

Economic Opportunity Analyses: A Case Study

(a very rough draft)

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Abstract

Economic opportunity analysis is an alternative to industrial targeting. The goal of economic opportunity analyses is to identify sectors which will bring maximum benefits to a particular region using a five step process. These steps include: (1) identifying the region's preferences for economic, social and environmental and other outcomes, (2) estimating the potential contribution of various industries to the region's preferences; (3) calculating the desirability of the sectors given the region's preferences; (4) identifying the region's attractiveness to particular industries, and 5) identifying strategies for increasing the region's attractiveness to the highest ranked sectors.

The utility of this method is tested and demonstrated with a case study in Virginia's New River Valley. First, a preference elicitation technique was used to develop weights for a range of potential economic, fiscal, environmental and other outcomes.

Sectors were then screened to eliminate all but *footloose* sectors - those not tied to resources such as farming or mining. Next the strength and quality of linkages between the qualifying sectors were measured using IMPLAN **and** the qualifying sectors were ranked on the basis of these and other characteristics.

Using various impact tools, including IMPLAN, the potential sectors are analyzed to determine their relative contributions to various economic, fiscal and environmental criteria.

Finally, the region's attractiveness to each potential sectors was measured and conclusions drawn regarding the best strategies for attracting targeted sector.

Economic Opportunity Analyses: A Case Study

Background

Many economic development agencies of state and local governments, in the face of a bewildering array of potential industrial targets and no coordinated and comprehensive economic development strategies, have been attracted by the siren call of industrial targeting studies offered by economic development consultants. It is often hoped that industrial targeting reports will bring some rationality and higher return to the commonly used economic development tools—shell buildings, infrastructure investments, local marketing boards, tax abatements and tax credits.

The typical target industry study starts with an overview of the subject region or community including a review of its economic base and possibly its available infrastructure, but ignores many of the unique and fundamental characteristics of the region—the preferences of residents, the attractiveness of the place to various sectors, and the impacts of various sectors on local variables.

This paper describes a more comprehensive approach to economic development strategies, here referred to as economic opportunity analysis, but which falls within what has recently been referred to as Targeted Regional Economic Development or TRED.

The goal of economic opportunity analyses is to identify sectors which will bring maximum benefits to a particular region using a five step process. These steps include: (1) identifying the region's preferences for economic, social, environmental and other outcomes, (2) estimating the potential contribution of various industries to the criteria included in the region's preferences; (3) calculating the desirability of the sectors given the region's preferences; (4) identifying the region's attractiveness to particular industries, and 5) identifying strategies for increasing the region's attractiveness to the highest ranked sectors.

The utility of this method is tested and demonstrated with a case study in Virginia's New River Valley. The research upon which this paper is based, occurred over a period of several years and several different but related projects (Bailey, 1996; Cox, 1996; Cox, et al., 2000; and Johnson, et al., 1994). This paper summarizes the lessons learned in this series of research projects and draws heavily from an unpublished report to the New River Valley Economic Development Commission (Johnson et al., 1994).

The Method

Economic opportunity analysis is based on the concept of a local social welfare function that is some function of the utility functions of individual residents of the region being studied. In order to approximate this social welfare function, a preference elicitation technique is used to develop weights for a range of potential economic, fiscal, environmental and other outcomes.

Considering the amount of money spent annually on local economic development programs, it is interesting how little research has examined community preferences for economic development outcomes. Community preferences matter. According to the Tiebout hypothesis, over time,

regions tends to attract residents to their particular mix of place-based attributes. Thus different places will have different preferences for these attributes, including those affected by economic development. Economic development outcomes, regardless of the program or policy in question, are felt locally in a number of ways and differ depending on the industry and local economic structure. Impacts include environmental changes, economic changes, increased population, increased demands for public services, increased congestion, changes in property values, etc. Evaluating the desirability of these different outcomes represents a form of multi-attribute decision-making.

Knowledge of these preferences can be used to target industries for certain localities as a part of a proactive economic development program. This knowledge can also be used to structure the development packages themselves. Development packages, whether tax abatements, shell buildings, or community marketing will affect the nature of the development outcome.

