R)
Garden City

George Dean
Kansas State Representative (D)
Wichita

Diane Gjerstad
Kansas State Representative (D)
Wichita

Bud Grant
Executive Director, Kansas Chamber of Commerce & Industry
Topeka

John Moore
Senior Vice President of Human Resources, Cessna
Wichita

Jack Pierson
President, Preco Industries, Inc.
Shawnee Mission

Jarvin Emerson
Professor of Economics, Kansas State University
Manhattan

Appendix 3.2: Survey Form for the Representative Body

Institute For Public Policy and Business Research

ROPI OBJECTIVES

The following survey is designed to help KTEC establish Kansas economic development objectives on a systematic basis. You are being tapped to respond to the survey because we believe that as one of the state leaders, you can provide informed opinions about the proper role of economic development in the state of Kansas.

We will present to you several commonly accepted objectives of economic development. You may add to these objectives if you think additional objectives need to be included. The survey will try to elicit your beliefs about the relative priorities among various objectives.

[Hand a copy of the next page to the interviewee.]

Institute For Public Policy and Business Research

ROPI OBJECTIVES: PART I

Instructions: Listed below are some commonly accepted goals of economic development and their meanings.

A. **Job creation**: increasing the total number of new jobs in the state, as well as opportunities for self employment.

B. **Increasing total money income and wealth**: increasing the real income received by Kansans, and also the tax base in Kansas.

C. **Maintaining or increasing the non-monetary quality of life**: reducing pollution and crime, protecting the environment, and increasing the quality of government services.

D. **Benefitting ordinary people**: creating new and better middle-income jobs and other opportunities for Kansans.

E. **Benefitting disadvantaged people**: creating more and better jobs likely to be held by poor people.

F. **Benefitting rural areas**: increasing real income in rural counties in western, central and eastern Kansas.

G. **Making physical investments**: putting new and productive buildings and equipment in place, and also building roads, sewers, communications links, parks, and public buildings.

H. **Making investments in human capital**: enhancing the skill and education level of people in Kansas.

I. **Encouraging a spirit of technological innovation**: increasing the number and quality of workers devoted to introducing technological improvements in Kansas.

J. **Encouraging an entrepreneurial spirit**: increasing the number and success rate of new business projects in Kansas, especially those which diversify the economy.

Are there other objectives that need to be achieved for economic development?

Please list: _____

_____

_____

ROPI OBJECTIVES RANKING: PART II

Instructions: In this part, we request you to compare the various objectives that were outlined in Part I. We will give you several pairs of objectives. In each case, we request that you compare one objective against the other.

For comparison, we request that you adopt the following two scales.

I. Consider two objectives A and F. Which objective is more important than the other? Check one alternative.

_____ A is more important than F
_____ F is more important than A

II. Please score on the following scale, your assessment of how much more important is one objective over the other

no   absolutely
difference   different
_____
1   2   3   4   5   6   7   8   9   10

That is, "1" represents no appreciable difference in importance.
"2" represents a barely perceptible difference.
...
"10" represents a maximal or absolute difference.

ILLUSTRATION:

Consider two objectives: A. Job creation and F. Benefitting rural areas.

Suppose that you believe that benefitting rural areas is more important than job creation.

> Then for scale I, you will choose the option:
> ___ F is more important than A.

Next suppose that you believe that both are important, however, benefitting rural areas is somewhat more important,

> Then for scale II, you may choose 4, 5, 6, 7 depending on your assessment of the extent to which benefitting rural areas is *more* important than jobs.

SCORING FOR PART II

[Instructions for interviewer: fill in only the upper half diagonal of the matrix. Enter the integer measuring intensity AS IS if the LEFT option is preferred over the TOP option (i.e. if preferences obey alphabetic order). Enter the RECIPROCAL of the integer if the TOP option is preferred over the LEFT option (i.e if preferences are anti-alphabetic).]

	A	B	C	D	E	F	G	H	I	J
A	1	__	__	__	__	__	__	__	__	__
B		1	__	__	__	__	__	__	__	__
C			1	__	__	__	__	__	__	__
D				1	__	__	__	__	__	__
E					1	__	__	__	__	__
F						1	__	__	__	__
G							1	__	__	__
H								1	__	__
I									1	__
J										1

Name of Interviewee _____   Title_____

Name of Interviewer _____

Location of Interview_____

Date of Interview _____

ROPI: PART III

      In this section, we request you to make any comments you may have about economic development, and about this procedure.

THANK YOU FOR YOUR HELP!

Appendix 3.3:   Eigenvectors for the Eight Respondents

\ Respondent Goal	#1	#2	#3	#4	#5	#6	#7	#8
A Jobs	0.0422	0.2647	0.2023	0.2563	0.0841	0.1880	0.1796	0.0336
B Monetary Standard	0.1761	0.0685	0.1291	0.0912	0.1606	0.1673	0.3243	0.1839
C Quality of Life	0.0396	0.0527	0.0525	0.0631	0.0557	0.0531	0.1001	0.0528
D Ordinary People	0.0435	0.1714	0.1118	0.1198	0.1390	0.1768	0.0910	0.0376
E Disadvantaged	0.0395	0.1098	0.1088	0.1116	0.1769	0.0431	0.0278	0.0417
F Rural Areas	0.0803	0.0587	0.0648	0.1289	0.1066	0.0295	0.0241	0.0537
G Physical Invest.	0.0885	0.0145	0.0350	0.0409	0.0353	0.0741	0.0315	0.1034
H Human Capital	0.2954	0.0724	0.1331	0.0912	0.1896	0.1686	0.0680	0.1384
I Innovation	0.1156	0.0780	0.0806	0.0549	0.0241	0.0802	0.0735	0.1442
J Entrepreneurship	0.0792	0.0318	0.0820	0.0420	0.0281	0.0193	0.0802	0.2106
K Hardware	0.0000	0.0774	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	1.	1.	1.	1.	1.	1.	1.	1.

Note: All of the eigenvectors have been adjusted so that Personal Weights sum to 1.

As in Section 2, the goals are:

    A. Job creation
    B. Increasing the monetary standard of living
    C. Maintaining or increasing the non-monetary quality of life
    D. Benefitting ordinary people
    E. Benefitting disadvantaged people
    F. Benefitting rural areas
    G. Making physical investments
    H. Making investments in human capital
    I. Encouraging a spirit of technological innovation
    J. Encouraging entrepreneurial spirit

One additional goal suggested by respondent 2 is:

    K. Investing in Technology Hardware.

Names of individual respondents have been suppressed; see text.

Appendix 3.4:   Results of the Preference Consistency Test

Respondent ID	Number of Goals (N)	Maximum Eigenvalue (ME)	Inconsistency Index (II)	Consistency Index (CI)
#1	10	13.573	.397	.779
#2	11	16.574	.658	.634
#3	10	11.342	.150	.916
#4	10	12.619	.291	.838
#5	10	11.516	.168	.907
#6	10	10.661	.073	.959
#7	10	10.585	.065	.964
#8	10	14.046	.450	.750

Note: Inconsistency Index is defined as $II = (ME-N)/(N-1)$.

If the respondent's pairwise comparisons are based on a perfect ratio scale then the inconsistency index would equal 0. If the pairwise comparisons differed from a perfect ratio scale by no more than a least perceptible difference (i.e. 1 point) then the index would be less than .1. If the pairwise comparisons were pure random numbers uniformly distributed between 1 and 10, then the inconsistency index would usually lie between 1.4 and 1.8.

The Consistency Index is defined (for the case of a scale of 1 to 10) as $CI = 1-(II/1.8)$. It equals 1 for a perfect ratio scale, and is nearly always less than .1 for random preferences.

Appendix 3.5: Dispersion Measures Across Preferences

Goal	Standard Deviation	Coefficient of Variation
A. Job creation	0.0808	0.5165
B. Monetary standard of living	0.0682	0.4194
C. Non-monetary quality of life	0.0158	0.2693
D. Benefitting ordinary people	0.0462	0.4146
E. Benefitting disadvantaged people	0.0463	0.5616
F. Benefitting rural areas	0.0317	0.4646
G. Making physical investments	0.0279	0.5263
H. Human capital	0.0662	0.4578
I. Technological innovation	0.0319	0.3923
J. Entrepreneurial spirit	0.0544	0.7595
K. Technology Hardware	0.0241	2.4944
SUM	0.4935	
MEAN(11 goals)	0.0449	0.6615
MEAN(10 goals)	0.0469	0.4782

The coefficients of variation are generally around 0.5. This means that any two respondents are likely to differ by about 50 percent on their Personal Weights for any one given goal.

Appendix 3.6: Average Weights and Ranks

Goal	Mean	Rank
A. Job creation	0.1564	2
B. Monetary standard of living	0.1626	1
C. Non-monetary quality of life	0.0587	9
D. Benefitting ordinary people	0.1113	4
E. Benefitting disadvantaged people	0.0824	5
F. Benefitting rural areas	0.0683	8
G. Making physical investments	0.0529	10
H. Human capital	0.1446	3
I. Technological innovation	0.0814	6
J. Entrepreneurial spirit	0.0717	7
K. Technology Hardware	0.0097	11
SUM	1.0000	

4 | Design of the Anticipated ROPI Procedure

Outline of Section

This Section (and also the following Section) will serve, in part, as technical documentation. The non-technically oriented reader may prefer to read only the introductions to the sections.

In this section we:

1. Review some scholarly literature on Cost Benefit Analysis and Impact Analysis.

2. Distinguish Anticipated ROPI (a forecast) from Realized ROPI (a retrospective evaluation).

3. Explain that both ROPI measures are weighted averages of rates of return. The weights are the Economic Development Weights, and the rates of return correspond to each of the Economic Development Goals.

4. Propose a method for measuring these rates of return. The method uses impact multipliers derived from a Social Accounting Matrix (SAM); a migration model; and a definition of the counterfactual, or "compared to what."

Introduction

The Anticipated Return On Public Investment Procedure (or A-ROPI Procedure) is a system developed by IPPBR for performing a prospective Cost-Benefit Analysis of a new economic development project while it is still at the stage of proposal or early implementation.

Economic impact analysis is far from being an exact science. *No* system, including this one, can be expected to make highly accurate predictions about the future outcomes of an economic development project. However, this system *can* assist KTEC in following an orderly development process. Therefore, the purpose of this system is:

1. to help insure internal consistency between the projected development plans and the ultimate goals of economic development that are intended by policy makers; and

2. to help insure that any selection between *competing* projects and programs is determined by an internally consistent set of standards.

The system will encourage the making of development plans which include clearly specified projections or forecasts about future outcomes. Moreover, if a careful record or database is maintained of these forecasts while they are being made, then at a later time it will be possible to compare the forecasts with the actual outcomes of the development projects. These comparisons can then be used to make systemic improvements, not only in the particular forecasting procedure, but also in the economic development program as a whole.

Therefore the A-ROPI system should be clearly contrasted with the proposed R-ROPI or Realized ROPI Procedure. The R-ROPI Procedure would make retrospective comparisons between actual outcomes of the economic development program, and its intended goals. The proposed R-ROPI procedure is described in Section 8 below.

The Anticipated ROPI Procedure has the following features:

1. It is based on the philosophical idea that economic development, at least in general, has multiple objectives. This reflects the fact that economic development programs are supported by a broad political coalition of private actors with independent private motives. Consequently, the objectives of an economic development program cannot, in general, be reduced to any one single goal such as income or jobs.

2. Yet, at the same time, it accepts the most general feature of the policy analysis approach known as Cost Benefit Analysis; that is, the A-ROPI Procedure provides a single, or unified, quantitative valuative measure. This measure summarizes the net balance of costs and benefits from performing the project. Although the use of any single valuative measure is not justified in general, it can be approximately valid within a specific political context.

3. It expresses the unified evaluation measure as a Return on Public Investment, or ROPI. In other words it measures the future benefits (e.g. a future gain in jobs or income or human capital) as a rate of return on the present cost to the taxpayers (translated into a current loss of jobs or income or human capital).

4. It accepts the political idea of representative democracy; therefore the value-judgements of political representatives are incorporated directly into the unified measure of costs and benefits. This is accomplished through use of the Economic Development Weights and Goals which were developed in Sections 3 and 4 above.

5. It accepts the economic analysis approach known as Impact Analysis; that is, the projected outcomes from performing the project are to be compared, as rigorously as possible, with the outcomes of a hypothetical situation in which the project would not be performed.

6. And finally, it accepts the economic modeling approach known as the Social Accounting Matrix or SAM. This means that the indirect impacts of an economic activity are to be estimated by using very detailed data on dollar flows between different industries, different types of households, and different types of governmental and non-profit agencies inside the state.

This section describes the more general design features of the A-ROPI procedure. Section 5 (which follows) describes an initial or "Pilot" implementation of this system, one which has been developed in an accessible LOTUS spreadsheet format by IPPBR. Sections 6 and 7 describe the results of applications of the Pilot A-ROPI Procedure to two particular KTEC projects.

Literature Review

The Evaluation of Economic Development Programs

The evaluation of economic development programs has received much attention in recent scholarly literature, especially in newer journals such as *Evaluation Review*, *Economic Development Review*, and *Review of Urban and Regional Development Studies*. For a review of some of the earlier literature, see Ashcroft [1982]. Evaluations have been based on both formally economic approaches [e.g. Vanhove and Klassen, chapter 8] and non-economic approaches [e.g. *Community Development Journal*, 1991].

It is important to distinguish evaluations which are *ex ante* (prospective, or before the fact) from those which are *ex post* (retrospective, or after the fact). The majority of research has used a prospective impact approach, like the A-ROPI system. Retrospective approaches like R-ROPI are used less extensively, partly because, by their nature, they cannot be employed until after much time has passed. Folmer [1986] provided a general retrospective framework for using econometric regional panel data to measure the size of policy effects. His two case studies showed very little effect from the regional policies he studied in the Netherlands.

Evaluation of technology transfer programs such as KTEC constitute an important special case [e.g. Rees, 1991; Rees and Lewington, 1990; Feller, 1988; Meyer-Krahmer, 1984]. There is strong evidence that public university *basic* research is highly socially productive [Mansfield, 1991]. However, no definitive evaluations of university *applied* research and technology transfer attempts were discovered in our review of literature.

Cost-Benefit Analysis

The cost-benefit analysis framework is the most widely-accepted, formal economic evaluation procedure. It has been described in numerous textbooks; [e.g. Schofiel, 1987]. Cost-Benefit Analysis has often been used in prospective evaluation. However, there are several important and unsettled controversies in the foundations of Cost Benefit Analysis, as discussed below.

The Criterion of Efficiency In general, there is no agreed-on way to set a unified efficiency criterion or "social welfare function" in the sense of Samuelson [1965;1947] for performing a cost benefit analysis. In other words, before we can measure how well a government project is accomplishing its goals, we first have to settle on a unified and quantitative measure that boils down all governmental goals into a single number. The choice of a criterion of efficiency is inherently controversial.

The efficiency criterion generally used in practice is to measure the effect of the project on net "social surplus." This measure is roughly the same as total real income or GNP (plus corrections for the dollar value of intangibles). This has been described as the "dollar is a dollar" approach, because it assumes that a dollar of real income received by a rich person is just as socially valuable as a dollar received by a poor person. The social surplus approach has been strongly criticized by most recent Cost-Benefit theorists [e.g. Wildasin, 1988; Drèze and Stern, 1987] as a relatively pro-rich approach, one not consistent with usual government policy choices which are concerned with distributional questions. However, no widely accepted alternative has emerged.

