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USERS' GUIDE TO ECONOMIC FORECASTING SYSTEMS FOR STATE POLICY DEVELOPMENT

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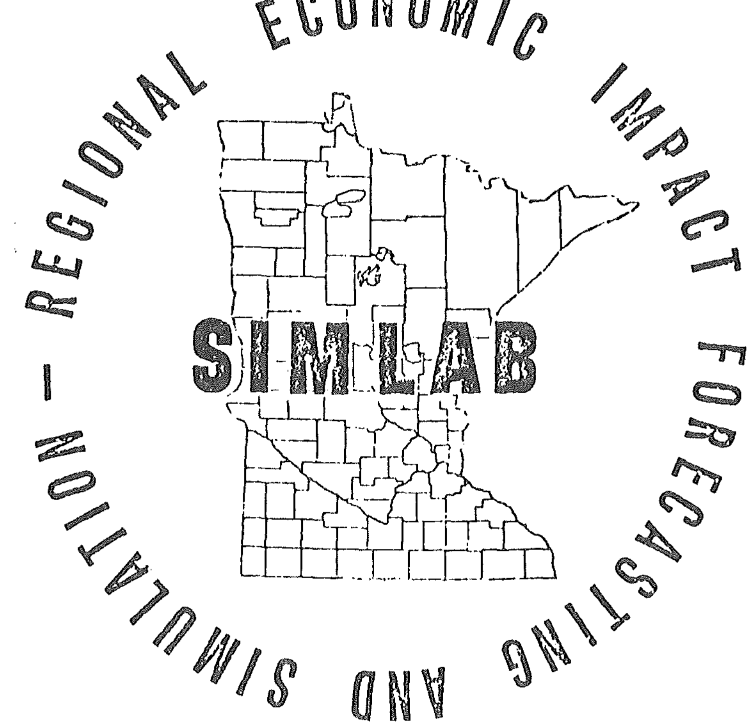

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USERS' GUIDE TO ECONOMIC FORECASTING SYSTEMS FOR STATE POLICY DEVELOPMENT [1/]

W. R. Maki, R. J. Dorf and R. W. Lichty [2/]

Over the past 20 years, regional scientists in government and the universities have participated in the development of an increasing number of state-level and state-wide forecasting and policy evaluation studies. The list of articles and books published on the results of these undertakings is in the hundreds and growing by the score each year.[3/] Activity in this area has increased to the point where the most prestigious of the private economic forecasters, including Chase Econometrics and Data Resources, now actively seek clients for an expanding range of state and substate economic forecasting services. Active competition now exists among university researchers, governmental staffs and private forecasting firms for the dollars spent for state policy impact analysis and forecasting services. This competition has greatly increased the options available to state officials when seeking such services, but the complexities of the selection process have also increased.

Critical decisions are involved in selecting among the competing systems.

1/ This report is one of a series being prepared under the Minnesota Regional Economic Impact Forecasting System (REIFS) Study. Earlier funding for the study was provided, in part, by the Minnesota Department of Administration and the Minnesota Energy Agency.

2/ The authors gratefully acknowledge the assistance of Mason Chen, Len Laulainen and Don Newell in the evaluation of SIMLAB and of R. J. Turnquist in the functional analysis of state government activities.

3/ For a partial listing of regional and state econometric and input-output models completed or reported since the mid-1960's, see "Selected References," p. 16.

The needed information must be specified, its relative worth must be determined, and a set of performance criteria for evaluating the information must be acquired. However, the development of a reasonable set of performance standards for choosing between forcasting systems has proved an exceedingly complex, if not confusing, issue for most decision makers. Technical arguments concerning accuracy, validity, reliability, and consistency of alternative forecast series are difficult to evaluate. This is further complicated by the lack of literature on the operational nature of different forecasting systems.

The use of information in decision making is a prime consideration in selecting a regional forecasting system. A state finance department, for example, depends on accurate quarterly forecasts of state revenues and cash flows and balances. A detailed industry accounting of gross state product is unnecessary and, indeed, counter-productive in providing the needed revenue forecasts. On the other hand, assessment of the regional economic impacts of extensive mining development or expansion of agriculture and related activities requires a detailed accounting of changes in industry output, employment and income associated with assumed or projected investment and production. The importance of the information in meeting resource management objectives and responsibilities thus influences the selection of the forecasting system.

This paper is an attempt to piece together the current status of operational state-level and state-wide, i.e., regional, forecasting systems in the United States and Canada. The focus is on the operational use and design of ongoing state and regional forecasting systems and how they are developing. A Minnesota economic forecasting system is presented, finally, to highlight issues in the use of such a system for economic impact analysis and forecasting.

Regional Forecasting Systems

Regional forecasting systems are available in a majority of the states and provinces of the United States and Canada (table 1). The development and maintenance of these systems occurs generally within academic institutions. Several of the systems were developed and housed in state agencies. Most of the users of operational systems are in state government.

In operational terms, the forecasting systems are grouped into two general classes -- econometric and input-output (table 2). This classification is in terms of core models and it is not exclusive in that some operational forecasting systems use a composite of both types of models. The econometric models that are operational at the state level are used primarily for revenue and expenditure forecasting. The input-output models are used to evaluate overall economic response to development or major policy changes. Econometric models which were developed initially to deal with overall economic response to policy changes have been abandoned or reformulated into input-output type systems. Segregation of forecasting responsibilities between the two systems stems from their operational characteristics.

The main operational differences between the two types of core models result from differing abilities to deal with time and a wide variety of economic issues and problems. The econometric models deal readily with discrete time intervals of short duration while input-output models are not time sensitive. In tax revenue and expenditure management, the need is for forecasts that are time specific, e.g., quarterly or yearly, or which make the econometric-type model the predominant choice. For large-scale growth and development questions, the many-faceted input-output systems have proved more flexible, especially in dealing with resource problems phrased in non-monetary terms.

Development of a fully operational regional forecasting system is an evolutionary process (fig. 1). State agency staff or university researchers typically start in a more or less random fashion, seldom from a preconceived

Table .1. Development and Use Status and Selected Artibutes of Regional Forecasting Systems, U.S. and Canada, 1976 (preliminary).