In the case study reported here, the analytical hierarchy process (AHP) is used to create cardinal weights for different local impacts of economic development outcomes based on interviews of local decision leaders. The weights derived from AHP are consistently derived and theoretically sound.

Sectors are then screened to eliminate all but *footloose* sectors - those not tied to resources such as farming or mining. Truly market oriented, or factor oriented firms cannot be influenced by factors other than the potential markets and the availability of factors of production. The remaining sectors are footloose and thus able to choose their location on the basis of policy relevant factors. It is important to recognize that the list of footloose sectors is growing all the time because of technological change. It is also important to remember that even market characteristics and factor characteristics may be influenced by policy.

Next the strength and quality of linkages between the qualifying sectors were measured using IMPLAN **and** the qualifying sectors were ranked on the basis of these and other characteristics.

Next, the critical development impacts of industry locations are identified and quantified for each of several "industries" that survive the initial screening. The final step involves applying the weights to the measured attributes of each industry to derive a community-specific measure or score for the industries. Using various impact tools, including IMPLAN, the potential sectors are analyzed to determine their relative contributions to various economic, fiscal and environmental criteria.

Finally, the region's attractiveness to each potential sectors was measured and conclusions drawn regarding the best strategies for attracting targeted sector.

Preference Elicitation

Since development outcomes are multi-dimensional, a means of weighting these dimensions is needed in order to rank the events that cause the outcomes. Following Cox et al. (2000), if

community preferences were known over the K impacts of an event (industry recruitment, for example), then scoring each of the $j=1\dots J$ industries would be straightforward:

$$\mathbf{S}_L = \mathbf{I}_L^* \cdot \mathbf{w}_L^*, \quad (1)$$

where \mathbf{S}_L is a $J \times 1$ vector of scores the J industries receive from the L^{th} community, \mathbf{I}_L^* is a $J \times K$ matrix of impacts of the J industries on the L^{th} community¹, and \mathbf{w}_L^* is a $K \times 1$ vector of weights of the K impacts by the L^{th} community. In general, the \mathbf{I}_L^* matrix will depend on the economic structure of the community (see, for example, Siegel, Alwang, and Johnson, 1995 a & b).

A major shortcoming of many weighting systems is the reliance on *ad hoc* scoring methods that do not adhere to basic principles. The less rigorous techniques include ordinal ranking or fixed point scoring. These methods are simple to use, but may lead to erroneous conclusions. As Cox et al. (2000) point out, these approaches “frequently lack rigor, have no theoretical basis, and are fraught with inconsistencies in assigned weights.”

The Analytic Hierarchy Process (Saaty, 1980) is a means of weighting impacts by analyzing peoples revealed preferences. AHP is a proven means of eliciting consistent and transitive preferences. They have also developed software that can be used with groups (Cox et al.).

Economic Impacts (attractiveness of the industry to the place)

Several tools were used in these projects to estimate the differential consequences of various industrial sectors. IMPLAN (a commercial input-output model) was used to identify industries that would bring the most benefits to the region, and to develop a series of sectoral multipliers for measuring linkages. The Virginia Impact Projection (VIP) model was used to measure the fiscal impacts (changes in value of public services, local government budget demands, and public revenues) of selected industries.

IMPLAN

IMPLAN (Impact Model for PLANing), an input-output modeling system originally developed by the U.S. Forest Service and now built and marketed by MIG Inc., was used to generate a series of economic multipliers for the New River Valley. IMPLAN provides multipliers for any of 528 sectors. When a new firm is anticipated in a sector for which there is no current firms, the IMPLAN system can be adjusted to include the new sector.