In contrast, our approach assumes that the efficiency criterion should be based on policy goals actually adopted by policy-makers; more of this will be discussed below.

<u>The Choice of a Social Discount Rate</u> Another controversy is concerned with the choice of a social discount rate. In other words, we need to decide how government should compare costs expected to be incurred at a future time, with costs being incurred in the present.

Those who favor the social surplus approach generally argue for using private market real interest rates; e.g. Arrow [1982]. Those who are more concerned about distributional questions generally argue that the discount rate should be determined on political or ethical grounds; e.g. Sen [1982]. For a discussion of the implications of selecting the discount using direct democracy, see Glazer [1989]. Again, no generally accepted consensus has emerged. For additional discussion, see other essays in Lind [1982] and *Journal of Environmental Economics and Management* (1990). Even though we are sympathetic to the Sen argument, the approach we adopt below is based on bond rates and hence is most similar to that of Arrow.

<u>The Use of the AHP in Cost-Benefit Analysis</u> The Saaty Analytic Hierarchy Process is a moderately well-established non-economic approach. It has been fairly widely used in goal-setting and planning; for citations, see Section 2 above. It has also been used directly in evaluation [e.g. *Socio-Economic Planning Sciences*, 1991].

However, it has apparently not been applied rigorously *inside* a formal Cost-Benefit context; that is, it has not been used to provide a social welfare function or other criterion of efficiency. Rather, traditional Cost-Benefit Analysis, which makes use of a social surplus concept, has been treated as one input into a wider analysis. Therefore, the approach has been supra-economic.

What is new in our approach is the use of the AHP *inside* the Cost-Benefit Analysis, as a device for establishing the criterion of economic efficiency preferred by policy-makers.

<u>The Question of "Standing": Who Counts?</u> Another controversy is concerned with the question of what individuals should have their personal costs and benefits counted in the analysis. In particular, one extreme view holds that only citizens who voted for the incumbent government party should be counted in a cost benefit analysis performed by that government. At the other extreme there is a view that all human beings, everywhere, present and future, should be counted. This question has recently been referred to as the "standing controversy" [e.g Zerbe, 1991].

The design philosophy of the Kansas ROPI Procedure implies that "standing" should in general be determined by political decision makers, not by the economic modelers. However, at this stage in the development of the pilot ROPI procedure, the question seemed relatively secondary. As an interim measure, we have adopted what is at least a defensible view among cost-benefit theorists--all presently existing Kansans do count, but in-migrants don't count. (In-migrants do appear in the SAM model of Kansas, however, and their presence does have an affect on the well-being of presently existing Kansans.)

Input-Output and SAM Modeling

Input-output modeling is a well established methodology for prospective impact analysis. Use of SAM models in impact studies is a relatively new extension. Survey models are considered more accurate, but constructing a survey model is usually prohibitively expensive. Non-survey models

are more widely used; that is what we will employ. See Burress [1989] for a discussion of the reliability of multipliers derived from non-survey models.

SAM is short for Social Accounting Matrix. This is a type of data set showing the dollar flows in a given year between different Sectors (i.e. types of businesses, households and government units) in a particular economy. A SAM is a generalization of a type of data set known as an "Input-Output Transactions Matrix."

General Theoretical Framework of the Return on Public Investment (ROPI) Model

Economic Development Goals

"Economic Development Goals" refers to a list of the main objectives which are assumed likely to motivate Kansas economic development activities. See Section 3 for a description of the Goals accepted for use in the Pilot ROPI Project.

These Goals should be contrasted with KTEC Goals, which are related to KTEC's specific economic development strategy (i.e. technology transfer). They should also be contrasted with Project Selection Criteria, which refers to the basis used by KTEC for selection of particular economic development projects. The Project Selection Criteria may include not only indicators related to the Economic Development Goals and KTEC goals, but also factors such as the organizational capabilities and past performance of the project's proposer.

Economic Development Weights

"Economic Development Weights" refers to a set of numbers measuring the relative importance that Kansas policy-makers place on each of the Economic Development Goals. The individual weights corresponding to each GOAL are positive (or zero); they sum to 1.

The political legitimacy both of these Weights and of the underlying list of Goals is potentially controversial. The most satisfactory resolution of this controversy would be by means of formal adoption of both Goals and Weights through a representative political process. The origin of the Goals and Weights used in the Pilot ROPI project differ to some extent from that perfect ideal; see Sections 2 and 3 above.

Costs and Benefits

In very general terms, an economic development project is justified if and only if all its costs exceed all its benefits. This statement implies that a well-defined and quantitative efficiency criterion (or social welfare function) has already been accepted and quantified; then "cost" refers to any reduction in the criterion; and "benefit" refers to any increase in the criterion. In our case, "cost" refers to anything which impedes the achievement of the Economic Development Goals; and "benefit" refers to anything which supports it.

Aggregation of ROPI

ROPI can be defined at many different organizational levels, ranging from the bottom to the top. At the bottom level, KTEC may want to forecast the ROPI of one particular small project, as part of its funding decision. At the middle level, KTEC may want to evaluate the ROPI of an entire program; this might be accomplished by summing up all the small projects, or else by means of taking a sample of small projects, or else by making use of data already aggregated to the program level. Finally, at the top level, the legislature may want to evaluate the ROPI of KTEC as a whole; once again, this can be accomplished by adding up data in some fashion from a lower level of analysis.

Some Types of ROPI

Anticipated ROPI refers to the Return on Public Investment for a project, a program, or an agency, as reflected in a forecast or prospective estimate of projected outcomes. This is contrasted with the Realized ROPI, the Return On Public Investment when measured using retrospective information on actual results or outcomes. A-ROPI is short for Anticipated ROPI, the expectation or *ex ante* measure. R-ROPI is short for Realized ROPI, the retrospective or *ex post* measure.

Since there are many different economic development goals, there are correspondingly many rates of return. The ROPI Vector refers to a *set* of rates of return, one with respect to each of the Economic Development Goals accepted in Kansas. Each rate of return is measured as the benefit/cost ratio, less 1. Both benefits and costs are discounted to the present using a discount rate based on the opportunity costs available to Kansas State Government.

The ROPI Scalar (or simply A-ROPI) refers to a unified, weighted average over the ROPI vector, using Economic Development Weights determined by the Weight Evaluation Procedure. A-ROPI (scalar) is the unified measure of benefits as a rate of return on costs of the economic development project; that is, it is the main and most important output of the A-ROPI Procedure.

Economic Development Proxies

The Goals are merely qualitative statements about what is desired by policy-makers. To perform a Cost Benefit Analysis, it is necessary to accept quantitative indicators of success for each goal. Economic Development Proxies refers to a set of measurable variables for the state of Kansas, which are accepted as reasonable indicators of the degree of success in accomplishing the Economic Development Goals. Each Proxy should be an extensive (aggregate or total) measure, usually a total of dollars or a total of jobs of a certain type. Other possibilities include: total wealth, total high tech jobs, total new high tech business projects, total jobs weighted by wages, etc. A list of proposed Proxies corresponding to each of the Economic Development Goals is provided in Appendix 4.2.

Benefit-cost ratios

ROPI is expressed in terms of a project-specific weighted benefit-cost ratio, less 1. It is a generalization of the concept of a benefit-cost ratio. The generalization consists in allowing for multiple goals of development, rather than emphasizing the single goal of income.

Benefit-cost ratios in terms of income have often been used to report the results of a Cost Benefit Analysis [e.g. Mansfield, 1991. For a discussion of the economic return on US Federal R&D funding, see *Congressional Budget Office*, 1991, pp. 89-100.] The benefit-cost ratio is higher than 1, to the extent that the benefits of the project are higher than the costs, taking into account the time it takes to receive the benefits or pay the costs.

For a quantitative definition of ROPI, consider one particular KTEC project, and one particular Goal and its Proxy, say $X(t)$. (The procedure for a whole program or for KTEC's aggregate impact is completely parallel.) Let $CX(t)$ be the flow of costs from the project and $BX(t)$ be the flow of benefits from the project. Then CX is conceptualized as the loss of $X(t)$ which results directly and indirectly from taxing the Kansas economy to raise enough dollars to fund the project. BX is conceptualized as the increase in $X(t)$ which results directly and indirectly from doing the project.

Then ROPI or R for that Goal is defined as the benefit-cost ratio (less 1) for BX on an investment of CX. In other words:

$$R = PV[BX(t);S]/PV[CX(t);S] - 1.$$

where $PV[.;.]$ is the present value function and S is the social discount rate.
Note that this formula may be somewhat sensitive to the chosen discount rate. As noted above, we used a real bond rate as the social discount rate in the study. In future work we propose to elicit S from the representative panel, similarly to the economic development weights.

Compared to What? The Counterfactual

ROPI'srate of return does not measure ordinary investment returns in terms of dollars; instead it measures public investment returns in terms of economic development Proxies. Consequently there is a problem of interpretation: how can we say whether a given rate of return is good or bad? Also, there is a problem of aggregation: what sense can we make of a weighted ROPI which averages results across different economic development goals?

We propose to handle these problems by introducing a standard of comparison, R_o, which should measure some kind of opportunity cost of having the KTEC project. In other words, R_o conceptually measures the return Kansas would have received on the best alternative project Kansas gave up in order to do the project. As long as R is greater than R_o, then the KTEC investment makes sense (at least in terms of the economic development proxy X). And, as $(R-R_o)$ gets larger, the case in favor of the project gets better. Therefore, ROPI will be reported as $(R-R_o)$ rather than R. Also, weighted ROPI across different economic development proxies should be calculated in terms of $(R-R_o)$ rather than in terms of R.

Conceptually, R_o should be the highest return on any project among all available alternatives to the project. However, as a simplification, we will consider only one standard alternative.

In the standard alternative (sometimes referred to as the counterfactual), Kansas would tax the same number of dollars as were needed for the project (leading to same cost CX(t)), but instead of spending the dollars on the project, Kansas would conceptually invest them in a console (perpetual bond) at the same real rate of interest that the Kansas state government pays on the investment bonds it issues. Proceeds of the console would then be handed out as a lump sum transfer to typical Kansas taxpayers, leading indirectly to an increase in X in the amount of BX*(t). Next, R_o is defined by the cost-benefit ratio, less 1, for the standard alternative:

$R_o = PV[BX*(t);S]/PV[CX(t);S] -1.$

Multipliers and Direct and Indirect Effects

To measure total costs and benefits of a project, it is necessary to account for economic multiplier effects. Economic multipliers are used to translate a known *direct effect* into an estimated *total impact* equal to the direct effect plus an *indirect effect*. For example, 100 jobs in a new manufacturing plant (the direct effect) might lead indirectly to 60 more jobs in the local service sector (the indirect effect). In this case, the total impact would be 160 jobs, and the job-job multiplier would be 1.6.

The indirect effects may result from several different kinds of linkages. Some examples would be new sales to the manufacturing plant, sales to the new workers, additional sales to the sellers, and even expanded sales to an expanded government made necessary by the expanded economy. The indirect effects also may include investment and the migration of workers. In the Pilot A-ROPI design, all of these effects are calculated using a SAM model of Kansas.

Project-Specific Data (Scoring)

The direct effects of the project must be estimated by KTEC personnel from financial data taken from the project proposal. This process is referred to as "Scoring."

Forecasts of Commercial Success Probabilities

An especially critical item of scoring has to do with the relative probability that the project will eventually meet or exceed the projected level of success. Forecasting ROPI depends first on forecasting the market outcome for the project under development. This outcome must be forecasted two different ways: first assuming that there is no KTEC intervention, and second assuming that KTEC intervention is forthcoming. The difference in outcomes is the anticipated effect due to KTEC's intervention. It is important to realize that differential forecasts of this type need to be routinely performed for each project proposal; otherwise KTEC cannot make a rational decision on funding or not funding the project.

Making these forecasts is *not* part of the A-ROPI system. Rather, it is an input which KTEC must provide. We assume that KTEC is presently making these types of forecasts in a relatively informal manner, and will continue informally in the near future. However, we believe that the A-ROPI system will encourage KTEC to keep a careful data base on the forecasts while they are being made over time. This data can eventually be used to evaluate the accuracy of these forecasts, and also to aid in improving the quality forecasts. In addition, KTEC may eventually want to adopt a formal forecasting methodology [for a discussion of potential accuracy of market forecasting systems, see Shelley and Wheeler, 1991.]

However, the A-ROPI system *does* impose careful internal consistency checks on these forecasts. For a technical description of these consistency checks, see Burress [1992d].

Since these forecasts are both critical to ROPI, and also somewhat subjective, it would be useful for KTEC to perform a sensitivity analysis on each A-ROPI forecast. For example, KTEC may want to run each ROPI forecast using three different estimates of the commercial success probabilities. The three estimates would correspond to a rather pessimistic view, a rather optimistic view, and a view which is considered most likely.

The Specific Design

The ROPI Procedures

The Anticipated ROPI Procedure consists of the manual, software, and activities for measuring Anticipated ROPI. It includes the Scoring Module and the Economic Impact Module (described below), and takes the Economic Development Goals and Weights as given. An initial version of this procedure which was developed during the Pilot ROPI Project is described in Section 5.

The Realized ROPI Procedure refers to a proposed procedure which will measure Realized ROPI; in other words, it will be a system for performing a retrospective Cost-Benefit Analysis of

an economic development initiative after it has been implemented. This system is planned for future development during a proposed Extended ROPI Project. This procedure will also take the Economic Development Weights as given, and will consist of an Outcome Measurement Module, which will gather available data on the directly measurable outcomes of a project, program, or agency; together with a Post-Impact Module, which will estimate any unmeasured indirect impacts.

The Extended ROPI Project is a proposed (1992-93) activity of designing and developing the Realized ROPI Procedure, and also a feed-back mechanism for improving the conceptual Economic Development Goals, the Weight Evaluation Procedure, and the Anticipated ROPI Procedure. See Section 8 for a more detailed description.

The Scoring Module

The Scoring Module refers to an activity using a manual to fill in tables so as to characterize direct economic effects expected from a given project. The results are known as Economic Development Scores. The Scores are a set of numbers reported for a particular project or program, which are intended as inputs for calculating its A-ROPI.

The Economic Impact Module

The Economic Impact Module is the procedure and software which forecasts the total (direct plus indirect) impacts of a project or program, based on given Scores for the direct effects. In this procedure, the Scores are first multiplied by various Multipliers and added up, yielding forecasts of the Proxies over time. Next, for each Proxy the program calculates a rate of return, yielding a set of ROPIs. Finally, the several ROPIs are averaged into one ROPI using the Weights.

The Economic Development Multipliers

The Economic Development Multipliers are a set of numbers used to translate Scores into forecasts of Proxies. The Multipliers consist of SAM Multipliers, plus Bridge Multipliers taken from other sources. The Bridge Multipliers are used to translate the rather specialized Scores into information corresponding to more general Sectors assumed by the SAM multipliers.

