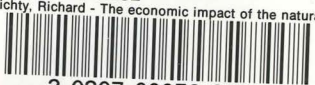


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THE ECONOMIC IMPACT OF THE  
NATURAL RESOURCES RESEARCH INSTITUTE  
ON NORTHEASTERN MINNESOTA

by

Richard W. Lichty\*

David J. McMillan\*\*

Working Paper

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## Introduction and Description of the Model

This study represents an effort to estimate the economic impact of the recently created Natural Resources Research Institute on the seven county Arrowhead Region of northeastern Minnesota. The Resource Institute represents a permanent addition to the research functions of the University of Minnesota-Duluth, facilitating an on-going effort to study and better utilize new and existing assets of the region. As such it will exert a positive impact on the local economy; both directly through the employment of a research and support staff and budget expenditures, and indirectly through short and long term benefits which accrue as a result of the research.

This paper presents estimates of the values of these impacts, in particular the direct and indirect economic benefits that the Institute will provide in 1984 and 1985. These include estimates of employment, income, population and interindustry trade impacts. Estimates of the short and long term benefits resulting from successful research on the part of the Institute are not included in this study.

In order to facilitate impact estimations, a large scale economic simulation model known as SIMLAB was employed. The model is based on an input-output system developed for the seven county Arrowhead Region, and on a series of nine interconnected modules. SIMLAB operates on a 75 industrial sector basis, reduced from a 214 sector input-output system. It is important to note that the components of final demand are included in the model as well. For the interested reader, a more complete description of the model can be found in the "Users Guide to the Minnesota Regional Development Simulation Laboratory."<sup>1</sup>

### Measuring Impacts

A researcher interested in measuring or estimating levels of economic activity within his or her region, can do so by developing a set of assumptions

about key economic variables and inserting these assumed values into SIMLAB. There are 125 parameters and variables in the model. While many of these are determined, or program created, a number are not.

Impacts are estimated against a set of assumptions consistent with present levels of economic activity and current rates of change in activity for the region. This creates what might be considered as an "all other things remaining constant," or best guess forecast of the region's economic performance. Since the model's base year is 1977, the user is able to insert actual values for certain parameters and subsequently adjust the model so regional output, employment, earnings and other key figures correspond to the genuine numbers for those previous years. Such a forecast, with all the appropriate parameters included, becomes a baseline run against which other forecasts involving modified sets of assumptions can be compared. This was precisely the methodology used in this study. In the remainder of the report, the baseline run will refer to region's economy under normal conditions. The modified run or scenario will refer to the economy with the addition of the Resource Institute.

#### Modifications and Results

The assumptions and projected rates of change incorporated into SIMLAB to form a basis for the baseline run will not be detailed or discussed in this study. The reader should be aware that while SIMLAB is not based on stochastic principles it does force the user to be consistent in his results. The researcher must be able to fully explain the outcome of changes made.

These "explanations" represent the strength of input-output based simulation. One cannot forecast large changes in output without also being able to identify and explain employment, income and population level changes. Thus, the results of parameter changes in one of SIMLAB's modules must be consistent with the computed results in all of the other modules.

In order to measure the impacts resulting from the addition of the Research Institute, a number of changes from the baseline had to be made. The timing of these changes is also crucial since, at the writing of this report, the Institute has not reached its full employment and budget expenditure levels. Its continued growth over the next several years will cause the levels of positive spinoff effects or impacts on the local economy to compound through time.

To more closely reflect reality, it was decided to simulate the addition of the Institute in the same manner, as opposed to inserting one or two lump-sum increases. Because the Institute had little or no full-time permanent employment through much of 1983, only two variables were changed in that year. First, the gross regional output for sector 75, "Government and Miscellaneous," was increased by \$600,000, the approximate budget expenditures of the Institute in 1983. Secondly, the state and local government employment to personal consumption expenditure ratio was increased slightly from .01853 to .01855.

The following assumptions were included and subsequent parameter and variable value changes were made for 1984. Gross regional output in sector 75 was again increased, this time by \$2,250,000 an amount equal to the total estimated budget of the Institute in 1984. Total employment in sector 75 was increased by 100, the estimated number of direct full and part-time jobs created by the Institute. It is important to note that SIMLAB differentiates between a full and part-time employee through a per worker earnings ratio for each industry. Therefore, the employment figures shown include both full and part-time employees, while the magnitude of the increases in terms of output and earnings take the differences between the two into effect. Total earnings for the Government and Miscellaneous sector were increased by \$1.38 million, of which \$.88 million was assumed to be full-time salary and wages and \$500,000 to be part-time earnings.