Virginia Impact Projection Model

The Virginia Impact Projection (VIP) Model uses statistically estimated relationships to predict changes in social and fiscal conditions of the New River Valley under altered economic conditions, such as changes in employment, real property tax base, personal property tax base, retail sales and total income. Estimated changes in total employment, total income, total retail

¹ Each element, \mathbf{I}_{Lij}^* , of \mathbf{I}_L^* represents the j^{th} impact that the i^{th} firm has on community L . For example, it might be the total change in migration attributable to the location of a rubber factor in Montgomery County, VA.

sales (based on direct employment increases for selected target industries), were obtained from the IMPLAN input-output model. Changes in the real property and personal property tax base were estimated on the basis of national statistics on employment levels per business establishment, and the level of investment per business establishment.

These estimates were entered into the VIP model to project changes in local government revenues and expenditures, as well as Net Public Service Benefits (NPSB) from 1994 through 2003. Impact projections are assessed on the basis of differences between estimated baseline levels (without a change in economic conditions, and steady rate of growth) and projected levels (with a change in economic conditions). Fiscal impact analysis is useful in determining whether induced increases in public service demands are balanced by corresponding equivalent increases in revenues generated.

Local expenditure decisions are made in response to increasing cost of, or demands for, public service provision. An increase in public expenditures when real costs rise can be interpreted as an effort to maintain a level of service. However, an increase in public expenditures may also reflect higher quantities of service provided, if improvements in quality are realized, such as higher pupil-student ratio or a greater percentage of crimes solved. Net Public Service Benefits (NPSB) is an estimate of actual benefits realized as increases or decreases in public expenditures are incurred. In other words, the NPSB measure indicates the change in the value of the services delivered by the local government to the community. A positive NPSB represents a benefit to the community.

Industrial attractiveness (attractiveness of the place to the industry)

The NorthEast Economic Development System (NEEDS) was used to estimate the attraction of the region to selected manufacturing, and needed desirable improvements in the region's "economic development infrastructure" - its natural, human, social, and man-made capital resources which influence the location and investment decision of employers. These analyses will enable policy makers to compare the following features for each industry: (1) the likelihood of it locating or growing in the New River Valley, (2) the degree to which it would be linked to the regional economy, (3) growth prospects for the sector, and (4) benefits and costs of the sector to the region.

NEEDS Model

The Northeast Economic Development System (NEEDS) provided information about how manufacturing firms perceive nonmetropolitan communities as an area to locate, based on factors such as market potential, input availability, current industrial composition, per capita incomes, tax rates, service structure and general population characteristics. The model was used to identify the region's attractiveness to target industries, and determine the characteristics that attract these firms. The system was applied to eight communities in the New River Valley region-Blacksburg, Christiansburg, Dublin, Narrows, Pearisburg, Pembroke, Pulaski, and Radford.

Based on community profiles of the New River Valley communities, choice indices or attractiveness scores indicate which industries are most attracted to the local economy, and measure the likelihood that these industries will locate in the New River Valley. Community attributes that tend to encourage or discourage capital investment by the private sector were evaluated for the region, and the more likely industry prospects were identified.

The results should provide local decision makers with a better understanding of complex interaction of industries within the New River Valley. Naturally, the models applied in this study cannot predict with 100 percent accuracy the fiscal or economic impacts of various scenarios (economic stimuli); however, the methods employed are robust in determining an objective ranking of those scenarios, which have the highest and lowest benefit to the region. Therefore, it is incumbent on the reader to interpret the results with some latitude.

Application of Economic Opportunity Analysis to the New River Valley

Initial Screening of Sectors

Seventy-three traditional and visionary industries were identified as potential sectors for the New River Valley. The target industry selection process entailed screening for those sectors which are footloose and have the potential of promoting economic growth and development in the area. By examining each sector's contribution of income per person, total income per dollar of output, growth rate, and total employment per million dollars of output. Data on these criteria were obtained from the IMPLAN input-output model and other sources.