The Migration Model

Because of the assumption about "standing" (see above), costs and benefits received by future newcomers to Kansas are not supposed to be counted in the cost benefit analysis. This leads to a rather difficult modeling problem. The easier part of problem is the following: of new jobs created directly by the project, what fraction will be filled by existing Kansans, and what fraction by newcomers? This question can be answered using available migration data by occupation. The harder part of the problem is this: if existing Kansans take some of the new jobs, then how many old jobs do they quit, and how many newcomers fill the old jobs? (And even if the old jobs are filled by other Kansans, *their* old jobs might be taken by newcomers; and so.) These questions must be handled by a migration model.

Summary of Economic Impact Assumptions and Limitations of the Model

Assumptions

Economic Impact Assumptions refers to the underlying mathematical-economic premises used in calculating the Economic Development Multipliers from a number of data sources. Most of these assumptions amount to proportionalities between inputs and outputs. In other words, things are expected to increase in the future in a manner which approximately maintains most ratios between inputs and outputs that were observed in the past.

Accuracy

In principle, impact modeling is among the most demanding forecasting exercise attempted by economists. It provides an extremely detailed look at relatively small economic changes, so that there is little opportunity for statistical averaging of results across many businesses or many events (the "law of large numbers" may not apply). Moreover, there is limited opportunity for controlled experimentation, and therefore it is hard to make improvements in the methods used in impact analysis.

In practice, impact modeling is likely to be significantly less accurate than macro-economic forecasting models, for example. Instead, it should be viewed as an information source which is reasonably internally consistent, which provides some kinds of reasonable comparisons across projects, which can assist but cannot substitute for good judgement and common sense.
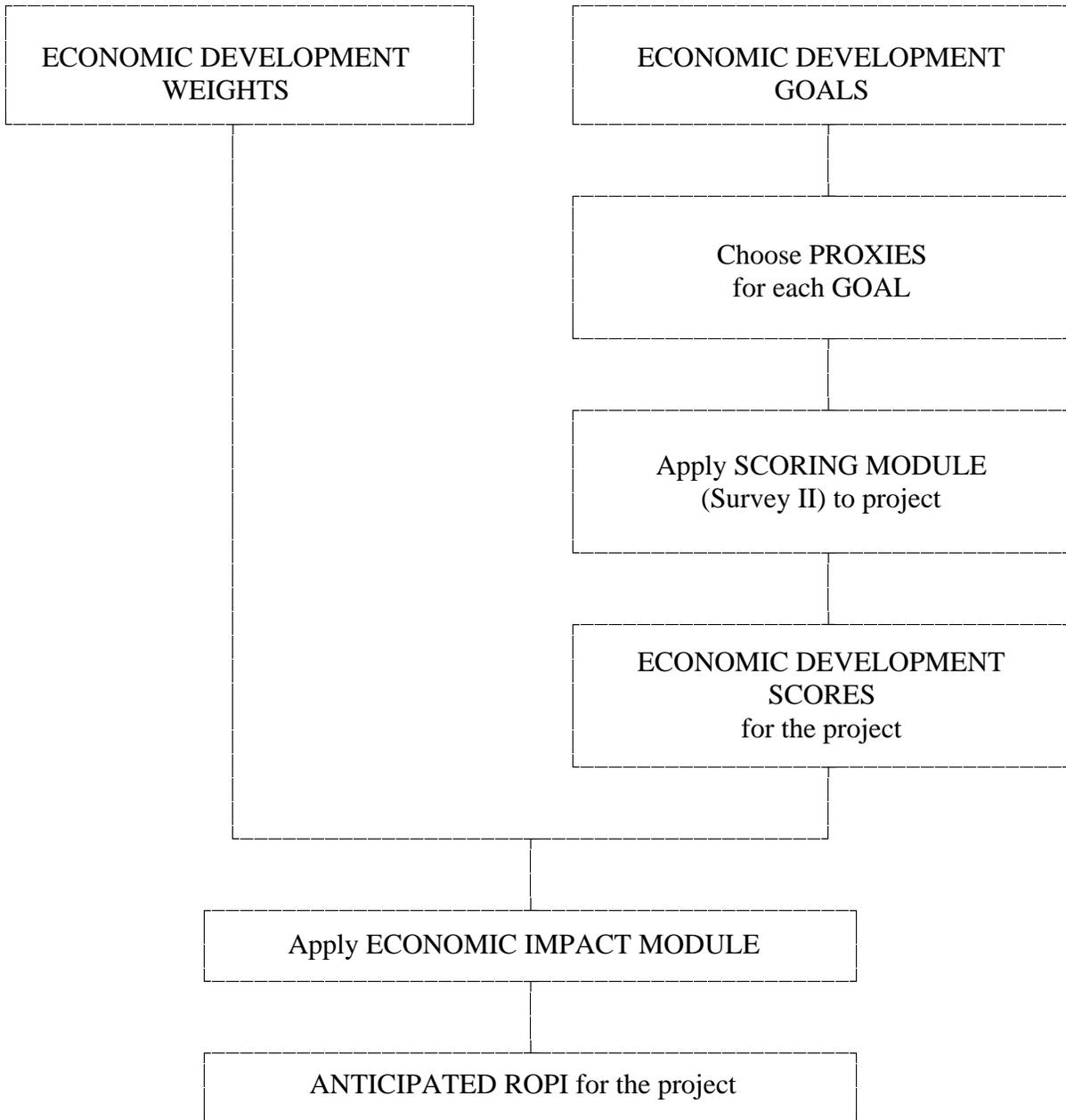
A4 | **Appendixes**

Appendix 4.1: Overview of Anticipated ROPI Procedure
Appendix 4.2: Suggested Proxies for Economic Development Goals