The output per worker ratio and rate of change in output per worker ratio were both modified as well. These parameters were modified in an attempt to bring the values which were in place more into line with the output per worker ratios existing in other industries. Such changes were required because government is included under two sector titles: Government Enterprises and Government and Miscellaneous. The industry covers federal, state and local government units as well as any other latter firms in the local economy that do not fit under the remaining 74 classifications. Because of this, a number of key variables in Government and Miscellaneous tend to be held at levels which are significantly lower than would be the case if the sector were comprised of government alone. The rate of change in output per worker parameter had to be changed for both 1984 and 1985 because it is a pre-determined matrix consisting of growth rates for each industry set in 3 and 5 year intervals, 1977-1979, 1980-84, 1985-90 and so on.

When considering these impact estimates it is important to keep in mind that the levels of economic activity shown in the two scenarios represent forecasted levels that are only as reliable as the assumptions upon which they are based. That is to say that this study does not represent a total analysis of the region's economic future. Indeed, the basis for the assumptions upon which these levels depend can be easily changed. Rather, this study simply compares the differences in performance of the regional economy, with the Natural Resources Research Institute, against performance without the Institute.

Tables 1 and 2 contain the comparisons of the regional economy under the baseline and modified scenarios. As one would expect, given the positive set of changes that were made, the modified run represents an increase in every economic variable measured.

While examining the impacts, it is interesting to consider where the

Government and Miscellaneous industry stands in relation to others in the area's economic structure in terms of direct requirement coefficients and demand multipliers. As discussed previously, SIMLAB is broken down into 75 individual industrial and commercial sectors. Because all the businesses which are not elsewhere classified are included with government in this sector, it was necessary to ensure that all the coefficients in the input/output system and all the parameters in SIMLAB properly reflected the sector as government. An example of this process was shown in the adjustments described earlier to the output per worker ratios for sector 75.

The input/output system shows that government ranked 8th regionally in terms of both direct requirements and demand multipliers. Thus, changes in government expenditures make a great deal of difference to northeast Minnesota.

These output multipliers form the basis for impact estimates. Tables 1 and 2 summarize these estimates. Both the baseline and modified levels as well as the difference or projected impact for each indicator are displayed.

Gross regional output represents the total value of products and services produced by the region in a given year. It is important to note that such a figure is the result of a double counting procedure inherent in input/output analysis. Both the goods and services produced for inputs to other production processes and those produced for final use are included. Hence the figure tends to be roughly twice the size obtained using income accounting procedures like those that produce the more familiar Gross National or Gross Regional Product.

At any rate, regional output under baseline conditions is estimated at a level of \$4,912,800,000 in 1984. Under these same conditions, with the addition of the Institute, regional output grows to \$4,195,300,000, an increase of \$2,500,500. Of this total, 2.25 million is directly attributable to the increased output of the same amount by the Institute. The remaining \$250,000, a

modest amount, represents the early increases in output experienced in other industries as a result of the Institute's economic impacts on the region. By 1985 however, gross regional output is seen to grow from \$4,834,200,200 on the baseline run to \$4,839,000,000 in the modified simulation. Assuming the same budget of 2.25 million for the Institute in 1985, this represents a total impact for the region of \$4,800,000 in output for that year.

Substantial increases can be seen both in regional earnings and other value added between 1984 and 1985 as a result of the Institute. Without the Institute, total regional earnings are seen to drop between 1984 and 1985 from a level of \$1,483,400,000 to \$1,461,800,000. With the Institute, the economy still experiences a decline in the absolute level of earnings. However, the economy experiences a relative increase of more than \$1.13 million in 1984 and roughly \$2.21 million by 1985. It may be noticed that the 1984 earnings impact does not represent the full \$1.38 million which the Institute has budgeted for wages and salaries. This is because SIMLAB differentiates between salaries and hourly earnings (the figures presented on the previous page) and other forms of value added such as proprietors income. When other value added is taken into account, the relative impact on earnings increases to \$2,400,000 in 1984 and nearly \$4,300,000 by the next year.

Another important indicator of economic activity is total final demand. This includes all household consumption, government spending, business inventories and private capital formation in the region. Under the baseline conditions the region's economy will have total final demand amounting to \$1,672,500,000 in 1984 while the modified scenario exhibits a final demand level of \$1,675,000,000 in this year. This increase represents a direct impact of more than \$2.50 million, and by 1985, the increase grows to \$4,602,900, a very substantial improvement for the entire economy.