State or Province	Forecasting System: Available: Now	Available: Planned	Provider: Author	Provider: Institution: Academic	Provider: Institution: Other	Operational (in system)	User: Academic	User: Other	Core Model: Econometric: Revenue	Econometric: Other	Input-Output: Single Region	Input-Output: Multi-Region	Region: State	Region: Sub-State	Modular Construction	Data Base: Primary	Data Base: Secondary
Alabama	No	?				-											
Alaska	Yes		Haring 1/			No		X									
Arizona	Yes				X	Yes		X			X		X	X	Yes	X	X
	Yes		Martin 1/	X		No	X				X		X		No	X	X
Arkansas	No	Yes	Tu 1/			No			X				X				X
California	Yes		Lofting	X	X	Yes	X	X	X	X	X	X	X	X	Yes	X	X
	Yes		Hall 2/	X		No	X			X				X	No		X
	Yes		Martin 2/	X		No											
Colorado	Yes		Miernyk	X		No	X				X			X	No	X	
Connecticut	No	?				-											
Delaware	No	?				-											
Florida	No	Yes				-											
Georgia	Yes		Shaffer	X	X	Yes	X	X			X		X	X	Yes	X	X
	Yes		Ratajczak	X	X	Yes	X	X	X	X	X		X		No		X
Hawaii	Yes		Artle 1/	X		Yes							X			X	
Idaho	Yes		Peterson 1/	X		No	X										
Illinois	No	?			X	-					X		X		No	X	X
Indiana	No	?				-											
Iowa	Yes		Barnard 1/	X		Yes	X	X				X	X		No		X
	Yes		Barnard	X		Yes		X	X								
Kansas	Yes		Emerson 1/	X		Yes	X	X					X	X	Yes	X	X
	No			X		No				X			X		No		
Kentucky	Yes		Charlesworth 1/	X		No	X					X	X		No		X
Louisiana	No	?				-											
Maine	No	?				-											
Maryland	Yes		Harris	X		No	X				X		X		No		X
Massachusetts	Yes		Bell	X		No	X			X			X		No		X
Michigan	Yes			X		No				X			X		No		
Minnesota	Yes		Maki	X		Yes	X	X				X	X	X	Yes		X
	No	Yes	Post 1/		X	-		X	X				X		No		X
	No		Hoppe 1/	X		-	X				X			X	No	X	X
	Yes		Hughes	X		No	X				X			X	No	X	
Mississippi	Yes		Tyner	X		No	X				X		X				
Missouri	Yes		Harmeston	X		No	X				X		X		No		X
	Yes		Markland 2/	X		Yes	X			X	X			X	No		X
Montana	Yes		Hoff 1/	X		No	X			X	X		X		No	X	X
Nebraska	Yes		Lamphear	X		Yes	X				X		X		No	X	
Nevada	No	?				-											
New Hampshire	No	?				-											
New Jersey	Yes		James 2/	X		Yes				X			X		No		
New Mexico	Yes		Blumenfeld 1/	X		No	X						X		No		
New York	Yes		1/			Yes		X		X					No		
North Carolina	No	?				-											
North Dakota	Yes		Hertsgaard	X		Yes	X				X			X	No		
Ohio	Yes		L'Esperance	X	X	Yes		X		X			X		No		
Oklahoma	Yes		Dockson	X		Yes	X				X		X	X	Yes	X	X
Oregon	Yes		Youmens 2/	X	X	?	X	X			X			X	No	X	
Pennsylvania	Yes		Isard	X		Yes	X				X			X	No		X
	Yes		Glickman	X		Yes	X			X				X	No		X
	Yes		Gamble	X		No	X				X			X	No	X	
Rhode Island	No	?				-											
South Carolina	Yes		Laurent	X		Yes					X			X	No		X
South Dakota	No	Yes	Thompson	X		No						X	X		Yes		
Tennessee	Yes		Moore 2/	X		Yes	X				X		X		No	X	
Texas	Yes		Grubb		X	Yes		X			X	X	X	X	Yes	X	
	No	Yes	Halloway		X	No		X			X	X	X	X	Yes	X	
	Yes		Adams	X		Yes		X			X			X	No	X	
	Yes		Fritsch	X		Yes		X			X			X	No	X	
	Yes		George 2/	X		Yes		X			X			X	No	X	
	Yes		Hawkins	X		Yes		X			X			X	No	X	
	Yes		Murrell	X 2/		Yes		X			X			X	No	X	
	Yes		Osborn	X 2/		Yes		X			X			X	No	X	
	Yes		Stern	X		Yes		X			X			X	No	X	
Utah	Yes		Bradley	X		No											
Vermont	No	?				-											
Virginia	No	?				-											
Washington	Yes		Borque	X	X	Yes	X	X			X		X		No	X	
West Virginia	Yes		Miernyk	X		Yes	X				X		X		Yes	X	
Wisconsin	Yes		DNR		X	No		X			X		X		No	X	
	Yes		DRE 1/		X	No		X	X						No	X	
Wyoming	Yes		Matson	X		Yes	X			X			X	X	No		
Puerto Rico	No	?				-											
Northeast U.S.	Yes		Crow	X		Yes	X			X							
Alberta	No	?				-											
British Columbia	Yes																
Manitoba	Yes			X	X	No	X	X			X		X		No	X	
	Yes		MacMillan	X		Yes	X				X			X	Yes	X	
	Yes		Tung	X		Yes	X				X			X	Yes	X	
Nova Scotia	Yes		Czamanski			Yes	X						X		No	X	
Ontario	No	?				-											
Quebec	No	?				-											
Saskatchewan	Yes		Pinota	X		No					X		X		No		

1/ Documentation not available.

2/ Multiple authors.

Table 2. Comparison of Selected Attributes of Econometric and Input-Output Models in Regional Forecasting Systems.