Appendix 4.1: Overview of Anticipated ROPI Procedure

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┌─────────────────────────┐          ┌─────────────────────────┐
│  ECONOMIC DEVELOPMENT   │          │  ECONOMIC DEVELOPMENT   │
│        WEIGHTS          │          │         GOALS           │
└─────────────────────────┘          └─────────────────────────┘
            │                                    │
            │                        ┌─────────────────────────┐
            │                        │    Choose PROXIES       │
            │                        │     for each GOAL        │
            │                        └─────────────────────────┘
            │                                    │
            │                        ┌─────────────────────────┐
            │                        │  Apply SCORING MODULE   │
            │                        │   (Survey II) to project │
            │                        └─────────────────────────┘
            │                                    │
            │                        ┌─────────────────────────┐
            │                        │  ECONOMIC DEVELOPMENT   │
            │                        │         SCORES          │
            │                        │     for the project     │
            │                        └─────────────────────────┘
            │                                    │
            └──────────────┬─────────────────────┘
                           │
         ┌────────────────────────────────────────┐
         │     Apply ECONOMIC IMPACT MODULE        │
         └────────────────────────────────────────┘
                           │
         ┌────────────────────────────────────────┐
         │    ANTICIPATED ROPI for the project     │
         └────────────────────────────────────────┘
```

Appendix 4.2: Suggested Proxies for Economic Development Goals

Each Proxy variable is an aggregate or total of some measurable state-wide quantity. Each Proxy is understood to include the direct effects, as well as the indirect (or multiplier) effects, of the economic development program on jobs, income, assets, and/or standard of living of current residents within the state of Kansas; less the direct and indirect effects of any tax revenues needed to pay for the program, and also less any negative effects due to crowding out of other Kansas capital investments.

A. Job creation:

> Number of new Full Time Equivalent (FTE) jobs created or preserved, less new jobs filled by in-migrants, less old jobs destroyed.

B. Increasing total money income and wealth:

> Amount of new income received or old income preserved in Kansas, less income received by in-migrants, less old income lost.

C. Maintaining or increasing the non-monetary quality of life:

> Develop Kansas survey data on citizen's willingness-to-pay for amenities and for avoiding pollution and congestion.

D. Benefitting ordinary people:

> Amount of new wages and salaries received, or old income preserved, less taxes paid, by middle income working people in Kansas. (Alternatively, number of new middle income jobs.)

E. Benefitting disadvantaged people:

> Amount of new wages, salaries and transfers received, or old income preserved, less taxes paid, by persons below the poverty level in Kansas. (Alternatively, number of new full time low skill jobs.)

F. Benefitting rural areas:

> Amount of new wages and salaries received, or old income preserved, less taxes paid, by rural working people in Kansas. (Alternatively, number of new rural jobs.)

G. Making physical investments:

> Amount of new business plus government investment, exclusive of housing investment.

H. Making investments in human capital:

> Number of new jobs filled by Kansans, or old jobs preserved, weighted by the wage level of the jobs.

I. Encouraging a spirit of technological innovation:

Number of new jobs created or old jobs preserved which are held by persons engaged in applied research and development of new products or processes in manufacturing or in high technology applications. (Alternatively, jobs of this type, weighted by the wage level of the jobs.)

J. Encouraging an entrepreneurial spirit:

Additions to the number of FTE entrepreneurs engaged in business initiatives leading to export-expansion or import-substitution, or leading to making improved technology applications directly available to businesses in Kansas.

5 | Pilot Implementation of the Anticipated ROPI Procedure[1]

Outline of Section

This Section like the previous section serves, in part, as technical documentation. The non-technically oriented reader may prefer to read only the Introduction.

In this section we:

1. Describe the computer programs (for the Scoring Module and the Economic Impact Module) which make the Pilot A-ROPI procedure directly usable by KTEC personnel.

2. Describe the survey form for gathering data on a particular project, so that its A-ROPI can be measured. This form is implemented in the Pilot Scoring Module.

3. Describe a Social Accounting Matrix for the State of Kansas for the year 1987, known as KSSAMv1. This dataset was used to create economic impact multipliers for the Pilot Impact Module.

4. Describe other data sources used in the Pilot Impact Module.

5. Describe some of the limitations of the Pilot Implementation.

Introduction

This section describes an initial implementation of the Anticipated ROPI Procedure that was developed during the Pilot ROPI Project. In this implementation, Proxies were modeled for only two of the most important Economic Development Goals. In particular, we modeled Jobs and Income. The two goals were assigned equal Economic Development Weights (see Section 4 for a discussion). However, the addition of other Goals to this procedure would be a straight-forward extension.

Both the Scoring Module and the Impact Module are expressed in the form of LOTUS 123 Spreadsheets. Appendix 5.1 contains a summary of features of these programs. The spreadsheet form is especially convenient, because it allows one to combine most of the features of a survey

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[1]Some of the material in this section is based on IPPBR Economic Research Technical Notes which are cited in the bibliography.

form, a procedural manual, an error-checking routine, and a report generator into a single entity. Appendix 5.10 explains how these programs can be run on an IBM-compatible PC.

Economic Development Multipliers used in the Impact Module were taken from a non-survey Social Accounting Matrix for Kansas, known as KSSAMv1. This data set was developed especially for the Pilot ROPI Project. To create it, over 10,000 data items were collected, collated, and analyzed from some 30 data sources. All data items were either based on, or adjusted to, the calendar year 1987 (the most recent year for which Kansas data sources are reasonably complete). The final results were then readjusted to forecasted price levels for 1992.

KSSAM Framework

The SAM framework used in constructing the KSSAMv1 matrix is partially summarized in Appendix 5.2. The main features are that capital expenditures are clearly distinguished from operating expenditures in each sector; and that businesses, households, and government units can be separately disaggregated.

The sector scheme used in KSSAMv1 is described in Appendix 5.3. There are 48 business sectors, 1 household sector, and 3 government sectors.

The steps followed in creating this SAM matrix are summarized in Appendix 5.4. All data citations are contained in Appendix 5.9.

KSSAMv1 Multipliers

As in any impact model, a number of simplifications were assumed in the construction of these multipliers. However, we hope to improve on some or all of these limitations in future work, as discussed in Section 8. Some of the simplifications in the model include:

1. We ignore inventory changes.
2. We treat investment as a proportional input to production.
3. We ignore endogenous federal operations in Kansas.
4. We ignore endogenous federal transfers.
5. We ignore purely financial flows.
6. We assume zero inputs to business investment from Kansas households and government.
7. We ignore short-run effects due to existing capacity constraints in Kansas.
8. We have not tried to analyze the sensitivity of these results to assumptions about endogenous changes in Kansas price levels.

However, our approach does endogenize both state and local government and the local distribution of income, consumption, and investment.

The multiplier formula we used is derived in Appendix 5.5, and the numerical multiplier results are reproduced in Appendix 5.6.

Firm Level Survey

The Scoring Module (i.e. the spreadsheet program SCOREMOD 1.0) computerizes a survey form which was initially tested in a manual form. The purpose of the survey is to gather data describing one particular economic development project, at the level of a single firm. A revised version of this survey form is reproduced in Appendix 5.7.

Bridge Multipliers

A number of assumptions as well as data items were needed to bridge the gap between specific data available at the project level, and KSSAM multipliers defined at the economy-wide level. Some of these data and assumptions are explained in Appendix 5.8. Data citations are again contained in Appendix 5.9.

Conclusion

This represents only the first version of the A-ROPI Procedure. To the extent possible, the software has been designed in a top-down and modular fashion, so that parts of the software can be replaced with a minimum impact on other parts. We anticipate that the software will change and improve over time, as we gain experience in its use.

A5 Appendixes

Appendix 5.1: The Spreadsheets and Other Programs
Appendix 5.2: The KSSAMv1 Framework
Appendix 5.3: KSSAMv1 Sector Definitions
Appendix 5.4: SAM Data Explanation
Appendix 5.5: The KSSAMv1 Multiplier Formula
Appendix 5.6: The KSSAMv1 Multiplier Matrix
Appendix 5.7: Firm-Level Survey Form
Appendix 5.8: Bridge Data Explanation
Appendix 5.9: Data Citations
Appendix 5.10: Instructions for Running the Impact Software

Appendix 5.1:   The Spreadsheets and Other Programs

Two spreadsheet programs are available for delivery to the ultimate user. These are:

Program Name	Current Version	Programming Language	Inputs	Action	Outputs
SCOREMOD	1.0	LOTUS 123v2.3	Keyboard	1. Error-checking 2. Data collection	1. Printed report 2. Dataset SCORES
IMPACTMOD	1.0	LOTUS 123v2.3	SCORES	Calculate A-ROPI	Printed report

In addition, several one-shot programs were developed for the internal use of the IPPBR staff. These programs were used to create the KSSAMv1 multiplier data and Bridge multiplier data contained in IMPACTMOD1.0.

Appendix 5.2: The KSSAMv1 Framework[2]

A portion of the KSSAMv1 table was extracted and made to look like the following:

Kansas:	|dim.	Consumption			Investment			"Final"	Total
		b	h	g	b	h	g	1	1
firms	|b	**KSBC**	**KSHC**	**KSGC**	**KSBI**	**KSHI**	**KSGI**	| **FB**	| **X**
households	|h	**KSBV**	**KSHV**	**KSTR**	**0**	**0**	**0**	| **FH**	| **Y**
government	|g	**KSBT**	**KSHT**	**IGTR**	**0**	**0**	**0**	| **FG**	| **G**
		———	———	———	———	———	———	———	———
"imports"	|1	**MB**	**MH**	**MG**	**0**	**0**	**0**	| **0**	| **MT**
		———	———	———	———	———	———	———	———
total	|1	**X'**	**Y'**	**G'**	**KSBI**	**KSHI**	**KSGI**	| **FT**	| **T**

where the accounting identities are simply the row and column sums:

(1) **KSBC.l +KSHC.l +KSGC.l +KSBI.l +KSHI.l +KSGI.l +FB = X**

(2) **KSBV.l +KSHV.l +KSTR.l +FH = Y**

(3) **KSBT.l +KSHT.l +IGTR.l +FG = G**

(4) **MB.l +MH.l +MG.l = MT**

(5) **X'l +Y'l +G'l +KSBI.l +KSHI.l +KSGI.l +FT = T**

(6) **l'KSBC +l'KSBV +l'KSBT +MB = X'**

(7) **l'KSHC +l'KSHV +l'KSHT +MH = Y'**

(8) **l'KSGC +l'KSTR +l'IGTR +MG = G'**

(9) **l'FB +l'FH +l'FG = FT**

(10) **l'X +l'Y +l'G +MT = T**

and where **l** is a column vector of 1's of conforming dimension, and "**.**" represents matrix multiplication.

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[2]This Appendix is based on Burress [1992c].

In the above, the following matrices are Kansas regional demands for regional goods, assumed endogenous:

KSBC: Kansas Business Consumption (used as intermediate goods)
KSHC: Kansas Household Consumption
KSGC: Kansas Government Consumption
KSBV: Business Value Added
KSHV: Household Value Added
KSTR: Kansas Government payments and Transfers to Households
KSBT: Business State and local Taxes
KSHT: Household State and local Taxes
IGTR: Kansas Inter-Government Transfers
KSBI: Business Investment
KSHI: Household Investment
KSGI: Kansas Government Investment

The following column vectors are Kansas total cash flows, assumed endogenous:

X: Kansas output
Y: Kansas household gross income
G: Kansas government operating expenditures

The following vectors are aggregates to be taken as exogenous final demands:

FB: total of all other business sales and inventory changes
FH: total of all other household income sources and net borrowing
FG: total of all other government net cash sources

The following row vectors represent endogenous aggregates of imports and other requirements:

MB: total of all other business imports and requirements
MH: total of all other household imports and requirements
MG: total of all other government imports and requirement

The following scalars represent various totals, both endogenous and exogenous:

MT: total of all imports and other requirements
FT: total of all final demands
T: total of all measured transactions.

Appendix 5.3:   KSSAMv1 Sector Definitions[3]

This Appendix specifies the sector definitions for the KSSMv1 Social Accounting matrix. The sector scheme includes 48 production sectors, 1 household sector, and 3 Kansas state and local government sectors. This sector scheme will be referred to as **AGGR52**.

#	Sector Definition	Included SIC Codes
1	Livestock	021, 024, 025 except 0254; 027, 029
2	Crops	01
3	Forestry, Commercial Fisheries	08
4	Agricultural Services	0254, 07 except 074; 085, 09
5	Metal and Nonferrous Mineral Mining	10
6	Coal Mining	1111, 1211
7	Oil and Gas Extraction	131,132
8	Stone, Clay, and Gravel	141, 142, 144, 145, 149
9	Construction	15-17 except 153; 1112, 1213, 138, 148
10	Food Processing	20
11	Tobacco Processing	21
12	Fabrics and Apparel	22, 23
13	Lumber and Wood	24 except 2451
14	Furniture and Fixtures	25
15	Paper Products	26
16	Printing and Publishing	27
17	Chemicals	147, 281, 286,287, 289
18	Plastic Materials and Synthetics	282
19	Drugs and Preparations	283, 284
20	Paints	285
21	Petroleum Refining	29
22	Rubber, Rubber Prod., Plastic Prod.	30
23	Leather and Leather Products	31
24	Glass, Stone, and Clay Products	32
25	Iron, Steel, and Other Metal Prod.	33, 3463
26	Metal Prod., Ordnance, Struct. Met	34 except 3463; 3761, 3795
27	Engines and Machinery	35 except 357
28	Computers, Computing Equipment	357
29	Electrical Equipment and Appliances	36 except 367; 3825
30	Electronic Components and Parts	367
31	Motor Vehicles and Equipment	371 except 3716
32	Aircraft and Parts	372, 376 except 3761
33	Other Transportation Equipment	2451, 3716, 373, 374, 375, 379 exc. 3795
34	Scientific and Photographic Equip.	38 except 3825

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[3]This Appendix is based in part on Burress, Oslund, and Thissen [1988].

35	Misc. Manufacturing	39
36	Transportation and Warehousing	40-42, 44-47
37	Communications Except Radio and T.V.	48 except 483
38	Business Services, Radio and T.V.	483, 73 except 7396; 8100, 89 exc. 8920
39	Electric Services, Utilities	49 except 491
40	Wholesale and Retail Trade	50-57, 59, 7396, 8042
41	Finance and Insurance	60-64 except 613; 67 except 6732
42	Real Estate and Rental	153, 65, 66
43	Hotels, Personal Services	70, 72, 76
44	Eating and Drinking Places	58
45	Automobile Repair and Services	75
46	Amusements	78, 79
47	Private Health, Ed., and Soc. Serv.	074, 6732, 80 exc. 8042; 82, 84, 86, 892
48	Federal Government Enterprises	43, 613
49	Household	N/A
50	State government except education	N/A
51	Local government except education	N/A
52	Public education	N/A

Appendix 5.4: SAM Data Explanation[4]