Tables 1 and 2 show the individual components of final demand and the impacts which the Institute exerts on each. Total government expenditures are seen to grow by \$2,300,000 in 1984 and by \$3,600,000 in 1985 with the addition of the Institute. This is in sharp contrast to significant declines seen in the baseline simulation. Personal consumption expenditures also show encouraging impacts, especially in 1985. A significant point to be made here is that the increases seen in household spending are probably smaller than would otherwise be the case, due to the effect of making all the changes in the one government and miscellaneous sector. As a result, some portion of the final demand impacts that should be reported as household spending may show up as increased government spending.

The exact levels of employment for the new Resources Institute have been estimated at 100 for 1984 and 1985. Of this total, approximately 35 will be full-time employees of the Institute while the remainder will be comprised of various part-time or temporary employees (on an annual or semi-annual basis). With this in mind, the total regional employment impacts can be examined. The modified simulation exhibits a net increase of 108 jobs in 1984 and 214 jobs in 1985. Of these totals 100 are directly created by the Institute and the remainder represent the substantial spin-off or indirect benefits which accrue as a result of this new addition to the economy. The large impact in 1985 as compared to 1984 is due to the fact that employment growth can occur only as fast as the economic entities themselves become embedded in the structure of the region's economy. As the Institute takes hold in the regional economy, new support industries will either come into being or existing industries will expand present operations. As this process continues over the years, employment and output impacts tend to grow. Indeed it is not possible to speak of an employment multiplier as such in this particular study because it encompasses

impact estimates for only 2 years.

The industry experiencing the largest gains would be government and miscellaneous, of course, while the retail trade, health services and entertainment industries would all see substantial increases as well. Here again, the character of the sector where most of the indirect employment gains created by the Institute will be experienced prevents a more detailed analysis of the impacts. Because the Institute will be involved in a great detail of speciality research, many of its supplying industries are themselves included in the miscellaneous category. The fact remains, however, that approximately 214 full and part-time jobs will likely be created in northeast Minnesota by 1985 with the addition of the Natural Resources Research Institute.

One final aspect of this study should also be mentioned, and that is the demographic impact which the Institute will have on our region. At present, the Arrowhead region is in the midst of a rather steady population decline, resulting primarily from a deteriorating traditional industry base. While the addition of the Institute to the local economy will not have a strong effect on this trend, it is pertinent to note that of the 108 new jobs in 1984, approximately half of them (50) will come from outside the region and the remaining 58 from the labor force existing in the region at the present time. In 1985, somewhat more than half of the total employment increase will likely come from outside the region.

All in all, the impacts exerted by the Natural Resources Research Institute on the local area will be very significant in the years to come; producing strong positive increases in all the important indicators of economic activity. It is very important to note that these impacts in no way represent a measurement of additional industrial expansion in the region resulting from successful research on the part of the Institute.

TABLE 1

COMPARISON OF SELECT ECONOMIC INDICATORS  
1984

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	<u>BASELINE</u>	<u>MODIFIED</u>	<u>IMPACT</u>
Gross Regional Output \$	\$4,912,800,000	\$4,915,300,000	\$2,500,000
Earnings	1,483,400,000	1,484,500,000	1,100,000
Other Value Added	1,027,300,000	1,028,600,000	1,200,000
 Total Final Demand	 1,672,500,000	 1,675,000,000	 2,400,000
Pers. Consumption Exp.	1,103,300,000	1,103,500,000	167,400
St. & Loc. Gov't. Exp.	389,000,000	391,000,000	
Federal Gov't. Exp.	<u>48,600,000</u>	<u>48,800,000</u>	
Total Gov't. Exp.	437,500,000	439,200,000	2,300,000
 Total Employment	 122,620	 122,728	 108
Population	332,320	332,370	50

TABLE 2

COMPARISON OF SELECT ECONOMIC INDICATORS  
1985

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	<u>BASELINE</u>	<u>MODIFIED</u>	<u>IMPACT</u>
Gross Regional Output \$	\$4,834,200,000	\$4,839,000,000	\$4,800,000
Earnings	1,460,000,000	1,470,000,000	2,200,000
Other Value Added	1,007,400,000	1,009,500,000	2,100,000
 Total Final Demand	 1,642,400,000	 1,647,000,000	 4,600,000
Pers. Consumption Exp.	1,084,000,000	1,085,000,000	990,000
St. & Loc. Gov't. Exp.	383,200,000	386,500,000	
Federal Gov't. Exp.	<u>47,800,000</u>	<u>48,400,000</u>	
Total Gov't. Exp.	431,100,000	434,700,000	3,600,000
 Total Employment	 119,505	 119,719	 214
Population	328,281	328,407	126

## References

1. Maki, W. R., Meagher, P. D. Laulainen, L. A. and M. Chen, "User's Guide to the Minnesota Regional Development Simulation Laboratory," REIFS Report No. 8, St. Paul, 1979