	Econometric Model		Input-Output Model
1.	Derived from Keynesian model	1.	Derived from Walrasian model
2.	Exogenous variables obtained from national income and product accounts	2.	Exogenous variables obtained from national income and product accounts and/or national input-output accounts.
3.	Endogenous variables form regional income and product accounts	3.	Endogenous variables form regional input-output accounts; derived variables form regional income and product accounts.
4.	"Basic" economic sectors intervene between exogenous (national) variables and total (regional) income and product to "drive" regional economy.	4.	Final demand sectors (including exports) "drive" production system to yield industry gross outputs.
5.	Aggregate economic (e.g., total employment) variables are related economically to form regional model for deriving endogenous variables	5.	Disaggregated economic (i.e., industry gross input) varialbes are related technologically to form tables of technical coefficients and output "multipliers" for deriving total effects of given demand changes.
6.	Regression analysis is used to derive coefficients for forecasting model	6.	Mathematical solution (matrix inversion) is used to derive output "multipliers" for impact analysis
7.	Statistical approach is best for short-term forecasting and business cycle analysis	7.	Mathematical approach is best for simulating economy-wide effects of projected (or assumed) changes in specified ecogenous variables
8.	Estimation of model parameters and confidence intervals requires extended time series or cross-sectional data (either discrete or continuous series)	8.	Model parameters are derived from other studies; tests of statistical reliability are not available directly from computational procedures.
9.	Spatial variables are typically excluded; if included, however, they may significantly affect results, i.e., results may be sensitive to spatial to spatial consideration	9.	Spatial differentiation of industry demands and gross output variables is feasible in a multi-region representation of inter-industry relationships
10.	Non-economic aaccounts are difficult to incorporate into model	10.	Non-economic accounts readily interface input-output accounts in overall forecasting system
11.	Constrained optimization is not readily incorporated into model	11.	Constrained optimization procedures readily interface input-output procedures in overall forecasting system
12.	Time and effort involved in model implementation is slight for simple model, large for complex model	12.	Input-output tables based on primary data are costly to prepare; use of secondary data sources greatly reduces set-up costs, but, also reduces perceived reliability of model for impact analysis and forecasting
13.	Model construction is highly technical but requires minimal understanding of regional economic structure and activity	13.	Model construction (and use) reveals important technical and economic linkages and develops understanding of regional economic structure and activity
14.	An operational econometric model, including exogenous variables, represents a complete regional forecasting system	14.	An operational input-output model, including exogenous variables, represents a static economy and, hence, is only part of a regional forcasting system
15.	Add-on features require re-computation of econometric model	15.	Add-on features (i.e., additional modules) readily interface an input-output model

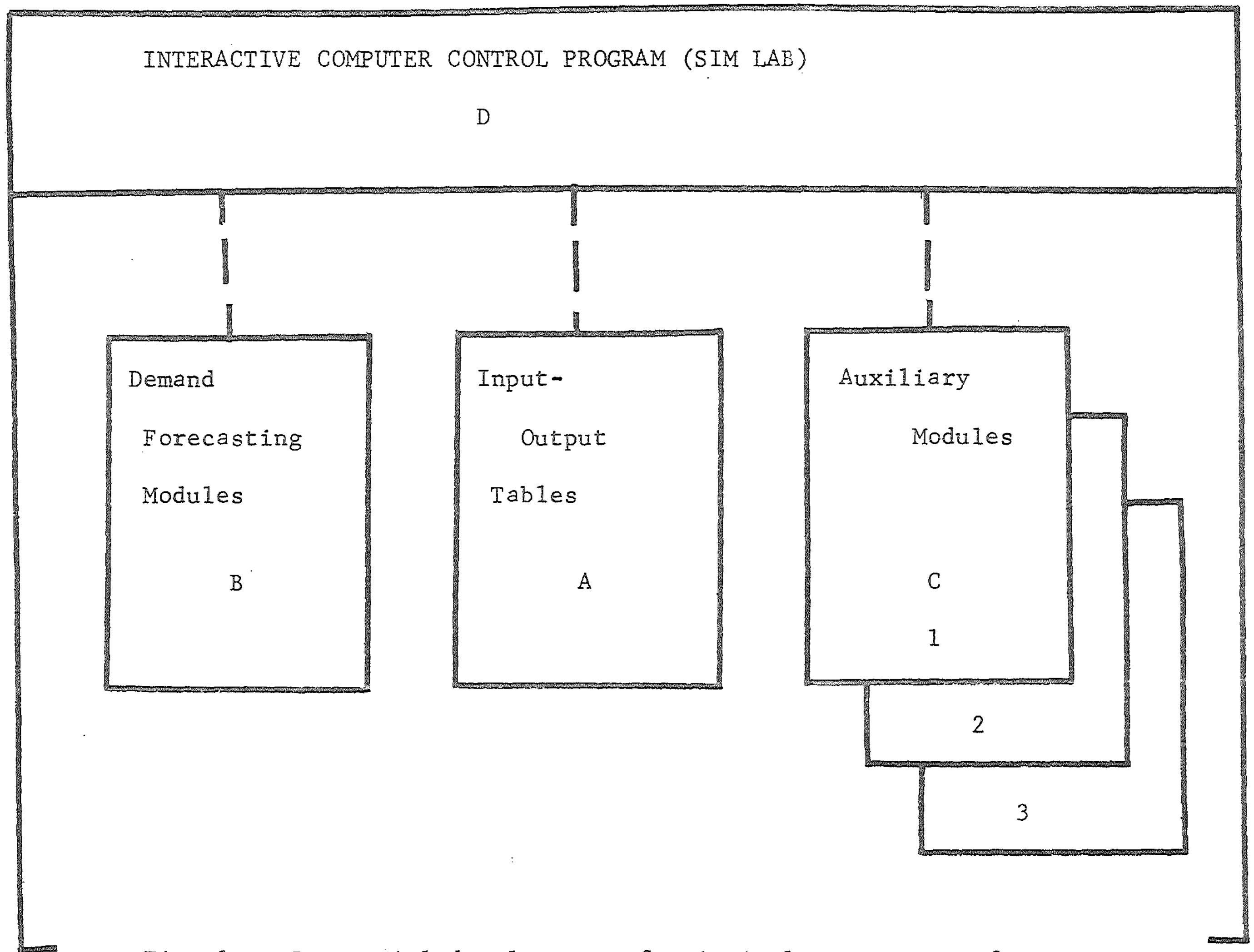

Fig. 1. Sequential development of principal components of an economic forecasting system for state policy development.

total system plan. Nontheless, the development process usually is sequential in that the input-output model is developed first, followed by the forecasting modules, a series of auxiliary modules and, most important for operational use, an interactive computer control module. This process implies, of course, that any input-output model by itself is a low-return investment as an information source. Only when the input-output model is used in conjunction with other models or components, the potential of a truly flexible forecasting and impact analysis system is achieved. However, the high cost of the core model and auxiliary modules has deterred development of completely operational input-output systems, thus resulting in widely varying levels of development and operation of regional forecasting systems from state to state.