- **QUALITY OF JOB** is defined here as "Direct plus Indirect Wage Income per Employee." It includes the linkages because multipliers have been applied. Industries that have the highest income per person include semiconductors and related devices (\$39,603), fabricated plate work (\$33,591), noncellulosic organic fibers (\$30,818), industrial organic chemicals (\$30,382), and doctors and dentists (\$29,172). For all 74 industries considered, the median level of income per person is \$23,130, and the minimum level of income per person is \$12,482 (wood kitchen cabinets).
Criteria Weighted: 40 percent
- **ECONOMIC BENEFITS PER DOLLAR OF SALES** is measured by the "Direct plus Indirect Wage and Property income per dollar of Output." It includes the linkages and incorporates the impact on business owners, land owners, investors as well as workers. Industries that have the highest total income per dollar of output include nursing and protective care (\$1.53), elementary and secondary schools (\$1.42), hotel and lodging places (\$1.17), and doctors and dentists (\$1.01). For all 74 industries considered, the median level of total income per dollar of output is \$.68, and the minimum level of income per person is \$.32 (metal cans).
Criteria Weight: 30 percent
- The **GROWTH RATE** is based on a ten-year average annual growth in employment, by two digit SIC. Some four digit sectors will grow faster than others within any two digit sector. Part of the lack of growth in some sectors is due to increased productivity of labor

and should therefore be given less weight. The highest employment growth rate (14.74 percent) prevails among durable goods manufacturing industries such as, search and navigation equipment, optical instruments and lenses, ophthalmic goods, automatic temperature controls, mechanical measuring devices, photographic equipment and supplies, surgical and medical instruments, surgical appliances and supplies, and watches and clocks. Non-durable goods manufacturing industries have sustained the most rapid decline in employment, an annual rate of -2.43 percent. This industrial classification includes noncellulosic organic fibers, industrial organic chemicals, explosives, cellulosic man-made fibers, plastic materials and resins, inorganic pigments, and drugs. The median employment growth rate for all industries is 1.7 percent.

Criteria Weight: 20 percent

- **EMPLOYMENT POTENTIAL** is measured by total employment per million dollars of output. It is a measure of linkage, and employment effects of each sector. Obviously, low wage, high employment sectors will score high so this criterion should be weighted less, or only used for higher wage sectors. Industries that rank high under this criteria include elementary and secondary schools (90.07), nursing and protective care (89.75), and hotels and lodging places (64.98). For all industries considered, the median employment per dollar of sales is 24.85, where the minimum is 6.05 (industrial and organic chemicals).
Criteria Weight: 10 percent
- **INTERNATIONAL COMPETITIVENESS** is an evaluation based on recent international trade trends and government forecasts. This criterion examines recent changes in employment, value of shipments, capital investments, total imports, and total exports. The evaluation scale rates international performance in terms of the following categories: excellent, very good, good, fair, poor, and very poor.
- **LONG-TERM GROWTH PROSPECTS** evaluates projected industry growth in the face of international competition, regulatory constraints, technological changes, and future market demand. The evaluation scale rates long-term growth prospects in terms of the following categories: excellent, very good, good, fair, poor, and very poor.
- **ENVIRONMENTAL CONCERNS** evaluate the potential environmental impacts of selected industries based on common industry practice and known by products. The evaluation scale rates environmental concerns in terms of the following categories: severe, many, few, not applicable, and not available.

The quantitative screening criteria are listed in order of perceived importance and have been reviewed by the New River Valley Planning District staff. The screening process utilized a subjective weighting system based on the economic objectives of the region. It was decided that 40-30-20-10 percent scale would be used to reflect the relative importance of each criteria. Although the weighting assignments were highly subjective, the final decision was based on the expert opinions and intuitive experience of the consultants, and the Planning District Commission staff. Different weighting assignments would logically reorder the target industries list. However, it was the opinion of the consultants and the Planning District Commission that attracting high quality jobs with strong linkages is consistent with the localities economic

development objectives. The subjective screening criteria were not weighted due to the highly subjective nature of these categories and the lack of available data. The findings were interpreted from the U.S. Department of Commerce publication entitled, *U.S. Industrial Outlook*, 1993.

Five SOCIAL RESPONSIBILITY INDICATORS not used in the target industry selection process were (1) treatment of employees, (2) equal opportunity, (3) environmental protection procedures, (4) community relations, and (5) ethical business practices. These indicators are recommended for recruiting of specific companies that are being considered for public subsidies or other assistance, and responsive to the social needs of the community.