The **A** matrix shows rates of flow of goods to Kansas sectors from national sectors. It was first inferred for eighty-six sectors using the 1986 BEA Make and Use Tables for the nation under commodity-based technology assumptions (i.e. $\mathbf{A=UV^{-1}}$). For consistency with theory, negative coefficients were eliminated as follows. Large negative coefficients in two sectors were removed by pre-aggregating communications with business services. A few very small negative coefficients in other sectors were simply set to zero. Then the **A** matrix was aggregated to forty-eight sectors. The aggregation was weighted using County Business Pattern data on Kansas 1987 output, so as to alter the 1986 national flows to reflect the structure of the 1987 Kansas economy.

The **B** matrix describes how economic activity affects investment in capital equipment. Investment coefficients were inferred for eighty-six sectors from the 1976 BEA capital flows table. Then they updated to 1986 using national data on investment by sector, together with other data on investment by commodity. The capital coefficients were then aggregated to forty-eight sectors, prorating on 1987 Kansas outputs.

Import coefficients **m** were estimated using 1986 location quotients data, based on County Business Patterns data, and using a desuppression routine to infer missing values. For inferring regional income coefficients ϕ, a matrix of Kansas property ownership was estimated by knowledgeable economists. Labor income was assumed received by Kansans.

For inferring consumption coefficients β, the 1986 BEA Use Tables were used for household demands; Census of government data were used to infer government demands in Kansas.

Kansas and U.S. annual output and household and government expenditure figures were pieced together from the BEA and several other sources.

Finally, the various coefficients were used to infer the KSSAM table from the values of Kansas outputs and expenditures.

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[4]For a more complete explanation of the construction of KSSAMv1, see Burress, Chou, McKinney, and Oslund [1992]; Chou [1992b]; and additional citations in subsequent appendices.

Appendix 5.5:   The KSSAMv1 Multiplier Formula[5]

This appendix describes the multipliers derived from the KSSAMv1 data set.

$$
(11) \quad U_1 = \begin{vmatrix} KSBC & KSHC & KSGC \\ KSBV & KSHV & KSTR \\ KSBT & KSHT & IGTR \end{vmatrix} \quad : \text{consumption uses}
$$

$$
(12) \quad U_2 = \begin{vmatrix} KSBI & KSHI & KSGI \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{vmatrix} \quad : \text{investment uses}
$$

$$
(13) \quad X^* = \begin{vmatrix} X \\ Y \\ G \end{vmatrix} \quad : \text{generalized state product}
$$

(14) $R^* = \hat{U}_1 X^{*-1}$: generalized domestic consumption requirements matrix, assumed to be a parametric constant.

(15) $B^* = \hat{U}_2 X^{*-1}$: generalized domestic investment requirements matrix, assumed to be a parametric constant.

$$
(16) \quad F^* = \begin{vmatrix} FB \\ FH \\ FG \end{vmatrix} \quad : \text{generalized final demands}
$$

From these equations plus equations (1-3) we can derive

(17) $R^*X^* + B^*X^* + F^* = X^*$.

Solving for X^* as a multiplier times final demand then yields

(18) $X^* = M^*F^*$, where the generalized multiplier is

(19) $M^* = [I - R^* - B^*]^{-1}$.

ENDFIELD
    [5]This Appendix is based on Burress [1992c].

Appendix 5.6:   The KSSAMv1 Multiplier Matrix

SECTORS	1	2	3	4	5	6	7	8	9	10	11	12	13
1	1.3191	0.0794	0.0179	0.0401	0.0000	0.0118	0.0093	0.0059	0.0156	0.3424	0.0000	0.0211	0.0098
2	0.4517	1.1130	0.0187	0.0652	0.0000	0.0106	0.0085	0.0054	0.0142	0.2189	0.0000	0.0234	0.0091
3	0.0033	0.0014	1.0333	0.0033	0.0000	0.0013	0.0011	0.0006	0.0018	0.0108	0.0000	0.0041	0.0870
4	0.0570	0.0464	0.1314	1.0134	0.0000	0.0027	0.0032	0.0016	0.0080	0.0211	0.0000	0.0031	0.0145
5	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
6	0.0000	0.0000	0.0000	0.0000	0.0000	1.0002	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
7	0.0554	0.0722	0.0318	0.0416	0.0000	0.0321	1.0522	0.0279	0.0332	0.0365	0.0000	0.0185	0.0213
8	0.0037	0.0068	0.0014	0.0018	0.0000	0.0011	0.0016	1.0238	0.0067	0.0027	0.0000	0.0008	0.0009
9	0.1707	0.1698	0.1539	0.1523	0.0000	0.1089	0.2475	0.0834	1.0949	0.1286	0.0000	0.0740	0.0813
10	0.2861	0.0483	0.0526	0.0669	0.0000	0.0394	0.0310	0.0196	0.0518	1.2518	0.0000	0.0357	0.0321
11	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000
12	0.0038	0.0038	0.0058	0.0059	0.0000	0.0038	0.0028	0.0017	0.0055	0.0035	0.0000	1.0788	0.0031
13	0.0001	0.0001	0.0001	0.0001	0.0000	0.0001	0.0001	0.0000	0.0003	0.0001	0.0000	0.0000	1.0017
14	0.0038	0.0035	0.0034	0.0049	0.0000	0.0032	0.0028	0.0020	0.0054	0.0036	0.0000	0.0028	0.0026
15	0.0164	0.0106	0.0068	0.0125	0.0000	0.0063	0.0050	0.0067	0.0095	0.0372	0.0000	0.0105	0.0068
16	0.0110	0.0096	0.0079	0.0124	0.0000	0.0084	0.0070	0.0060	0.0105	0.0154	0.0000	0.0076	0.0068
17	0.0715	0.1577	0.0390	0.0715	0.0000	0.0145	0.0080	0.0088	0.0092	0.0405	0.0000	0.0089	0.0207
18	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
19	0.0095	0.0057	0.0053	0.0086	0.0000	0.0057	0.0044	0.0029	0.0076	0.0098	0.0000	0.0062	0.0044
20	0.0006	0.0007	0.0007	0.0006	0.0000	0.0004	0.0008	0.0003	0.0030	0.0005	0.0000	0.0003	0.0018
21	0.0767	0.0985	0.0457	0.0560	0.0000	0.0434	0.0208	0.0332	0.0481	0.0477	0.0000	0.0233	0.0275
22	0.0004	0.0003	0.0001	0.0002	0.0000	0.0002	0.0001	0.0002	0.0002	0.0004	0.0000	0.0003	0.0002
23	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
24	0.0127	0.0120	0.0089	0.0102	0.0000	0.0107	0.0114	0.0048	0.0450	0.0200	0.0000	0.0057	0.0097
25	0.0010	0.0011	0.0009	0.0008	0.0000	0.0016	0.0014	0.0013	0.0018	0.0008	0.0000	0.0004	0.0005
26	0.0125	0.0099	0.0088	0.0080	0.0000	0.0107	0.0110	0.0084	0.0271	0.0201	0.0000	0.0037	0.0142
27	0.0676	0.0805	0.0365	0.0585	0.0000	0.1194	0.0487	0.0772	0.0263	0.0424	0.0000	0.0212	0.0241
28	0.0033	0.0030	0.0022	0.0032	0.0000	0.0022	0.0020	0.0018	0.0026	0.0029	0.0000	0.0019	0.0017
29	0.0002	0.0003	0.0002	0.0002	0.0000	0.0002	0.0002	0.0001	0.0004	0.0002	0.0000	0.0001	0.0001
30	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
31	0.0006	0.0004	0.0004	0.0006	0.0000	0.0003	0.0003	0.0004	0.0004	0.0004	0.0000	0.0003	0.0003
32	0.0032	0.0025	0.0040	0.0107	0.0000	0.0016	0.0014	0.0014	0.0021	0.0027	0.0000	0.0013	0.0018
33	0.0029	0.0030	0.0544	0.0038	0.0000	0.0029	0.0024	0.0014	0.0029	0.0029	0.0000	0.0019	0.0061
34	0.0050	0.0046	0.0045	0.0062	0.0000	0.0039	0.0040	0.0038	0.0058	0.0048	0.0000	0.0034	0.0030
35	0.0032	0.0030	0.0028	0.0046	0.0000	0.0031	0.0025	0.0020	0.0046	0.0030	0.0000	0.0060	0.0024
36	0.0709	0.0554	0.0375	0.0578	0.0000	0.0338	0.0211	0.0235	0.0458	0.0613	0.0000	0.0282	0.0370
37	0.0313	0.0294	0.0182	0.0275	0.0000	0.0195	0.0163	0.0124	0.0276	0.0261	0.0000	0.0221	0.0159
38	0.1162	0.1286	0.0804	0.1195	0.0000	0.0948	0.0803	0.0764	0.1503	0.1290	0.0000	0.0780	0.0650
39	0.1061	0.1303	0.0492	0.0854	0.0000	0.0757	0.0470	0.0990	0.0578	0.0909	0.0000	0.0561	0.0563
40	0.2276	0.2123	0.1660	0.2357	0.0000	0.1522	0.1046	0.0911	0.2021	0.2192	0.0000	0.1309	0.1367
41	0.1153	0.0986	0.0531	0.0897	0.0000	0.0605	0.0536	0.0448	0.0754	0.0764	0.0000	0.0451	0.0468
42	0.2408	0.3424	0.1020	0.2053	0.0000	0.1394	0.2568	0.0836	0.1391	0.1622	0.0000	0.0948	0.0848
43	0.0169	0.0150	0.0126	0.0198	0.0000	0.0128	0.0101	0.0110	0.0167	0.0161	0.0000	0.0119	0.0108
44	0.0333	0.0315	0.0348	0.0525	0.0000	0.0335	0.0314	0.0196	0.0419	0.0349	0.0000	0.0302	0.0280
45	0.0263	0.0229	0.0205	0.0345	0.0000	0.0224	0.0152	0.0144	0.0216	0.0218	0.0000	0.0142	0.0167
46	0.0032	0.0030	0.0035	0.0114	0.0000	0.0029	0.0023	0.0016	0.0040	0.0030	0.0000	0.0024	0.0023
47	0.0783	0.0596	0.0617	0.1019	0.0000	0.0702	0.0514	0.0322	0.0913	0.0666	0.0000	0.0578	0.0536
48	0.0095	0.0088	0.0076	0.0145	0.0000	0.0068	0.0055	0.0054	0.0086	0.0097	0.0000	0.0090	0.0059
49	0.5457	0.5099	0.5326	0.9012	0.0000	0.6180	0.4538	0.2724	0.8261	0.5517	0.0000	0.5092	0.4703
50	0.0593	0.0583	0.0559	0.0825	0.0000	0.0424	0.0479	0.0413	0.0553	0.0523	0.0000	0.0360	0.0347
51	0.0254	0.0260	0.0277	0.0342	0.0000	0.0227	0.0273	0.0242	0.0258	0.0235	0.0000	0.0176	0.0186
52	0.0236	0.0240	0.0246	0.0316	0.0000	0.0196	0.0247	0.0215	0.0226	0.0212	0.0000	0.0154	0.0160

SECTORS	14	15	16	17	18	19	20	21	22	23	24	25	26
1	0.0131	0.0116	0.0149	0.0113	0.0000	0.0136	0.0167	0.0096	0.0107	0.0202	0.0135	0.0127	0.0140
2	0.0117	0.0101	0.0137	0.0114	0.0000	0.0127	0.0146	0.0086	0.0096	0.0141	0.0122	0.0114	0.0125
3	0.0015	0.0015	0.0017	0.0017	0.0000	0.0016	0.0042	0.0011	0.0012	0.0010	0.0015	0.0014	0.0016
4	0.0024	0.0023	0.0027	0.0059	0.0000	0.0025	0.0038	0.0029	0.0021	0.0019	0.0028	0.0025	0.0026
5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
6	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
7	0.0200	0.0320	0.0233	0.0639	0.0000	0.0202	0.0405	0.6358	0.0266	0.0105	0.0331	0.0289	0.0220
8	0.0010	0.0036	0.0013	0.0056	0.0000	0.0015	0.0060	0.0044	0.0015	0.0005	0.0397	0.0026	0.0011
9	0.0919	0.1001	0.0985	0.1104	0.0000	0.0823	0.1168	0.2033	0.0850	0.0418	0.1242	0.1128	0.1091
10	0.0434	0.0390	0.0499	0.0375	0.0000	0.0459	0.0567	0.0315	0.0355	0.0722	0.0452	0.0423	0.0467
11	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
12	0.0140	0.0058	0.0043	0.0028	0.0000	0.0028	0.0037	0.0028	0.0079	0.0106	0.0044	0.0036	0.0040
13	0.0005	0.0003	0.0001	0.0000	0.0000	0.0000	0.0000	0.0001	0.0001	0.0000	0.0001	0.0001	0.0001
14	1.0070	0.0030	0.0041	0.0027	0.0000	0.0031	0.0039	0.0028	0.0028	0.0015	0.0037	0.0033	0.0042
15	0.0139	1.1498	0.1512	0.0140	0.0000	0.0219	0.0142	0.0080	0.0220	0.0129	0.0200	0.0068	0.0108
16	0.0097	0.0075	1.1127	0.0092	0.0000	0.0109	0.0148	0.0072	0.0076	0.0054	0.0100	0.0085	0.0108
17	0.0067	0.0299	0.0294	1.2179	0.0000	0.0448	0.1945	0.0068	0.0352	0.0200	0.0305	0.0110	0.0091
18	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000
19	0.0059	0.0060	0.0063	0.0069	0.0000	1.0443	0.0084	0.0080	0.0051	0.0060	0.0069	0.0060	0.0069
20	0.0028	0.0005	0.0005	0.0010	0.0000	0.0006	1.0037	0.0007	0.0005	0.0002	0.0010	0.0005	0.0019
21	0.0258	0.0404	0.0295	0.0410	0.0000	0.0256	0.0403	1.0755	0.0309	0.0127	0.0396	0.0344	0.0280
22	0.0009	0.0005	0.0003	0.0002	0.0000	0.0006	0.0002	0.0001	1.0011	0.0008	0.0002	0.0002	0.0003
23	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0002	0.0000	0.0000	0.0000
24	0.0106	0.0069	0.0065	0.0075	0.0000	0.0123	0.0141	0.0115	0.0139	0.0036	1.0909	0.0104	0.0103
25	0.0047	0.0007	0.0006	0.0016	0.0000	0.0005	0.0014	0.0010	0.0010	0.0003	0.0011	1.0169	0.0143
26	0.0210	0.0080	0.0060	0.0096	0.0000	0.0116	0.0201	0.0108	0.0069	0.0054	0.0088	0.0086	1.0243
27	0.0232	0.0373	0.0416	0.0340	0.0000	0.0210	0.0231	0.0391	0.0328	0.0130	0.0350	0.0439	0.0607
28	0.0025	0.0030	0.0046	0.0025	0.0000	0.0026	0.0031	0.0025	0.0019	0.0013	0.0028	0.0025	0.0034
29	0.0001	0.0001	0.0001	0.0001	0.0000	0.0001	0.0001	0.0002	0.0001	0.0001	0.0002	0.0002	0.0002
30	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
31	0.0004	0.0004	0.0004	0.0003	0.0000	0.0003	0.0004	0.0003	0.0003	0.0001	0.0004	0.0003	0.0004
32	0.0019	0.0020	0.0022	0.0022	0.0000	0.0019	0.0025	0.0026	0.0016	0.0009	0.0029	0.0018	0.0127
33	0.0023	0.0020	0.0024	0.0020	0.0000	0.0020	0.0026	0.0024	0.0020	0.0008	0.0027	0.0024	0.0025
34	0.0038	0.0048	0.0103	0.0061	0.0000	0.0075	0.0085	0.0046	0.0044	0.0019	0.0062	0.0055	0.0054
35	0.0034	0.0026	0.0041	0.0024	0.0000	0.0027	0.0036	0.0025	0.0027	0.0050	0.0035	0.0032	0.0035
36	0.0395	0.0520	0.0544	0.0623	0.0000	0.0357	0.0605	0.0714	0.0411	0.0236	0.0811	0.0474	0.0391
37	0.0242	0.0188	0.0276	0.0187	0.0000	0.0211	0.0233	0.0185	0.0188	0.0120	0.0236	0.0200	0.0248
38	0.1064	0.0791	0.1111	0.0961	0.0000	0.2080	0.1094	0.0929	0.0769	0.0637	0.0935	0.0761	0.0899
39	0.0570	0.0917	0.0642	0.1369	0.0000	0.0496	0.0708	0.0735	0.0721	0.0308	0.1106	0.1015	0.0641
40	0.1550	0.1514	0.1773	0.1350	0.0000	0.1236	0.1609	0.1138	0.1254	0.0780	0.1506	0.1605	0.1583
41	0.0646	0.0475	0.0645	0.0480	0.0000	0.0530	0.0620	0.0573	0.0489	0.0322	0.0624	0.0556	0.0612
42	0.1168	0.0974	0.1248	0.0999	0.0000	0.1123	0.1219	0.1892	0.1013	0.0448	0.1245	0.1132	0.1231
43	0.0146	0.0133	0.0160	0.0112	0.0000	0.0132	0.0162	0.0106	0.0122	0.0087	0.0155	0.0142	0.0162
44	0.0383	0.0303	0.0572	0.0325	0.0000	0.0394	0.0430	0.0317	0.0333	0.0164	0.0403	0.0358	0.0409
45	0.0212	0.0166	0.0182	0.0142	0.0000	0.0149	0.0192	0.0158	0.0150	0.0080	0.0213	0.0167	0.0186
46	0.0034	0.0025	0.0032	0.0024	0.0000	0.0030	0.0032	0.0023	0.0025	0.0011	0.0032	0.0030	0.0033
47	0.0745	0.0591	0.0739	0.0534	0.0000	0.0609	0.0752	0.0525	0.0623	0.0213	0.0775	0.0744	0.0815
48	0.0098	0.0068	0.0327	0.0070	0.0000	0.0090	0.0103	0.0067	0.0065	0.0104	0.0084	0.0072	0.0077
49	0.6549	0.5256	0.6584	0.4631	0.0000	0.4971	0.6585	0.4563	0.5411	0.1818	0.6910	0.6708	0.7295
50	0.0437	0.0478	0.0522	0.0503	0.0000	0.0523	0.1191	0.0557	0.0367	0.0200	0.0557	0.0438	0.0597
51	0.0217	0.0229	0.0246	0.0237	0.0000	0.0263	0.0385	0.0277	0.0190	0.0155	0.0267	0.0198	0.0258
52	0.0186	0.0205	0.0213	0.0200	0.0000	0.0210	0.0220	0.0240	0.0163	0.0132	0.0236	0.0172	0.0228

SECTORS	27	28	29	30	31	32	33	34	35	36	37	38	39
1	0.0177	0.0126	0.0126	0.0112	0.0068	0.0128	0.0101	0.0153	0.0107	0.0111	0.0131	0.0160	0.0108
2	0.0158	0.0112	0.0113	0.0101	0.0062	0.0115	0.0091	0.0136	0.0105	0.0099	0.0119	0.0145	0.0098
3	0.0020	0.0014	0.0014	0.0013	0.0008	0.0015	0.0012	0.0017	0.0014	0.0012	0.0015	0.0018	0.0012
4	0.0032	0.0023	0.0024	0.0024	0.0013	0.0023	0.0020	0.0027	0.0021	0.0022	0.0031	0.0029	0.0030
5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
6	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001
7	0.0263	0.0200	0.0202	0.0192	0.0113	0.0178	0.0181	0.0229	0.0180	0.0372	0.0201	0.0218	0.1422
8	0.0012	0.0008	0.0011	0.0012	0.0007	0.0007	0.0012	0.0012	0.0020	0.0009	0.0015	0.0009	0.0018
9	0.1205	0.0842	0.0907	0.0949	0.0485	0.0837	0.0744	0.0972	0.0780	0.1028	0.2108	0.1014	0.2367
10	0.0591	0.0421	0.0422	0.0375	0.0227	0.0429	0.0337	0.0512	0.0351	0.0371	0.0437	0.0533	0.0361
11	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
12	0.0052	0.0034	0.0036	0.0031	0.0063	0.0039	0.0059	0.0072	0.0069	0.0033	0.0039	0.0043	0.0032
13	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0003	0.0000	0.0001	0.0000	0.0001	0.0000	0.0001
14	0.0049	0.0034	0.0038	0.0058	0.0033	0.0042	0.0071	0.0039	0.0030	0.0035	0.0040	0.0049	0.0031
15	0.0106	0.0100	0.0127	0.0098	0.0043	0.0059	0.0059	0.0227	0.0245	0.0059	0.0070	0.0094	0.0061
16	0.0123	0.0101	0.0092	0.0117	0.0049	0.0090	0.0078	0.0115	0.0084	0.0092	0.0112	0.0181	0.0082
17	0.0074	0.0046	0.0116	0.0161	0.0044	0.0046	0.0060	0.0178	0.0095	0.0046	0.0053	0.0063	0.0109
18	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
19	0.0084	0.0057	0.0059	0.0050	0.0033	0.0059	0.0048	0.0069	0.0047	0.0052	0.0067	0.0079	0.0055
20	0.0007	0.0007	0.0012	0.0005	0.0011	0.0005	0.0021	0.0006	0.0018	0.0004	0.0008	0.0005	0.0007
21	0.0345	0.0264	0.0260	0.0235	0.0146	0.0234	0.0240	0.0296	0.0235	0.0569	0.0264	0.0291	0.0732
22	0.0003	0.0006	0.0005	0.0009	0.0006	0.0001	0.0003	0.0009	0.0006	0.0002	0.0001	0.0002	0.0001
23	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
24	0.0133	0.0062	0.0134	0.0148	0.0117	0.0059	0.0188	0.0145	0.0076	0.0062	0.0103	0.0064	0.0115
25	0.0081	0.0020	0.0068	0.0033	0.0048	0.0028	0.0058	0.0025	0.0041	0.0005	0.0006	0.0004	0.0008
26	0.0154	0.0185	0.0156	0.0171	0.0278	0.0075	0.0255	0.0143	0.0093	0.0058	0.0075	0.0053	0.0107
27	1.1614	0.0212	0.0462	0.0339	0.0458	0.0477	0.0830	0.0276	0.0187	0.0169	0.0140	0.0170	0.0357
28	0.0043	1.0607	0.0036	0.0042	0.0015	0.0056	0.0019	0.0033	0.0021	0.0022	0.0039	0.0050	0.0026
29	0.0004	0.0005	1.0009	0.0003	0.0004	0.0002	0.0004	0.0002	0.0002	0.0001	0.0002	0.0002	0.0003
30	0.0000	0.0001	0.0000	1.0002	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0002	0.0000	0.0000
31	0.0005	0.0003	0.0004	0.0003	1.0026	0.0003	0.0005	0.0004	0.0003	0.0005	0.0004	0.0004	0.0004
32	0.0025	0.0016	0.0024	0.0019	0.0011	1.0886	0.0034	0.0018	0.0017	0.0292	0.0014	0.0030	0.0016
33	0.0031	0.0022	0.0022	0.0021	0.0013	0.0022	1.0233	0.0026	0.0021	0.0086	0.0024	0.0033	0.0024
34	0.0058	0.0042	0.0077	0.0058	0.0032	0.0091	0.0041	1.0169	0.0035	0.0046	0.0045	0.0075	0.0070
35	0.0044	0.0035	0.0038	0.0028	0.0018	0.0031	0.0030	0.0038	1.0229	0.0029	0.0036	0.0044	0.0030
36	0.0427	0.0377	0.0363	0.0392	0.0207	0.0314	0.0312	0.0402	0.0404	1.1227	0.0300	0.0383	0.0344
37	0.0301	0.0260	0.0217	0.0250	0.0112	0.0209	0.0189	0.0282	0.0234	0.0250	1.0711	0.0382	0.0196
38	0.1063	0.1068	0.0850	0.1145	0.0519	0.0788	0.0708	0.1119	0.0987	0.0909	0.1002	1.1349	0.0755
39	0.0711	0.0537	0.0567	0.0610	0.0324	0.0481	0.0468	0.0609	0.0482	0.0461	0.0542	0.0559	1.1878
40	0.2003	0.1507	0.1607	0.1636	0.1000	0.1195	0.1412	0.1621	0.1479	0.1127	0.1222	0.1335	0.1203
41	0.0737	0.0637	0.0591	0.0549	0.0306	0.0562	0.0452	0.0641	0.0509	0.0618	0.0610	0.0676	0.0520
42	0.1543	0.1173	0.1129	0.1346	0.0605	0.1052	0.1062	0.1320	0.1034	0.1083	0.1313	0.1583	0.1152
43	0.0194	0.0288	0.0155	0.0168	0.0075	0.0181	0.0115	0.0169	0.0118	0.0129	0.0148	0.0201	0.0123