Forecast Information Users

Using the State of Minnesota as an example, certain information users in the public sector are identified and their management functions are listed (table 3). The listing of management functions serves as a partial surrogate for a listing of information needs.[4/]

Economic forecasts of one type or another are prepared and used in projects of each one of the 16 specified State departments and agencies. The functional areas in which the projects are located range from central fiscal and administrative services to general support activities. However, a large number of the projects are concentrated in several specific areas: for example, almost nine percent deal with natural resource management. In each of these

4/ Management functions are given in each edition of the "functional analysis" prepared by the Bureau of Program Management and Budget Coordination in the Minnesota Department of Administration.

Table 3. Number of programs of selected state departments and agencies in specified functional areas, Minnesota, 1972-75. 1/

Functional Areas	Administration	Agriculture	Commerce	Econ. Development	Education	Energy Agency	Envir. Qual. Coun.	Employment Serv.	Finance	Health	Natural Resources	Pollution Con. Agency	Public Welfare	Revenue	State Plan. Agency	Transportation 2/	Water Res. Board	Other	Total
	(number)																		
Central Fiscal & Administra. Serv.																			
1. Personnel management	2	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	29	31
2. Revenue administration	0	0	1	0	0	0	0	0	0	0	0	0	0	28	0	0	0	4	33
3. Financial management	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	6	11
4. State planning	5	0	0	0	0	0	0	0	2	0	0	0	0	0	9	0	0	3	19
·State policy develop. & plan.	1	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0	0	1	9
·State govern. plan. & oper.	4	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	4	10
5. State property services	17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	25
6. Communication services	13	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	3	17
7. Services to local government	2	0	1	0	0	0	0	0	0	0	0	0	1	11	4	0	0	7	26
Protection of Persons & Property																			
8. Safety programs	0	0	0	0	0	0	0	0	0	1	2	0	0	0	0	0	0	28	31
9. Protective services	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	30	30
10. Services to local governments	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	9
Transportation																			
11. Transportation planning	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	5	0	3	10
12. System construction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	6	9
13. System operation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	4	8
14. Services to local government	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	1	0	0	4
Individual Social Development																			
15. Equal opportunity for indiv.	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	17	19
16. Legal administration	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12	12
17. Financial assistance prog.	0	0	0	0	2	0	0	1	0	0	0	0	4	0	0	0	0	26	33
18. Comm. based rehabilitation	0	0	0	0	0	0	0	0	0	0	0	0	12	0	0	0	0	6	18
19. Institutional care	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	12	18
20. Program plan. develop. &assist.	0	0	0	0	0	0	0	0	0	0	0	0	26	0	2	0	0	16	44
Environmental Management																			
21. Natural resources management	1	0	0	0	0	7	4	0	0	0	53	15	0	0	4	0	1	4	89
·Energy studies and analysis	0	0	0	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	7
·Land use studies and analysis	1	0	0	0	0	0	0	0	0	0	10	0	0	0	1	0	0	1	13
·Environ. qual. studies & anal.	0	0	0	0	0	0	4	0	0	0	8	5	0	0	3	0	0	1	21
22. Fish & wildlife management	0	0	0	0	0	0	0	0	0	0	16	0	0	0	0	0	0	0	16
23. Services to local government	1	1	0	0	0	0	0	0	0	0	9	2	0	0	2	0	1	2	18
Health Services																			
24. Medical treat. services	0	0	0	0	0	0	0	0	0	22	0	0	1	0	2	0	0	3	28
25. Health information serv.	0	0	0	0	0	0	0	0	0	8	0	0	0	0	1	0	0	1	10
·Health plan. & research	0	0	0	0	0	0	0	0	0	4		0	0	0	1	0	0	0	5
·Health statist. & pub. info.	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	1	5
26. Health standards	0	0	0	0	0	0	0	0	0	14	0	0	0	0	0	0	0	18	32
27. Services to local government	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	3
Business and Industry																			
28. Promotion of bus. & indus.	0	4	0	12	0	0	0	0	0	0	0	0	0	0	0	0	0	4	20
29. Protection of bus. & indus.	0	13	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	17	31
30. Business & indust. inform.	0	2	1	10	0	0	0	0	0	0	0	0	0	0	1	0	0	0	14
·Info. about bus. & industry	0	0	1	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7
·Info. & assist. for bus. & ind.	0	2	0	4	0	0	0	0	0	0	0	0	0	0	1	0	0	0	7
31. Services to local government	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	1	4
Educational Opportunities																			
32. Pre-school, prim. & sec. educ.	0	0	0	0	18	0	0	0	0	0	0	0	4	0	0	0	0	4	26
33. Post secondary education	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	50	51
34. Public interest educ. prog.	0	0	0	0	3	0	0	0	0	0	0	0	1	0	0	0	0	28	32
Consumer Protection																			
35. Inst. & finan. organ. & reg.	0	0	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15
36. Regulat. of prod. & standards	1	9	7	0	0	0	0	0	0	0	0	1	1	1	0	0	0	22	42
37. Busi. & industry regulations	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15	17
38. Services to local government	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Manpower Develop. & Admin.																			
39. Provision of vocat. skills	0	0	0	0	18	0	0	0	0	0	0	0	0	0	0	0	0	10	28
40. Employment information	0	0	0	0	2	0	0	9	0	0	0	0	0	0	0	0	0	6	17
·Manpower plan. & info. serv.	0	0	0	0	2	0	0	3	0	0	0	0	0	0	0	0	0	2	7
41. Labor relations	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	7
General Support	2	4	6	1	5	0	0	1	1	9	6	2	12	1	1	1	0	69	121
Total	46	33	33	26	51	7	4	17	10	58	90	20	69	41	31	14	2	435	1,014

1/ 3rd Functional Analysis. The Analysis and Description of the Activities Representing the Primary Purposes for Which the Executive Branch of State Government is Working, Compiled by the Department of Administration, Bureau of Program Management and Budget Coordination, State of Minnesota, 1976.