Results of Industry Screening Process

The average QUALITY OF JOB for all industries, as measured by direct and indirect wage income per employee, was \$18,000. Industries that are characterized as low wage (i.e. below \$18,000) and yielding low economic benefits per dollar of sales (less than .9) were discarded, and industries characterized as high wage (greater than or equal to \$30,000) were retained for further consideration. In the next phase of the screening process, industries were excluded if they failed to meet at least two of the following three criteria: (1) scored greater than 0.8 on ECONOMIC BENEFITS PER DOLLAR OF SALES; (2) had a positive growth rate; and (3) created more than 20 employees per million dollars of output (EMPLOYMENT POTENTIAL).

The final results of the industry screening process should not be interpreted as an exhausted list of potential target industries. As the New River Valley continues to experience economic growth and development, all jurisdictions should continue to explore other economic opportunities. However, the following list represents those industries that possess either strong economic linkage with the New River Valley, are positive growth industries, or produce the type of high quality jobs that the region desires.

Table 1: Normal Scores for Industry Selection Criteria

SIC	Sector	Income Per Person (40%)	Z Score	Total Income Per \$ Output (30%)	Z Score	83-93 Growth Rate (20%)	Z Score	Total Employ Per \$M Output (10%)	Z Score	Industry Index	RANK
2421	Sawmills and Planing Mills, General	18,734	-0.88	0.56	-1.09	1.74	-0.85	21.52	-0.38	-88.71	29
2452	Prefabricated Wood Buildings	18,553	-0.91	0.66	-0.67	1.74	-0.85	21.52	-0.38	-77.31	28
2824	Organic Fiber, Noncellulosic	30,818	1.11	0.56	-1.09	-2.43	-1.57	13.67	-0.77	-27.59	22
2869	Cyclic Crudes, Interm. & Industrial Organic Chemicals	30,382	1.04	0.4	-1.76	-2.43	-1.57	6.05	-1.16	-54.40	27
3053	Gaskets, packing, and Sealing	24,355	0.05	0.83	0.04	4.66	-0.35	21.4	-0.39	-7.79	17
3080	Misc. Plastics Products	21,276	-0.46	0.69	-0.55	4.66	-0.35	21.08	-0.40	-45.80	26

SIC	Sector	Income Per Person (40%)	Z Score	Total Income Per \$ Output (30%)	Z Score	83-93 Growth Rate (20%)	Z Score	Total Employ Per \$M Output (10%)	Z Score	Industry Index	RANK
3443	Fabricated Plate Work	33,591	1.56	0.7	-0.50	-0.66	-1.27	19.57	-0.48	17.30	12
3471	Plating and Polishing	23,507	-0.09	0.79	-0.13	8.3	0.28	26.19	-0.15	-3.46	14
3543	Industrial Patterns	25,860	0.29	0.97	0.63	8.3	0.28	33.65	0.22	38.38	8
3545	Special Dies and Tool and Accessories	22,206	-0.31	0.91	0.38	8.3	0.28	32.49	0.17	6.24	13
3562	Ball and Roller Bearings	24,170	0.02	0.69	-0.55	8.3	0.28	20.54	-0.43	-14.51	19
3599	Industrial Machines	23,493	-0.10	0.79	-0.13	8.3	0.28	26.19	-0.15	-3.55	15
3674	Semiconductors and Related Devises	39,603	2.55	0.61	-0.88	-1.47	-1.41	18.81	-0.52	41.31	5
3713	Truck and Bus Bodies	23,704	-0.06	0.73	-0.38	0.54	-1.06	20.54	-0.43	-39.28	24
3812	Search & Navigation Equipment	28,981	0.281	0.71	-0.46	14.74	1.39	15.86	-0.66	39.47	7
3827	Optical Instruments & Lenses	28,977	0.81	0.64	-0.76	14.74	1.39	16.8	-0.62	31.11	9
3860	Photographic Equipment and Supplies	26,772	0.44	0.72	-0.42	14.74	1.39	14.99	-0.71	25.78	10
3822	Automatic Temperature Controls	27,330	0.54	0.95	0.55	14.74	1.39	32.95	0.19	67.37	1
3829	Mechanical Measuring Devises	26,937	0.47	0.81	-0.04	14.74	1.39	20.16	-0.45	40.77	6
3841	Surgical and Medical Instruments	22,286	-0.29	0.65	-0.71	14.74	1.39	21.74	-0.37	-9.13	16
3842	Surgical Appliances and Supplies	19,764	-0.71	0.69	-0.55	14.74	1.39	22.85	-0.32	.20.12	20
3850	Ophthalmic Goods	27,808	0.61	0.9	0.34	14.74	1.39	26.72	-0.12	61.10	2
4890	Communications except Radio	25,350	0.21	0.87	0.21	1.9	-0.83	13.77	-0.77	-9.54	18
7000	Hotels and Lodging Places	13,920	-1.67	1.17	1.47	1.69	-0.86	64.98	1.79	-22.03	21
8040	Doctors and Dentists	29,172	0.84	1.01	0.80	5.31	-0.24	25.7	-0.17	50.90	4
8050	Nursing and Protective Care	14,507	-1.57	1.53	2.98	5.31	-0.24	89.79	3.03	52.01	3
8060	Hospitals	19,050	-0.83	0.8	-0.08	5.31	-0.24	33.96	0.24	-37.91	23