44	0.0515	0.0445	0.0377	0.0415	0.0192	0.0433	0.0300	0.0484	0.0325	0.0374	0.0368	0.0501	0.0310
45	0.0229	0.0166	0.0160	0.0171	0.0354	0.0152	0.0141	0.0243	0.0152	0.0327	0.0173	0.0251	0.0146
46	0.0042	0.0030	0.0031	0.0030	0.0017	0.0030	0.0028	0.0040	0.0025	0.0027	0.0031	0.0082	0.0025
47	0.1032	0.0699	0.0728	0.0621	0.0401	0.0720	0.0579	0.0869	0.0593	0.0621	0.0761	0.0920	0.0625
48	0.0099	0.0080	0.0077	0.0114	0.0047	0.0081	0.0063	0.0096	0.0097	0.0070	0.0104	0.0143	0.0085
49	0.9282	0.6250	0.6538	0.5381	0.3530	0.6412	0.5194	0.7484	0.5069	0.5435	0.6769	0.7964	0.5516
50	0.0701	0.0458	0.0462	0.0387	0.0253	0.0504	0.0379	0.0547	0.0393	0.0442	0.0569	0.0619	0.0507
51	0.0295	0.0203	0.0232	0.0179	0.0139	0.0283	0.0201	0.0255	0.0213	0.0248	0.0306	0.0313	0.0279
52	0.0250	0.0167	0.0193	0.0150	0.0119	0.0237	0.0170	0.0225	0.0183	0.0217	0.0263	0.0282	0.0245

SECTORS	40	41	42	43	44	45	46	47	48	49	50	51	52
1	0.0164	0.0240	0.0074	0.0161	0.0739	0.0108	0.0187	0.0220	0.0517	0.0272	0.0181	0.0413	0.0158
2	0.0147	0.0221	0.0069	0.0148	0.0554	0.0097	0.0353	0.0194	0.0703	0.0243	0.0173	0.0382	0.0155
3	0.0019	0.0026	0.0008	0.0018	0.0113	0.0012	0.0016	0.0023	0.0037	0.0030	0.0018	0.0037	0.0015
4	0.0052	0.0042	0.0058	0.0036	0.0075	0.0023	0.0066	0.0041	0.0065	0.0044	0.0049	0.0092	0.0048
5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
6	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000
7	0.0276	0.0308	0.0144	0.0270	0.0273	0.0228	0.0237	0.0282	0.0321	0.0309	0.0334	0.0712	0.0334
8	0.0011	0.0013	0.0018	0.0013	0.0014	0.0011	0.0013	0.0012	0.0014	0.0012	0.0016	0.0024	0.0014
9	0.1314	0.1537	0.2799	0.1449	0.1315	0.0935	0.1543	0.1403	0.1255	0.1332	0.2085	0.2637	0.1710
10	0.0546	0.0803	0.0244	0.0536	0.2502	0.0361	0.0545	0.0729	0.1756	0.0909	0.0597	0.1379	0.0518
11	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
12	0.0044	0.0067	0.0026	0.0078	0.0045	0.0032	0.0049	0.0059	0.0057	0.0076	0.0053	0.0091	0.0047
13	0.0001	0.0001	0.0001	0.0001	0.0001	0.0000	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
14	0.0066	0.0122	0.0028	0.0109	0.0065	0.0032	0.0055	0.0050	0.0044	0.0062	0.0051	0.0136	0.0050
15	0.0121	0.0135	0.0045	0.0099	0.0174	0.0060	0.0074	0.0134	0.0144	0.0111	0.0119	0.0263	0.0121
16	0.0142	0.0267	0.0067	0.0142	0.0122	0.0079	0.0111	0.0269	0.0205	0.0157	0.0183	0.0509	0.0190
17	0.0061	0.0084	0.0043	0.0079	0.0133	0.0047	0.0094	0.0109	0.0145	0.0085	0.0113	0.0205	0.0118
18	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
19	0.0075	0.0109	0.0036	0.0128	0.0084	0.0052	0.0061	0.0207	0.0094	0.0130	0.0135	0.0189	0.0137
20	0.0005	0.0006	0.0008	0.0005	0.0005	0.0020	0.0006	0.0005	0.0005	0.0005	0.0007	0.0015	0.0006
21	0.0357	0.0402	0.0194	0.0326	0.0339	0.0312	0.0297	0.0365	0.0454	0.0413	0.0463	0.0990	0.0465
22	0.0002	0.0002	0.0001	0.0002	0.0003	0.0001	0.0002	0.0003	0.0002	0.0002	0.0002	0.0003	0.0002
23	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
24	0.0077	0.0093	0.0122	0.0108	0.0112	0.0144	0.0083	0.0090	0.0088	0.0086	0.0120	0.0172	0.0107
25	0.0004	0.0006	0.0006	0.0005	0.0005	0.0006	0.0005	0.0005	0.0005	0.0005	0.0006	0.0009	0.0005
26	0.0063	0.0082	0.0078	0.0068	0.0090	0.0188	0.0065	0.0067	0.0082	0.0067	0.0078	0.0130	0.0069
27	0.0155	0.0164	0.0157	0.0153	0.0198	0.0286	0.0189	0.0144	0.0191	0.0145	0.0173	0.0290	0.0185
28	0.0047	0.0184	0.0017	0.0059	0.0032	0.0023	0.0041	0.0029	0.0025	0.0030	0.0032	0.0067	0.0035
29	0.0002	0.0002	0.0002	0.0003	0.0002	0.0003	0.0002	0.0002	0.0002	0.0002	0.0002	0.0003	0.0002
30	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
31	0.0007	0.0007	0.0002	0.0005	0.0004	0.0020	0.0004	0.0005	0.0005	0.0006	0.0005	0.0008	0.0005
32	0.0023	0.0026	0.0010	0.0016	0.0019	0.0017	0.0019	0.0018	0.0034	0.0017	0.0021	0.0040	0.0024
33	0.0030	0.0042	0.0053	0.0029	0.0033	0.0028	0.0060	0.0036	0.0042	0.0046	0.0036	0.0060	0.0034
34	0.0058	0.0128	0.0028	0.0095	0.0045	0.0034	0.0068	0.0127	0.0049	0.0057	0.0074	0.0129	0.0080
35	0.0046	0.0064	0.0024	0.0109	0.0046	0.0028	0.0126	0.0056	0.0054	0.0065	0.0050	0.0124	0.0046
36	0.0464	0.0502	0.0197	0.0338	0.0452	0.0423	0.0404	0.0425	0.1058	0.0413	0.0391	0.0954	0.0377
37	0.0380	0.0545	0.0144	0.0346	0.0289	0.0272	0.0297	0.0368	0.0334	0.0351	0.0282	0.0603	0.0262
38	0.1666	0.1866	0.0740	0.1190	0.1231	0.0877	0.1548	0.1296	0.1112	0.0930	0.0983	0.1764	0.0949
39	0.0780	0.0844	0.0355	0.0920	0.0859	0.0528	0.0725	0.0786	0.0623	0.0779	0.0721	0.1529	0.0703
40	1.1478	0.2019	0.0921	0.1582	0.2017	0.2059	0.1314	0.1722	0.1716	0.2132	0.1450	0.2772	0.1244
41	0.0776	1.2979	0.0598	0.0846	0.0888	0.0510	0.0697	0.0823	0.0734	0.0973	0.0828	0.1246	0.0783
42	0.1839	0.2220	1.1672	0.1727	0.1767	0.1169	0.1687	0.2487	0.1796	0.2208	0.1529	0.2690	0.1357
43	0.0191	0.0278	0.0079	1.0255	0.0204	0.0131	0.0189	0.0232	0.0219	0.0270	0.0264	0.0338	0.0264
44	0.0568	0.0685	0.0212	0.0461	1.0419	0.0315	0.0445	0.0574	0.0521	0.0688	0.0444	0.0784	0.0382
45	0.0340	0.0295	0.0100	0.0244	0.0210	1.0185	0.0293	0.0271	0.0285	0.0290	0.0215	0.0384	0.0194
46	0.0048	0.0056	0.0018	0.0039	0.0076	0.0027	1.0558	0.0052	0.0047	0.0061	0.0037	0.0079	0.0030
47	0.0895	0.1377	0.0404	0.0976	0.0892	0.0623	0.0779	1.1265	0.1035	0.1641	0.0962	0.1754	0.0790
48	0.0134	0.0399	0.0070	0.0107	0.0099	0.0064	0.0091	0.0148	1.0359	0.0102	0.0109	0.0160	0.0110
49	0.7980	1.2127	0.3587	0.8224	0.7809	0.5568	0.6412	1.0045	0.9300	1.5015	0.8019	1.5671	0.6238
50	0.0561	0.0835	0.0388	0.0556	0.0550	0.0451	0.0476	0.0615	0.0675	0.0816	1.0488	0.4556	0.1049
51	0.0279	0.0357	0.0280	0.0293	0.0266	0.0242	0.0255	0.0310	0.0285	0.0377	0.0229	1.0441	0.0190
52	0.0243	0.0305	0.0249	0.0256	0.0234	0.0216	0.0223	0.0269	0.0259	0.0324	0.0241	0.0406	1.0167

Appendix 5.7:   Firm-Level Survey Form

PILOT SCORING MODULE.

General Instructions: base all dollar projections on the peak year of operation. Use 1992 dollars with no inflation factor. All items are to be estimated by KTEC or by the center of excellence grant officer.

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1.   ID section

1.1   Name of Company

1.2   Name or ID of project

1.3   Name of person performing survey

1.4   Date of survey

2.   General description of project and location

2.1   Location of proposed plant or operation (county, city)

2.2   Is the business organized as
        ___ Corporation   ___ Partnership   ___ Sole proprietor

2.3   What percentage of the ownership is by persons who reside in Kansas?
        ___ Kansas owner's share
        ___ Non-Kansas owner's share
        ___ Total (total should be 100%)

2.4   In the peak year, what percentage of vendors by dollar cost will be located in Kansas?
        ___ Materials and supplies   ___ Subcontractors

2.5   Describe the expected marketing region.
        (e.g counties; states; or center plus radius in miles)

2.6   Describe the particular product or service in words

2.7   SIC code of product or service

2.8   Define an effective market concept; i.e., what other products or services are in direct
        competition.

2.9   What share of this market in this marketing region is now held by all existing competitors?
        ___ Kansas competitor's share
        ___ Non-Kansas competitor's share
        ___ This firm's share
        ___ Total (total should be 100%)

2.10   What share of this market in this marketing region is anticipated for this company in the peak
        year?

2.11   What is the nature of the main contribution to economic development?
        ___ Export expansion   ___ Import substitution   ___ Market retention

2.12   Why will it occur?
        ___ Price reduction   ___ New product   ___ Improved quality

2.13   What KTEC intervention is being provided?
        ___ Grants   ___ Technical assistance ___ Other (describe)

3. Workforce, sales location, and annual operating statement (peak year)

3.1 Uses of revenue

_____

Type of Job	FTE Kansas Employees Existing (A)	New hires (B)	Average Annual Salary Plus Benefits (C)	Total Cost (A+B)*C
Owners/partners	_____	_____	_____	_____
Executive, admin., & managerial	_____	_____	_____	_____
Professional, tech., & related skills	_____	_____	_____	_____
Sales	_____	_____	_____	_____
Administrative support	_____	_____	_____	_____
All Service	_____	_____	_____	_____
Farming, forest & fishing	_____	_____	_____	_____
Precision craft & repair	_____	_____	_____	_____
Machine operator, assembly & inspect.	_____	_____	_____	_____
Transportation & material moving	_____	_____	_____	_____
Handler, cleaner, helper & labor	_____	_____	_____	_____

_____

SUM = Total Kansas wages _____

Total Kansas wages (from above)
Total non-Kansas wages
Taxes (except sales)
  Federal and SSI
  Kansas taxes
  State business income
      Property
      Payroll
      Other
  Non-Kansas taxes
Transportation costs
Rent
Energy
Water and sewer
Communications
Materials and supplies
Advertising
Insurance
Other business services
Subcontracts
Other non-capital costs

                                  _____

SUM = Total non-capital costs
Interest:
  Bank loans
  Other loans
KTEC reimbursement
After-tax Profits
Depreciation

                                  _____

SUM = Total expenditure

3.2 Sources of revenue

_____

Sales Item (describe) Proj. ID ...	Quantity by Destination of Goods		Unit Price	Total Revenue
	Kansas (D)	Outstate (E)	(F)	(D+E)*F

_____

1. 1
2. 2
3. 3
4. 4

_____

SUM =   Total sales

_____

Grant or Revenue item (describe) Proj. ID ...	Quantity by Origin of Dollars		Total Revenue
	Kansas (G)	Outstate (H)	(G+H)

_____

1. 5
2. 6
3. 7
4. 8

_____

SUM =   Total other revenue
Total sales (from above)

_____

SUM =   Total income
(Should equal total expenditure on previous page.)

4. Projected Financial Statement (peak year)

4.1. Uses of capital

4.1.1 Physical assets (Book value, deflated to 1991 prices)

_____

Type of Asset	New Kansas	New non-Kansas	Used	Total
Land			xxxxxxx	
Site prep. and infrastr.			xxxxxxx	
Structures				
Machinery and equipment				
Materials inventory			xxxxxxx	
Product inventory			xxxxxxx	

_____

        SUM =   Total physical assets

4.1.2 Operating Capital

4.1.3 Future development costs

        Total dollar operating costs during
          development and marketing*
        Value of future unpaid labor*

4.1.4   _____

        SUM =   Total capital uses
                (excludes goodwill and depreciation.)

4.2 Projected Sources of capital

        Supplied by existing owners:
          Cash and physical assets
          Value of future unpaid labor*
        Loans
          Banks
          Industrial revenue bonds
          Other, Kansas origin
          Other, non-Kansas
        New equity participation
          Kansas origin
          Non-Kansas
        Grants
          Site preparation paid by government
          KTEC
          Other Kansas source
          Non-Kansas

                                 _____

        SUM =   Total capital sources
      (Excluding good will and depreciation; should equal total capital uses, 4.1.3 above)

    * exclude all operating costs sunk prior to 1992

5. Projected time profile

For each sales or grant item on previous page:

Number of months until capital assets are in place . . . . :
Number of months until first sale . . . . :   :
Number of months until peak sales are reached . . . . : . . . . :   :
Number of years in product life cycle . . . . :   :   :   :
  Project ID . . . . :   :   :   :   :
_____ ___:___ ___:___ ___:___ ___:___
___:___

Sales item
1.   1
2.   2
3.   3
4.   4

Grant item
1.   5
2.   6
3.   7
4.   8

_____ _____ _____ _____ _____
_____

                                                mnths.   mnths.   mnths.   mnths.
Months. = elapsed time after Jan.1, 1992

6. Intangible contributions

Detailed occupations and FTEs of employees to be engaged in product development and improvement

Other intangible contributions to Kansas business climate

7. Projected probabilities of success

Overall subjective probability estimates:

_____

Range of eventual outcomes (expressed as % of sales/revenue goals)	conditional probabilities: with KTEC help	without KTEC help
7.1. exceed 70%		
7.2. reach 10% to 70%		
7.3. reach 0+ to 10%		
7.4 exactly 0%		
Total (must sum to 1.00)	1.	1.

_____

8. Describe the probability structure of any contingent returns to KTEC

Appendix 5.8:   Bridge Formulas and Data Explanation

Bureau of Labor Statistics wage bill data were used to estimate 1987 wage coefficients.

Migration rates were estimated according to:[6]

$$M_i = \cfrac{\cfrac{(\text{number of immigrants to Kansas})_i^{1980}}{(\text{Total number employed in Kansas})_i^{1980}}}{\cfrac{(\text{number newly hired in U.S.})_i^{1980}}{(\text{Total number employed in U.S.})_i^{1980}}} \ ,$$

where: M_i = Ratio of newly hired non-Kansans to total newly hired, in 1980 in occupation i. Data were taken from the 1980 Census and the BLS.

Kansas Real Bond Rates were estimated using CITIBASE data on Tax-Free Bond Yields and US inflation rates.[7]

Shares of Kansas Taxes paid by households and businesses were estimated using several sources:[8]

Government Finances in 1986-1987, and *1987-1988.*
State Government Tax Collections in 1987 and *1988.*
Ring [1989].
Property Assessment and Taxation, 1986, 1987.

Other bridge data are documented in McKinney [1992b].

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[6].   See McKinney [1992a].

[7].   See Burress [1992b].

[8].   See Chou [1992a].

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Appendix 5.10:   Instructions for Running the Impact Software

       This software is designed to run on an IBM-compatible PC, preferably with a 286 chip or better, and under LOTUS 123 version 2.01 through 2.3.

1.   Make sure the three files IMPACT1.WK1, IMPACT2.WK1 and TO_IMP2.WK1 are all on the same directory.

2.   Start Lotus 123. Set the directory to the one which contains the above files if it isn't already.

3.   Retrieve IMPACT1. Make sure you are in the upper-left corner of the worksheet by typing the <HOME> key.

4.   Fill in the survey.

5.   When the survey is complete, type <ALT>-G by holding down the <ALT> key and pressing the "G" at the same time. This will run the program. It will take approximately fifteen minutes.

6.   When the program is done, it will tell you to save the current worksheet, retrieve IMPACT2, and type <ALT>-G to run the second program. Perform these steps. Running the second program will take a few minutes.

7.   When the second program is done, it will show you the results.

6 | Applying the Anticipated ROPI Procedure to a Small Project

Outline of Section

This section describes a trial application of the A-ROPI procedure to a small project. The Section includes:

1. A description of the KTEC Applied Research Matching Grant Program and of the small project;

2. A discussion of some special assumptions which were needed in order to make the application; and

3. The results of the trial application.

Introduction

This section describes a trial application of the Pilot A-ROPI Procedure to a small project grant actually administered by KTEC during 1991. The project consisted of the final development phase of a combined product and service in the health care field. The anticipated market area included most of Kansas plus the Kansas City metropolitan area.

The KTEC Applied Research Matching Grant Program

The Applied Research Matching Grant Program provides funding to educational institutions and private enterprises in Kansas. The objective of the program is to support proposals with the potential to move innovation and applied research toward commercial application.

Confidentiality of Data

The present application is merely an example showing how the A-ROPI procedure can be applied. The A-ROPI model is presently at a very early stage in its development. As we gain experience with the A-ROPI model, it is quite possible that there will be some instability over time resulting from improvements in the data and assumptions employed. Therefore the results of this particular example may not be directly comparable to results obtained with more mature versions of the model. Moreover, there was no particular reason for selecting this particular project and this particular firm rather than some other as our guinea pig. There seemed no compelling reason for us to expose this small new firm to the possible glare of (possibly unfavorable) publicity.

Therefore we decided to conceal the identity of the particular firm in question. We reached this decision before we knew the A-ROPI outcome. Furthermore, certain data have been either withheld or modified in order to impede the identification of the firm.