2/ Changed from Department of Highways to Department of Transportation in 1976.

areas, forecasts are keyed (as in the national forecasting systems) to population and labor force projections which, in Minnesota, are prepared in the Office of the State Demographer.[5/]

A focus on information use draws attention to the need for a forecasting system which relates data to decisions. Data lacks value as information without an intervening capability for analysis and interpretation. An information system includes the three related entities -- the data system, the forecasting system, and the information user.

The forecasting system, like the data system, starts with concept building. Most forecast data systems are based on statistical series built from business reports. The initial concept for these data systems originated from, or is related to, legislation, not economic theory. In the forecasting system, its development relates to both the data system --imperfect as it is-- and the information user. A forecasting model -- statistical and/or mathematical -- is built to operationalize the forecast concept. The model then is fitted and tested as a forecasting tool. Only after these steps are completed is the system operational in the sense that it provides reliable forecast output for the information user.

Along with a functional analysis of government, an input-output based forecasting system has been developed in Minnesota. The two independent, but related, efforts are brought together in an examination of specific information needs in state government and the use of the Minnesota regional

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5/ Minnesota Population Projections: 1975-2000, November 1975 and Minnesota Labor Force Projections, July 1976; State Planning Agency Division of Development Planning, 101 Capitol Square Bldg., St. Paul, MN 53701.

economic impact forecasting system in meeting the perceived information needs (table 4).

The Minnesota forecasting system is composed of all four operational elements described earlier (table 5). The computer interactive control module in this sytem is represented by the Minnesota Regional Development Simulation Laboratory -- in short, SIMLAB. A two-region matrix of 95 sectors each is used as the core input-output module. A multi-sector demand forecasting module is linked to the two region input-output tables and other operational modules -- a total of nine core and auxiliary modules. These nine modules are listed with the key operational variables used in each module. It is these modules that provide the primary economic impact forecast series for use in operational and developmental decisions within state agencies.

Detailed analysis of selected projects shows considerable expenditures for basic information acquisition and utilization. A major portion of the total expenditures was for operational, rather than developmental, data and forecasts.

Most agencies have some forecasting needs that are short and time-specific while others operate in a long-term perspective. Those agencies that have the short-term horizon are almost totally concerned with decisions affecting ongoing programs while those that deal with policy development have a non-specific time horizon. While these are not mutually exclusive conditions, one system could not meet all forecasting needs of all departments or agencies. Nor does the level of agency activity mean that an economic impact analysis and forecasting is or is not justified. The listing of the modules in SIMLAB in relation to perceived project information needs and the relation of each project to forecasting system development is presented, therefore, as a guide to potential interaction between forecasting system and information user in certain functional areas of state government, as illustrated by the

Table 4. Listing of selected department and agency projects in specified functional areas, by estimated actual cost and possible relation to socio-economic information system, Minnesota, 1972-75.

Project 1/				Possible Relation to Socio-Economic Information System 3/														
				Module Construction														
					Demand Forecasting Modules			Auxiliary Modules										
						Regional												
No.	Title	Department or Agency 2/	Actual Costs (in $1000)	Input Output	Exp. mkt.	Invest	Other	Income	Employ.	Lab. For.	Popula.	Household	Fiscal	Ecolog.	Interactive Program	Forecast Concept Dev.	Analysis and Interpret.	Forecast Output
4.01	Planning Information Base	SPA	133													P	P	U
4.02	State/Local/Regional Policy Development	SPA	334	U	U	U	U	U	U	U	U	U	U			P		U
4.03	Issue Analysis	SPA	348	U	U	U	U	U	U	U	U	U	U			P		U
4.04	State Development Planning	SPA	200	U	U	U	U	U	U	U	U	U	U		U	P	P	U
4.05	Human Resources Planning	SPA	172 4/					U	U	U	U	U	U			P		U
4.06	Commission on Minnesota's Future	Other	144 5/	U	U	U	U	U	U	U	U	U	U		U	P	P	U
4.07	Population Forecasting	SPA	89		U	U	U	U	U	P	P	P	U		U	P	P,U	U
4.08	Rural Development Council	SPA	92	U				U	U	U	U	U	U					U
4.09	Constitution Study Commission	Adm.	25 4/															U
4.10	Financial Research and Development	Fin.	795									P						
6.01	State/University Computer Projects	Adm.	604															
6.02	Minn. Analysis and Planning System (MAPS)	Adm.	89 4/					P	P	P	P	P	P					
6.03	Minnesota Educ. Computing Consortium	Educ.	2,494												P			
7.01	Intergovernmental Services	Adm.	718													P		
7.02	Technical Assistance	SPA	587													P		U
11.01	Transportation Systems Planning	Trans.	295	U		P,U	P,U	U	U	U	U	U	P,U					U
21.01	Information and Education	DNR	3,108 4/										U					U
21.02	Dev. & Main. of Cur. Stat. on Energy Flows	Energy	267	P,U										P	P	U		U
21.03	Forecasting Future Energy Supplies, Demand, Need, and Analyzing Impacts	Energy	87 5/	P,U	U	U	U	U	U	U	U	U		P,U	U	P	P,U	U
21.04	Prep. & Updating of Energy Cons. & Alloc. Plan	Energy	18 5/											P				U
21.05	Research into Alt. Sources of Fuel	Energy	3 5/											P				U
21.06	Criteria of Need for New Energy Facilities	Energy	3 4/											P,U				U
21.07	State Land Use Planning	SPA	471	U	U	U	U	U	U	U	U	U	U	P,U		P		U
21.08	Land Use Planning	DNR	336	U	U	U	U	U	U	U	U	U	U	P,U		P		U
21.09	Water and Related Land Res. Planning	DNR	343	U				U			U	U	U	P,U		P		U
21.10	Forest Inventory Surveys and Studies	DNR	1,058 6/											P,U				
21.11	Pollution Studies and Investigations	DNR	108											P,U				
21.12	Planning & Environmental Services	DNR	413											P,U		P		
21.13	Planning and Research	PCA	578 4/											P,U		P		U
21.14	Copper-Nickel Study	SPA	94	U	P,U	P,U	U	U	U	U	U	U	U	P	U	P	P,U	U
21.15	Environmental Systems Planning	SPA	462											P				U
21.16	Special Environmental Studies	SPA	389 4/											P				
21.17	Critical Areas Planning	EQC	72													P		U
21.18	Environmental Quality Council Adm.	EQC	225													P		U
21.19	Power Plant Studies	EQC	447											P				U
23.01	Solid Waste Resource Recovery	PCA	2,879											P				U
23.02	Comprehensive Envir. Cons. & Dev. Plans	Other	84 4/											U				U
23.03	Minneapolis Library Envir./Info. Center	Adm.	100											U		U		U
25.01	Comprehensive Health Planning	SPA	925					U	U	U	U	U	U			P	P,U	U
25.02	Statistical Services	Health	464								P							
25.03	Vital Record Services	Health	627								P							
30.01	Econ. Anal. of Govt. Dept./Agencies Programs and Proposals	Econ. Dev.	40	U	U	U	U	U	U	U	U	U	U		U	P	P,U	U
30.02	Econ. & Soc. Data for Mass Media and Public Ind., Libr., Stud., Travel, & Pub.	Econ. Dev.	50												U			U
30.03	Econ. Data & Anal. for State Exec. & Legis. Branches and Congr. Delegations	Econ. Dev.	23	U	U	U	U	U	U	U	U	U	U		U	P	P,U	
30.04	Community & Industry Profiling	Econ. Dev.	185	U	P,U	P,U	U	U	U	U	U	U	U		U			U
30.05	Econ. & Market Data for Mfg. Interests	Econ. Dev.	197	U	P,U	P,U	U	U	U	U	U	U	U		U			U
30.06	Grain Transit Study	SPA	22	P	P													
30.07	Crop & Livestock Stat. Reporting Serv.	Agr.	196	P	P			P										
30.08	Market News Reporting	Agr.	42		P													
31.01	Community Econ. Dev. Counseling	Econ. Dev.	246	U	U	U	U	U	U	U	U	U	U		U	P		U

1/ First two digits of numbering system correspond with functional area listing in table 3.
2/ Actual cost reported for 1972-73 and 1974-75 periods.
3/ Elements of economic forecasting system are identified in table 5. Letters refer to provider (P) and user (U) of specified data, concept, or element.
4/ Activity began in FY1974.
5/ No fiscal history available prior to FY1974-75.

Table 5. Sequence of Module Development in Minnesota Regional Economic Impact Forecasting System.

Development Stage	No. Title

A. Building input-output model

1. Production

   a. Gross output (realized)
   b. Gross output (demand limit)
   c. Gross output (output-increasing capacity limit)
   d. Gross output (pollution abatement capacity limit)
   e. Gross output (employment limit)

B. Building demand forecasting modules

2. Export Market

   a. U.S. Industry gross output
   b. Regional market share
   c. Change in regional market share

3. Investment

   a. Replacement investment, output increasing
   b. Expansion investment, output increasing
   c. Expansion investment, pollution abatement
   d. Output-increasing capital
   e. Pollution abatement capital

4. Demand

   a. Personal consumption expenditures
   b. Gross private capital formation
   c. Net inventory change
   d. Federal government
   e. State and local government

C. Building auxiliary modules

5. Income

   a. Employee compensation, by industry
   b. Indirect taxes, by industry
   c. Capital depreciation, output-increasing
   d. Capital depreciation, pollution abatement
   e. Business income (retained earnings, dividends and direct taxes)
   f. Regional imports

6. Employment

   a. Employment, by industry and occupation

7. Labor Force

   a. Total population, by age and sex
   b. Unemployed labor force, by occupation
   c. In-commuting employment, by occupation
   e. Resident employment, by occupation

8. Population

   a. Total population, by age and sex
   b. Total births, by sex
   c. Total deaths, by age and sex
   d. Total in-migration, by age and sex

9. Households

   a. Total households, by income class
   b. Total personal income, by income class
   c. Total personal income tax, by income class
   d. Total personal taxes, by income class
   e. Total personal savings, by income class

D. Building interactive computer control program

Minnesota experience.

Forecast System Development

Presented at this time as a case study in building and using a regional forecasting system is the Minnesota system cited earlier. The modular design of this system provides for systematic reduction of a highly complex regional economy into a computable model which is, then, tested and fitted to various data -- time-series, cross-sectional (including survey), and engineering. Additional modules readily interface existing modules in the total system concept. System utilization is facilitated by the modular construction and the user-activated computer programs. The SIMLAB programs make use of centralized high-speed computer facilities in the creation of alternative regional futures from any terminal hook-up in the state[6/]

Only a few state forecasting systems make use of modular construction. In SIMLAB, eight of the nine core modules are completed for several state and substate (Minnesota) regions. Under construction are the household and the fiscal modules. An energy system module will be prepared, also, along with a water industry module. Among the nine core modules, a total of 45 different sets of variables are used. The additional modules will more than double the current SIMLAB data base.

Currently, the data base for each module is developed for 1970. Nearly complete data series exist for selected years, including 1972 and 1974. When the 1972 U. S. input-output tables are available, the entire SIMLAB data base

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6/ A detailed discussion of SIMLAB operation and use in regional impact analysis and forecasting is provided in USERS' GUIDE TO SIMLAB II by W. R. Maki, L. A. Laulainen, Jr., M. Chen, and D. R. Newell, Department of Agri. and Appl. Econ.

will be updated from 1970 to 1972.

The modular approach to forecast system development facilitates the use of SIMLAB in special purpose studies, e.g., copper-nickel and peat land development in northern Minnesota and irrigated agriculture development in west central Minnesota. In each study, a two-region input-output program (based on an expanded 1970 U.S. input-output table) is used in the preparation of a 95 to 112 sector regional input-output model. The detailed sector breakdown is aggregated to a smaller number of sectors in SIMLAB--35 to 65 sectors--the maximum currently feasible.

Institutionally, the Minnesota regional economic impact forecasting system, of which SIMLAB is a part, is located at the University of Minnesota. Institutuional coordination between state agencies and the University occurs as special studies are initiated in collaboration with particular state agencies.