Special Assumptions

The project under consideration was intended to design and then produce a good or service that is competitive with goods and services already being supplied by native Kansas firms. Consequently, success of this project is likely to have a negative impact on existing Kansas competitors. From the point of view of the Economic Development Goals, this negative impact constitutes a major cost of the project. It was treated as such in the impact analysis reported here.

However, the above approach tends to understate A-ROPI. Presumably, continuing technological development activities of this type are necessary in order to maintain the over-all competitiveness of Kansas industry. If they failed to occur Kansas industries would then tend to be replaced over time by more progressive non-Kansas industries. In other words, the negative impact on competitors referred to above would probably occur even in the absence of this project, although probably at a slower pace. Therefore, discounting the full effect on competitors as a cost is a conservative approach to measuring A-ROPI.

Another special assumption concerns the effect of KTEC intervention on the development phase of the project (as opposed to the effect on the final sales). We assumed that KTEC intervention was absolutely necessary to getting the project started. This is NOT a conservative assumption; rather it overstates the probability that Kansas receives benefits from aiding the development phase of the project.

A third set of assumptions has to do with the effect of KTEC intervention on the final sales resulting from the project. These assumptions are referred to as the Commercial Success Probabilities. As a baseline case, we assumed that:

1. the project had a 30% chance of getting to the sales stage before KTEC intervened;

2. the project's chances were increased to 60% as a result of KTEC's help;

3. if any sales were achieved, then the expected sales with KTEC's help was twice as high as that to be expected without KTEC's help.

We are unable to characterize the degree of conservatism of this assumption. It is simply an assumption that seems plausible. Obtaining solid information on the efficacy of KTEC intervention is a task that really belongs to R-ROPI, a future project which is proposed in Chapter 8.

Results

The project will be highly worthwhile to the state of Kansas if it actually turns out much as it was projected to turn out.
The weighted Anticipated ROPI of the small project is estimated as 372 (i.e., 37,200 percent). The results were quite high when stated either as an anticipated ROPI in terms of income (314) or in terms of jobs (430).

Sensitivity to the Commercial Success Probabilities

We have also examined the effect of changes in the assumed Commercial Success Probabilities on the A-ROPI. These are key parameters which require some subjective judgement on the part of KTEC. Moreover, we had expected A-ROPI would be quite sensitive to these parameters.

That expectation was not especially borne out in practice. When we replaced the actual KTEC estimates in turn with estimates half as optimistic and then twice as optimistic, we found that measured A-ROPI varied from 270 to 576. ("Half as optimistic" was defined by assuming that the total effect of KTEC intervention on average final sales was half as large; "twice as optimistic" was defined by assuming the total effect was twice as large.) So, a factor of 4 increase in optimism led to only a factor of 2 increase in A-ROPI.

However, in all three variant scenarios, a major benefit of the project comes during the investment and development phase; these development benefits were not varied across scenarios. Even when the parameter for the effect of KTEC intervention on sales was set to 0 percent, the development benefits still produced a positive A-ROPI (weighted A-ROPI = 26; Jobs A-ROPI = 35; Income A-ROPI = 17.) In other words, the mere act of attempting to start up production of a new product using KTEC help apparently has a positive net benefit on jobs and income in Kansas, even when the attempt fails. (But of course, success of the project would be much better for Kansas than failure.)

7 | Applying the Anticipated ROPI Procedure to Grants Received by a Center of Excellence

Outline of Section

This section describes a trial application of the A-ROPI procedure to outside grants received in one year by a Center of Excellence.

This section includes:

1. A description of the KTEC Center of Excellence Program;

2. A discussion of some special assumptions which were made so as to support the application; and

3. The results of the trial application.

Introduction

This section describes a trial application of the Pilot A-ROPI Procedure to a KTEC Center of Excellence. This application focused on the economic impact of grants received by the Center from outside the State of Kansas which were leveraged by KTEC funds during the fiscal year 1990-91.

The previous section focused on predicting the ROPI of a single small grant. That approach would be especially suitable for assisting KTEC to select between alternative small grant proposals. A similar disaggregation to the level of a single grant or program could assist the Centers of Excellence in directing their internal activities toward economic development.

In contrast, this section focuses on the entire institutional impact of a Center of Excellence, rather than on any specific program or grant being carried on within it. This higher level of aggregation would be especially suitable for the review of a Center by KTEC or by the legislature.

The KTEC Centers of Excellence Program

The Centers of Excellence Program funds university-based centers to promote the development of new technologies, advancement of basic and applied knowledge in science and technology, and transfer of these technologies to Kansas businesses for commercial development.
The five Centers are specialized as follows: Higuchi in biochemicals and CECASE in computer-aided design tools, both at the University of Kansas in Lawrence; NIAR in aeronautic engineering, at Wichita State University; AMI in manufacturing processes at Kansas State University in Manhattan; and CTT in general technology transfer at Pittsburg State University.

Confidentiality of Data

The present application is merely an example showing how the A-ROPI procedure can be applied to the leveraging of matching grants. As in the previous section, we caution readers not to place too much emphasis on the significance of the actual results at the this early stage of development of the A-ROPI procedure.

Therefore, we decided to conceal the identity of the particular Center of Excellence. (As in the previous section, we reached this decision before we knew the A-ROPI outcome.) Moreover, certain data have been withheld in order to preclude the identification of the Center of Excellence.

Special Assumptions

In this exercise, we examined *only* the effects on the State of Kansas economy of grants brought into the state from outside sources by the center. In particular, we were concerned with the employment and income effects of the new dollars brought into the state (Keynesian-style "pump priming" effects).

We made no attempt to evaluate the usefulness of actual Center of Excellence research, as such, to the state economy. Instead, we ignored any commercialization benefits that may occur in the future (i.e. we set them to zero in the model). Evaluating these benefits can be done using the A-ROPI model, but that would be best accomplished by aggregating detailed estimates up from the small project level. Since we omitted research benefits, the A-ROPI measured here is only a lower bound estimate.

We treated grants from KTEC sources as lumped together identically with grants from other Kansas governmental sources. In other words, we assumed that neither can used to leverage the other; and also that either can be used interchangeably to leverage non-Kansas grants. On the cost side, we included dollars provided through the University of Kansas system in addition to dollars provided by KTEC.

One very important parameter for this analysis is the effect that KTEC and other Kansas grants have on obtaining these outside grants. Based on statements by Center personnel, we assumed that the degree of leveraging was proportional. In other words, the dollars of non-Kansas grants comprise a constant ratio of the Kansas dollars. In particular they would go to zero if the Kansas dollars went to zero.

Results

Under these assumptions, we found that the program has been rather beneficial to Kansas Economic Development Goals. We found the (weighted average) Anticipated ROPI of the Grant-leveraging activity to be about .63 (i.e., about 63 percent). The individual results were rather higher for jobs (.82) than for income (.45).

The A-ROPI found here is definitely positive, but it is far below than the range of 270 to 580 found for the small matching grant project analyzed in Section 6. This would appear to imply that the Center of Excellence program was less beneficial, on a dollar for dollar basis, than the small project examined in Section 6. However, such a comparison is misleading, since commercialization benefits (expected in the future) were included in the Section 6 analysis but were excluded here.

Sensitivity Analysis

In a sensitivity analysis, we examined the effect of varying the leverage ratio. We set the leverage ratio on operating funds to zero. In this case, the calculated A-ROPI fell to about .010 (a positive 1 percent) for jobs and to around -.322 (a negative 32 percent) for income. The weighted average ROPI was -.156.

The implication is that the Center of Excellence program could not be justified in terms of economic development if the benefits were based solely on the pump-priming effects of the Kansas grant dollars, in the absence of any outside leveraged dollars. In other words, under these extreme assumptions, it would be as good in terms of Kansas jobs, and better in terms of income, to have no Centers program and simply return the dollars to the taxpayers. This result should not be especially surprising; it simply says that the stimulus to the Kansas economy of a dollar in Centers' spending is somewhat less than the stimulus of handing a dollar back to the taxpayers. Or to turn the point around, this result emphasizes that substantial leveraging and commercialization are essential if the Centers are to achieve their economic development goals.

Conclusion

The results above suggest that the model results need to be expressed in terms which cleanly separate three types of effects: Keynesian effects which are presumably available from almost any Kansas public expenditures; the effects due to leveraging; and effects to commercialization and other ultimate results of KTEC research and technology transfer.

The sensitivity results contained above and in the previous section also imply that the A-ROPI measure of project success is partly a subjective one, at least in the short run. In particular, it depends to some extent on assumptions or forecasts about grant leveraging ratios and forecasts of the commercial success of the applications. If KTEC uses the A-ROPI measure as one input to comparative decisions on project funding, then KTEC will need to take care that the comparative degree of optimism is reasonably based on real evidence of the comparative quality of the proposals. In particular, it would be desirable for KTEC to adopt a formal market forecasting procedure to provide an additional input to the A-ROPI Procedure and the Funding decision.

Moreover, if the Kansas Legislature or its Committees uses the A-ROPI measure as an input for an overall evaluation of KTEC, then they should do so with considerable caution. The measure can be a useful indicator of the extent to which KTEC plans and forecasts are consistent with Economic Development Goals. But it cannot take the place of a retrospective evaluation (such as the proposed R-ROPI). If A-ROPI is used as the main measure of KTEC success, then KTEC will be placed in a relatively untenable position. In particular, when the economy is in a recession, KTEC may face a choice between providing honest estimates of A-ROPI, which might then be used by the

Legislature to the institutional disadvantage of KTEC; or KTEC could provide over-optimistic estimates, which would serve its short-run institutional needs, but would not serve its long-run goal of effectively managing technology transfer in Kansas.

To avoid forcing KTEC into this dilemma, the Legislature needs to develop additional tools for evaluating KTEC. One of these tools is an independent measure of the accuracy of KTEC forecasts of project's commercial success. More generally, the legislature needs a system for assessing R-ROPI, a retrospective measure of actual projects. We turn to this and other recommendations for further work in the next section.

8 | Suggestions for Further Work

Outline of the Section

This section describes further tasks proposed by the authors of this report for KTEC the coming year and in following years. These tasks include both some additional implementation of designs described in the previous chapters, and also some additional design and its implementation.

The topics covered are:

1. Formalizing the Representative Body.
2. Updating Economic Development Goals.
3. Updating Economic Development Weights.
4. Expanding the Anticipated ROPI procedure.
5. Improving and expanding the SAM model.
6. Improving the Anticipated ROPI procedure.
7. Developing a Realized ROPI procedure.
8. Improving KTEC internal routine procedures.
9. Improving KTEC internal learning procedures.
10. Creating a KTEC ROPI data base.
11. Making applications to other public investment activities.

Introduction

It was understood at the beginning of the Pilot ROPI Project that development of an evaluation model would be an iterative process of improvement, extended over time. In this Section we suggest what some of the next steps in that process may entail. We are referring these suggestions, taken together, as the "Extended ROPI Project." Appendix 8.1 contains a flow chart showing some of the key elements to be developed by this proposed project.

Formalizing the Representative Body

In a representative democracy, action by the elected representatives is the accepted and legitimate method for selecting the goals and sub-goals of public policy. This can be accomplished either directly, by writing those goals into public laws; or indirectly, by delegating the task to a specific agency under ultimate control of the legislature.

We are suggesting that an indirect approach is more suitable in this case. The goals of economic development are relatively technical, detailed, and programmatic, and demand some degree of specialized understanding. These goals should be allowed to change and evolve flexibly over time, in the light of new experience and also new political developments. This flexible approach is best accomplished by delegating the choice of goals to a formal representative body.

It is our recommendation that the Kansas legislature or a legislative committee should take up the task of formalizing the procedure by which the representative body is to be selected.

Updating the Economic Development Goals

The initial list of economic development goals that we used in setting up the pilot current ROPI procedure represents the list of goals that are commonly listed by economic development. We should update the list as a result of our experience with interviews and as a result of further knowledge of the economic development process in Kansas. The list may be expanded or contracted. The language stating the specific goals may also need to be modified.

Moreover, the legislature may want to define a process by which the representative body modifies the list of economic development goals.

Updating the Economic Development Weights