For state agencies planning to use the system, funding and staffing problems persist. Neither the level of agency funding nor the timing of its use is favorable for efficient deployment of system capabilities. The time frame for project completion is of such short duration that additional staff cannot be acquired and trained to carry out the proposed project tasks. The agencies which could acquire staff usually lack commitment or funding for proper staff training in system development and use. University training of students in the theoretrical foundations of the system and its operational characteristics has been minimal, hence; few trained persons have been available to state agencies. Attempts to reduce system implementation costs by combining different agencies projects into one also have failed. Different agencies have different planning time frames and different data needs. The controversy between econometric and input-output models also enters the evaluation process within each agency. Only limited effort has been made, finally, to encourage agencies with similar information needs to work together.

The changing nature of state policy development issues limits and, also, extends the use of SIMLAB. A majority part of state agency information needs, in terms of number of projects and dollar amounts, are in the fiscal and environmental areas. In this framework, the input-output based forecasting system has continued to prove its flexibility. Fiscal modules are now being developed to interface the nine core modules and the ecological modules. Existing user manuals will be expanded to cover these areas in efforts to improve the use of SIMLAB and the related data base for state policy development purposes.

Selected References

1. Adams, John W. 1972. An Input-Output Model of the Economy of Northeast Texas, Division of Planning Coordination, Office of the Governor, Austin, Texas.

2. Barnard, Jerald R. and Warren T. Dent. 1976. Regional Econometric Models and State Tax Revenue Forecasts: The Case for Iowa. The Institute for Economic Research, University of Iowa, Iowa City, Iowa 52242.

3. Bell, Frederick W. 1967. An Econometric Forecasting Model for a Region, Journal of Regional Science, Vol. 7, No. 2, pp. 190-227.

4. Borque, Philip J., Edward J. Chambers, John S. Y. Chiu, Frederick L. Denman, Barney Dowdle, Guy Gordon, Morgan Thomas, Charles Tiebout, and Eldon Weeks. 1967. The Washington Economy: An Input-Output Study, Graduate School of Business Administration, University of Washington, Seattle, Washington.

5. Crow, Robert Thomas. 1973. A Nationally Linked Regional Econometric Model, Journal of Regional Science, Vol. 13, No. 2, pp. 187-204.

6. Cumberland, John H. and Robert J. Korbach. 1973. A Regional Interindustry Environmental Model, The Regional Science Association Papers, Vol. 30.

7. Czamanski, C. 1969. Regional Econometric Models: A Case Study of Nova Scotia, In: Studies in Regional Science, A.J. Scott (ed.), Pion, London.

8. Darr, David R. and Roger D. Fight. 1974. Douglas County Oregon Potential Economic Impacts of a Changing Timber Resource Base, Pacific Northwest Forest and Range Experiment Station, Forest and Range Experiment Station, Forest Service, U.S. Department of Agriculture, Portland, Oregon.

9. Doekson, Gerald A. and Dean F. Schreiner. 1971. A Simulation Model for Oklahoma with Economic Projections from 1963 to 1980. Oklahoma Agr. Exp. Sta. Bull. B-693, University of Oklahoma, Stillwater, Oklahoma.

10. Doekson, Gerald A. and Dean F. Schreiner, 1974. Simulation of Short, Intermediate and Long Run Effects of Private Investment on Employment by Industrial Grouping, Journal of Regional Science, Vol. 12, No. 2, pp. 219-232.

11. Emerson, J., M. Jarvin with Leonard D. Atencio, Philip D. Brooks and J. David Reed. 1969. The Interindustry Structure of the Kansas Economy, Report No. 21, Office of Economic Analysis and Kansas Department of Economic Development Planning Division, Manhattan, Kansas.

12. Emerson, M. Jarvin in Association with Ronald Adams, Leonard Atencio, Duane Hockman, Richard Lichty, Forest Myers, Rose Rubin, William Speleman and Albert Winkler. 1972. Interindustry Projections of the Kansas Economy; Industry and Regional Forecasts for 1980, 1990, 2000, 2010, and 2020, Department of Economics, Kansas State University, Manhattan, Kansas.

13. Emerson, M. Jarvin. 1972. Large Scale Models in Regional Development Planning, Regional Science Perspective, pp. 1-17.

14. Fritsch, Conrad F. 1972. Agricultural Employment and Economic Growth Potential in the Lower Rio Grande Region. Texas State Office of Employment Services, Austin, Texas.

15. Gamble, Hays B. and David L. Raphael. 1966. A Micro-regional Analyses of Clinton County, Pennsylvania, Volumes I and II, Pennsylvania State University, College Station, PA.

16. George, Edward Y. et. al. 1972. Upper Rio Grande Valley Texas Interindustry Study. University of Texas, El Paso, Texas.

17. Glickman, Norman J. 1971. An Econometric Forecasting Model for the Philadelphia Region, Journal of Regional Science, Vol. 11, No. 1, pp. 15-32.

18. Grubb, Herbert W. 1973. The Structure of the Texas Economy Volumes I and II, Office of Information Services, Office of the Governor, Austin, Texas.

19. Grubb, Herbert W. and William G. Lesso. 1974. The Input-Output Model for the State of Texas, Texas Business Review, Vol. XLVIII, January, pp. 1-7.

20. Hall, Owen P. and Joseph A. Licari. 1974. Building Small Region Econometric Models: Extension of Glickman's Structure to Los Angeles, Journal of Regional Science, Vol. 14, No. 3, pp. 337-354.

21. Hamilton, H.R., et. al. 1969. Systems Simulation for Regional Analysis: An Application to River Basin Planning, Cambridge, Mass., the M.I.T. Press.

22. Harmston, Floyd K. 1968. An Inter-Sector Analysis of the Missouri Economy, 1963, Research Center, School of Business, and Public Administration, University of Missouri, Columbia, MO.

23. Hawkins, Charles F. 1972. An Input-Output Model of the Southeast Region of Texas. Lamar University, Beaumont, Texas.

24. Hughes, Jay M. 1970. Forestry in Itasca County's Economy: an Input-Output Analysis, Misc. Report 95, Forestry Series 4, Agricultural Experiment Station, St. Paul, MN.

25. Hwang, Henry H. and Wilbur R. Maki. 1976. A Guide to the Minnesota Input-Output Model. Research Bulletin (in process), Department of Agricultural and Applied Economics and Agricultural Experimental Station, University of Minnesota, St. Paul, Minnesota.

26. Isard, Walter and Thomas W. Langford. 1971. Regional Input-Output Study: Recollections and Diverse Noted on the Philadelphia Experience, the M.I.T. Press, Cambridge, Massachusetts.

27. Kendrick, John W. and C. Milton Jaycox. 1965. The Concept and Estimation of Gross State Product, Southern Economic Journal, 32, pp. 153-168.

✓28. Klein, Lawrence R . 1969. The Specification of Regional Econometric Models, Papers of the Regional Science Association, Vol. XXIII, pp. 105-115.

29. Laurent, E.A. and J.C. Hite. 1971. Economic-Ecologic Analysis in the Charleston Metropolitan Region: An Input-Output Study. Water Res. Research Institute, Clemson University, Charleston, South Carolina.

30. L'Esperance, W.L., G. Nestel and D. Fromm. 1969. Gross State Product and an Econometric Model of a State, American Statistical Association Journal, Vol. 64, pp. 787-807.

31. Lofting, E.M. and P.H. McGaughey. 1963. An Interindustry Analysis of the California Water Economy, University of California, Water Resources Center.

32. MacMillan, James A., Chang-mei Lin and Charles F. Framingham. 1975. Manitoba Interlake Area. A Regional Development Evaluation. Ames, Iowa: Iowa State University Press.

33. Maki, Wilbur R. and Ernesto C. Venegas. 1974. State Regional Economic Models for Long Range Energy Planning, p. 24-27. Staff Paper, Department of Agriculture & Applied Economics, University of Minnesota, St. Paul, Minnesota.

34. Maki, Wilbur R., et. al. 1975. Economic Data Base for Long-Range Energy Planning in Northeast Minnesota and Douglas County, Wisconsin, Regional Economic Impact Analysis Project, Sponsored by Minnesota Energy Agency, Management Information Systems Research Center, College of Business Administration, University of Minnesota, and Agricultural Experiment Station, Institute of Agriculture, University of Minnesota.

35. Markland, Robert E. and Peter J. Grandstaff. 1974. Analyzing Change in a Small Area Economy Using Computer Simulation, Simulation and Games, Vol. 5, No. 3, pp. 291-315.

36. Matson, Roger A. and Jeanette B. Studer. 1974. Simulating the Prospective Impact of Coal Development in Wyoming. Paper presented at the 6th Annual meeting of the Mid-Continent Regional Science Assoc., Duluth, Minnesota, June, 1975.

37. Miernyk, William H., et. al. 1970. Simulating Regional Economic Development: An Inter-Industry Analysis of the West Virginia Economy, Lexington, Mass., D.S. Heath Company.

38. Mullendore, Walter E., Arthur L. Ekolm and Payl M. Hayaski. 1972. An Inter-industry Analysis of the North Central Texas Region, Division of Planning Coordination, Office of the Governor, Austin, Texas.

39. Mullendore, Walter E. and Lawrence F. Ziegler. 1972. Projections of Final Demand for the North Central Texas Region, Center for Business and Economic Research, University of Texas at Arlington.

40. Murrell, C. et. al. 1972. An Input-Output Model of the Lower Rio Grande Region Input-Output Study. Texas State Division of Planning Coordination, Austin, Texas.

41. Osborn, James E. et. al. 1972. An Interindustry Analysis of the Texas High Plains. Texas State Office of Information Services, Austin, Texas.

42. Osborn, James E. et. al. 1973. An Input-Output Model Analysis of Texas High Plains Labor Employment Potentials to 1980. Texas State Office of Information Services, Austin, Texas.

43. Porter, H.R. and E.J. Henley. 1972. An Application of the Forrester Model to Harris County, Texas, IEEE Transactions on Systems, Man, and Cybernetics SMC-2, No. 2, pp. 126-134.

44. Ratajczak, Donald. 1974. Data Limitations and Alternative Methodology in Estimating Regional Econometric Models, The Review of Regional Studies, Vol. 4, No. 2, pp. 51-64.

45. Regional-Urban Studies, Inc. 1971. An Interindustry Study of the State of Maryland, Regional-Urban Studies, Inc., 7008 Wells Parkway, Hyattsville, MD, 20872.

46. Riefler, Roger and Charles M. Tiebout. 1970. Interregional Input-Output: An Empirical California-Washington Model, Journal of Regional Science, Vol. 10, No. 2, pp. 135-152.

47. Shaffer, William A., Eugene A. Laurent and Ernest M. Sutter, Jr. 1972. Using the Georgia Economic Model, The College of Industrial Management, Georgia Institute of Technology, Atlanta, Georgia, 30332.

48. Scheppach, Raymond C. 1974. The Metropolitan Council Input-Output Model, Jack Faucett Associates, Inc. 5454 Wisconsin Avenue, Chevy Chase, MD, 20015.

49. Schreiner, D.G. Muncrief and B. Davis. 1973. Solid Waste Management for Rural Areas: Analysis of Costs and Service Requirements, American Journal of Agricultural Economics, Vol. 55 (Part I), pp. 567-576.

50. Stern, Louis H. 1972. Houston-Galveston Input-Output Study for 1967. University of Houston, Houston, Texas.

51. Stern, Louis H. and Chang-lih Tung. 1973. An Investigation into the Use of the Houston-Galveston Region Input-Output Model to Make Employment Projections to 1980, Office of Information Services, Office of the Governor, Austin, Texas.

52. Tung, Fu-Lai, James A. MacMillan, and Charles F. Framingham. 1976. A Dynamic Regional Model for Evaluating Resource Development Programs. Amer. J. Agri. Econ., 58 (3): 403-414.

53. Venegas, E.C., W.R. Maki and J.E. Carter. 1975. A 1972 Structural Model of the Minnesota Economy - - Toward a Policy-Oriented Tool. Research Division, Minnesota Energy Agency, St. Paul, Minnesota.

54. Venegas, E.C. and J.E. Carter. 1976. Energy Demand Forecasting at the State Level - - the Minnesota Approach, Paper prepared for Invited Paper Session on State Energy Modelling, ORSA/TIMS 1976 Joint National Meeting, Philadelphia, PA, March 31-April 2, 1976.

55. Youmans, Russell C., David R. Darr, Roger Fight, and Dennis L. Schweitzer. 1973. Douglas County, Oregon: Sturcture of a Timber County Economy, Circular of Information 645, Agricultural Experiment Station, Oregon State University, Corvallis, Oregon.