Interviews will need to be conducted periodically with members of the new representative body, using the revised list of economic development goals. This will result in weights that represent the current valuations that Kansans would use in judging the results of their investments. It is hoped that the weights that result from the update will not differ dramatically from the old weights, but it is important to allow for the possibility that they may. During the follow-up stage, naturally, the weights used in computing Anticipated ROPI for projects supported at a given year will be the ones used to compute the Realized ROPI for that group of projects. We anticipate that the method of going from binary ranking to create the weights by the panel will remain unchanged.

Expanding the Anticipated ROPI Procedure

After the new weights are obtained, a longer list of economic development criteria, perhaps the top 4 or 5 Goals, will be used to calculate anticipated ROPI. To each goal a Proxy economic variable will be assigned and measured. In case a readily available economic variable does not exist, a measurable Proxy needs to be conceptualized and measured.

Improving and Expanding the SAM Model

The Proxies mentioned above measure the direct effects of undertaking a given project. To get at the ripple effects or indirect effects, one must have a more detailed accounting of the flow of goods and services in the economy. This is done in the framework of a Social Accounting Matrix (SAM). As we expand the set of economic variables and their proxies, the SAM model also needs to be expanded to enable us to calculate the indirect effects on the new variables.

An ambitious and desirable undertaking would be to construct a dynamic SAM (i.e. one which accounts directly for flows across time as well as across institutions). However, this might make it necessary to have access to more powerful computing technology than we have so far used.

Even in the absence of extensions to the SAM model, data improvements would be desirable. In the initial stage of computing ROPI we used a primitive SAM model in the sense of having to accept some compromises. We should construct a more complete SAM. This will involve serious theoretical modeling work as well as the acquisition of data either through surveys or through other statistical estimation methods.

Improving the Anticipated ROPI Procedure

So far we have assumed very limited amounts of uncertainty in calculating the Anticipated ROPI on projects. We would like to move on go to the more realistic approach of taking account of the presence of uncertainty with respect to the success of projects as well as with respect to external environment such as prices and general economic conditions. Moreover, we would like to take into account the degree of correlation across projects, as well as the attitudes of Kansas policy makers towards bearing more risk when that could lead to higher ROPI.

This can be accomplished in stages. This activity should be adaptive in its nature in the sense of allowing experience with certain types of projects to inform the updating of probabilities of success.

Creating a Realized ROPI Procedure

This is possibly the most significant step in the process both from the point of view of evaluation and of modeling. First, we need fundamental design work as well as implementation of a system for measuring the actual ROPI outcomes (R-ROPI). Second, at least a sample of KTEC supported projects should be evaluated to compare the Anticipated ROPI with the Realized ROPI from these projects. The results will help in modifying the calculations of the probability of success for the relevant class of projects and to point at possible modification of the ROPI procedure itself. Depending on the type of a project or program, the sample could consist of the entire population or it could consist of a reasonable fraction. The validation of the process of evaluation depends crucially on the results of this step.

Improving KTEC Internal Routine Procedures

To the extent possible, all proposed new projects should be scored according to the Scoring survey form so that A-ROPI can be calculated and used as one of the Project Selection Criteria. However, resources may permit the scoring of only a subsample of all projects; if so, then the sampling procedure needs to be designed. The format of the applications and decision documents may have to be changed to facilitate the scoring. We discovered, for example, that some information needed for calculating economic impacts is not presently available in the Applied Technology Matching Grant application files.

One advantage of building the Scoring form partly into the application form is that proposers will get into the habit of thinking of economic development when they make project proposals. An added benefit of the procedure is that it will help programs with formulating their strategic plans and make it easier for KTEC to evaluate these plans. The more or less uniform format of the application procedure will result in simplified evaluation processes.

After the scoring and the electronic storing of the information, a valuable data base will be created. Its primary use will be for the calculation of anticipated ROPI at various organizational levels (project, program, KTEC). Other uses, such as preparing economic impact reports, are certainly possible. Routine procedures need to be designed for maintaining and updating this database.

Improving KTEC Internal Learning Procedures

This will involve training KTEC personnel in scoring of proposals, sampling and scoring of implemented proposals, and processing the information to obtain ROPI. Personnel need to gain the ability to apply the model and to suggest modifications in its structure.

In the course of gaining experience with scoring, we expect to discover shortcomings of the survey forms and to make the necessary changes. We note that the entire portfolio of projects handled by KTEC—ranging from small grants to widely diverse Centers of Excellence—is very broad. As we gain experience in varied applications, the Scoring survey will have to be improved, and we expect that some tailoring of the scoring procedure to the various proposals will take place.

Creating a KTEC ROPI Data Base

We expect a large quantity of information to accumulate at KTEC as a result of running the ROPI model, e.g., the results of the scoring of proposals and as a result of follow up efforts.

A standard data management program can be set up with the goal of facilitating retrieval and updating. Potential users in KTEC as well as personnel responsible for the updating and running of the ROPI model should be involved in the design of the data base.

Making Applications to Other Public Investment Activities

The main features of the ROPI procedures are that it converts learned intuition on part of representatives of the public into quantitative valuations of economic and social variables which either have no market valuations or which the market would imperfectly evaluate. This aspect of the procedure makes it applicable to a very wide group of public investment activities.

Making this wider application of the ROPI system may be of some interest to KTEC. Such a potential application would be, quite precisely, an example of a technology transfer. It is true that the ultimate consumer of the technology would consist of agencies in the public sector. However, it is entirely possible that the ROPI technology could be developed and marketed by a private sector firm.

However, the procedure developed here needs to be customized to fit the specific activity. New goals must be defined and perhaps a new Representative Body must be identified. New variables and methods of measuring them must be introduced. The supporting SAM model must be modified so that the appropriate multipliers can be generated.

A8 Appendix

Appendix 8.1: Flow chart for Extended ROPI Project (Preliminary proposal)

Appendix 8.1: **Flow chart for Extended ROPI Project (Measurement of Return on Public Investment) Preliminary Proposal**

ROPI Glossary

1. Main glossary

ASSUMPTIONS: see GOAL MAPPING ASSUMPTIONS and ECONOMIC IMPACT ASSUMP-
TIONS.

ANTICIPATED ROPI: the forecast or projected Return on Public Investment for a project, a
program, or an agency. Contrasted with REALIZED ROPI.

ANTICIPATED ROPI PROCEDURE: the manual, software, and activities for measuring
ANTICIPATED ROPI. Includes the SCORING MODULE and the ECONOMIC IMPACT
MODULE, and takes the ECONOMIC DEVELOPMENT WEIGHTS as given. An initial
version of this procedure was developed during the PILOT ROPI PROJECT.

BRIDGE MULTIPLIERS: see ECONOMIC DEVELOPMENT MULTIPLIERS.

ECONOMIC IMPACT ASSUMPTIONS: the underlying mathematical-economic premises used in
calculating the ECONOMIC DEVELOPMENT MULTIPLIERS from a number of data
sources. (The major data source is the KSSAMv1). Most of these assumptions amount to
proportionalities between inputs and outputs.

ECONOMIC IMPACT MODULE: the procedure and software which forecasts the indirect impacts
of a project or program, based on given SCORES for the direct effects. In this procedure, the
SCORES are first multiplied by MULTIPLIERS and added up, yielding forecasts of the
PROXIES over time. Next, for each PROXY the program calculates a rate of return, yielding
a set of ROPIs. Finally, the several ROPIs are averaged into one ROPI using the WEIGHTS.

ECONOMIC DEVELOPMENT GOALS: a list of the main objectives which are assumed likely to
motivate Kansas economic development activities. (These goals were kept rather general, so
that the total number can be limited to around 10. Therefore, they were boiled down from a
more detailed list known as the EXPANDED ECONOMIC DEVELOPMENT GOALS.)
These GOALS are more general than the KTEC GOALS.

ECONOMIC DEVELOPMENT MULTIPLIERS: a set of numbers used to translate SCORES into
forecasts of PROXIES. The MULTIPLIERS consist of KSSAM MULTIPLIERS taken from
the KSSAMv1 model, plus BRIDGE MULTIPLIERS taken from other sources. The BRIDGE
MULTIPLIERS are used to translate the rather specialized SCORES into information
corresponding to more general SECTORS assumed by the KSSAM MULTIPLIERS.

ECONOMIC DEVELOPMENT PROXIES: a set of measurable variables for the state of Kansas, which are accepted as reasonable indicators of the degree of success in accomplishing the ECONOMIC DEVELOPMENT GOALS.

ECONOMIC DEVELOPMENT SCORES: a set of numbers reported for a particular project or program, which are intended as inputs for calculating its ANTICIPATED ROPI.

ECONOMIC DEVELOPMENT WEIGHTS: a set of numbers measuring the relative importance that Kansas policy-makers place on each of the ECONOMIC DEVELOPMENT GOALS. The individual weights corresponding to each GOAL are positive (or zero); they sum to 1. The WEIGHTS which describe the policy preferences of one particular policy-maker are referred to as (ECONOMIC DEVELOPMENT) PERSONAL WEIGHTS. The average weights accepted for use in the ROPI project are just referred to as (ECONOMIC DEVELOPMENT) WEIGHTS.

EXPANDED ECONOMIC DEVELOPMENT GOALS: see ECONOMIC DEVELOPMENT GOALS.

EXTENDED ROPI PROJECT: a proposed (1992-93) activity of designing and developing a REALIZED ROPI PROCEDURE, and also a feed-back mechanism for improving the conceptual ECONOMIC DEVELOPMENT GOALS, the WEIGHT EVALUATION PRO-CEDURE, and the ANTICIPATED ROPI PROCEDURE.

GOAL MAPPING ASSUMPTIONS: the conceptual framework used in the ROPI PROJECT for bridging the gap between verbal expressions of the policy-preferences of various political constituencies, on the one hand, and measurable economic impacts, on the other. This framework includes: the selection of the REPRESENTATIVE BODY; the choice of ECONOMIC DEVELOPMENT GOALS used in the POLICY PREFERENCE ELICITA-TION MODULE; the use of the "Analytic Hierarchy Process," developed by Thomas Saaty, to develop WEIGHTS in the PRIORITIZATION MODULE; the choice of PROXIES which stand for the GOALS; and the use of a weighted average internal rate of return (ROPI) as a measure of the degree of success in achieving the GOALS.

GOALS: short for ECONOMIC DEVELOPMENT GOALS; contrasted with KTEC GOALS.

IPPBR: the Institute For Public Policy and Business Research at the University of Kansas.

KSSAM: a Social Accounting Matrix for the State of Kansas, developed by IPPBR from a variety of non-survey sources.

KSSAM MULTIPLIERS: see ECONOMIC DEVELOPMENT MULTIPLIERS.

KSSAMv1: a Social Accounting Matrix for the State of Kansas for the year 1987; the initial version of KSSAM, developed for use in the PILOT ROPI PROJECT.

KTEC: the Kansas Technology Enterprise Corporation, a quasi-public agency established by the State of Kansas to promote technology transfer.

KTEC GOALS: strategic goals adopted by KTEC, which emphasize technology transfer.

MULTIPLIERS: short for ECONOMIC DEVELOPMENT MULTIPLIERS.

OUTCOME MODULE: see REALIZED ROPI PROCEDURE.

PERSONAL WEIGHTS: see ECONOMIC DEVELOPMENT WEIGHTS.

PILOT ROPI PROJECT: the completed (1991-92) activity of developing the initial versions of the ANTICIPATED ROPI PROCEDURE and the WEIGHT EVALUATION PROCEDURE.

POLICY PREFERENCE ELICITATION MODULE: an activity using a survey instrument to interview policy-makers so as to ascertain their views about the relative importance of competing ECONOMIC DEVELOPMENT GOALS for the State of Kansas.

POST-IMPACT MODULE: see REALIZED ROPI PROCEDURE.

PROJECT SELECTION CRITERIA: the basis used for selection of economic development projects, which includes not only the general ECONOMIC DEVELOPMENT GOALS of Kansas, but also the more specific KTEC GOALS, as well as organizational capabilities and past performance of the agency.

PRIORITIZATION MODULE: a computer program which calculates a set of ECONOMIC DEVELOPMENT WEIGHTS giving the best representation of the preferences expressed by policy-makers.

PROXIES: short for ECONOMIC DEVELOPMENT PROXIES.

REALIZED ROPI: the Return On Public Investment for a project, program, or agency, when measured using information on actual results or outcomes.

REALIZED ROPI PROCEDURE: a procedure which will measure REALIZED ROPI; planned for future development during a proposed EXTENDED ROPI PROJECT. The procedure will take the ECONOMIC DEVELOPMENT WEIGHTS as given, and will consist of an OUTCOME MEASUREMENT MODULE, which gathers available data on the directly measurable outcomes of a project, program, or agency; together with a POST-IMPACT MODULE, which estimates any unmeasured indirect impacts.

REPRESENTATIVE BODY: a group of individuals who have been selected or designated to represent the informed opinions of Kansas citizens for the purpose of determining ECONOMIC DEVELOPMENT GOALS and WEIGHTS.

ROPI: (Return On Public Investment) a measure of the productivity of an economic development initiative, project or program, expressed in terms of a project-specific rate of return.

SAM: short for Social Accounting Matrix. A type of data set showing the dollar flows in a given year between different SECTORS (i.e. types of businesses, households and government units) in a particular economy. A SAM is a generalization of a type of data set known as an "Input-Output Transactions Matrix."

SECTORS: see SAM.

SCORES: short for ECONOMIC DEVELOPMENT SCORES.

SCORING MODULE: an activity using a manual to fill in tables so as to characterize direct economic effects expected from a given project. The results are known as SCORES.

WEIGHTS: short for ECONOMIC DEVELOPMENT WEIGHTS.

WEIGHT EVALUATION PROCEDURE: the manual, software, and activities for determining the ECONOMIC DEVELOPMENT WEIGHTS to be used in measuring the weighted average ROPI. Includes the POLICY PREFERENCE ELICITATION MODULE and the PRIORI-TIZATION MODULE. An initial version of this procedure was developed during the PILOT ROPI PROJECT.

2. Technical Glossary Addendum

ROPI: return on public investment, measured as an own-rate of return.

ROPI VECTOR: a set of rates of return, with respect to each of the main competing ECONOMIC DEVELOPMENT GOALS accepted in Kansas. (Measured as internal or own rates of return.)

ROPI SCALAR: a weighted average over the ROPI vector, using ECONOMIC DEVELOPMENT WEIGHTS determined by the WEIGHT EVALUATION PROCEDURE.

A-ROPI: short for ANTICIPATED ROPI. It is an expectation or *ex ante* measure.

R-ROPI: short for REALIZED ROPI. It is a retrospective or *ex post* measure.

ECONOMIC DEVELOPMENT WEIGHT VECTOR: the set of ECONOMIC DEVELOPMENT WEIGHTS. Each individual weight is associated with an ECONOMIC DEVELOPMENT GOAL.

ECONOMIC DEVELOPMENT PROXIES (comment): Each PROXY should be an extensive (aggregate) measure, usually a total of dollars or a total of jobs of a certain type.

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Index