SIC	Sector	Income Per Person (40%)	Z Score	Total Income Per \$ Output (30%)	Z Score	83-93 Growth Rate (20%)	Z Score	Total Employ Per \$M Output (10%)	Z Score	Industry Index	RANK
8210	Elementary and Secondary Schools	12,612	-1.88	1.43	2.56	4.47	-0.38	90.071	3.041	24.221	11
8220	Colleges, Universities, Schools	14,360	-1.60	0.95	0.55	4.47	-0.38	52.1	1.15	-43.68	25
	TOTAL	698,078		23.72		194		846			
	AVERAGES	24,072		0.82		6.70		29.16			
	STANDARD DEVIATIO	6,087		0.24		5.80		20.01			

Data obtained for the first four criteria described above were normalized (observations adjusted for the mean and variance) , and the resulting Z scores for each criteria were multiplied by respective weights and summed. The standardized series of observations was ranked in descending order to establish meaningful comparisons of performance levels among target industries. Based on this weighting scheme, the highest scoring industries were:

1. Wood Buildings and Mobile Homes (245) - *Prefabricated Wood Buildings (2452)*,
2. Plastics Materials and Synthetics (282) - *Noncellulosic Organic Fibers (2824)*,
3. Drugs (283) - *Diagnostic Substances (2835)*,
4. Hose and Belting and Gaskets and Packing (305) - *Gaskets, Packing and Scaling (3053)*,
5. Miscellaneous Plastic Products (308) - *Miscellaneous Plastic Products (3080)*,
6. Fabricated Structural Metal Products (344) - *Fabricated Plate Work (3443)*, *Plating and Polishing (3471)*.
7. Metalworking Machinery (354) - *Industrial Patterns (35"43)*, *Special Dies and Tools and Accessories (3545)*,
8. General Industrial Machinery (356) - *Ball Bearing and Roller Bearings (3562)*,
9. Industrial Machinery (359) - *Industrial Machines (3599)*,
10. Electronic Components and Accessories (367) - *Semiconductors and Related Devices (3674)*,
11. Motor Vehicles and Equipment (371) - *Truck and Bus Bodies (3713)*,
12. Search, Detection, Navigation Equipment (381) - *Search and Navigation Equipment (3812)*,
13. Measuring and Controlling Devices (382) - *Optical Instruments and Lenses (3827)*, *Automatic Temperature Controls (3822)*, *Mechanical Measuring Devices (3829)*,
14. Medical Instruments and Supplies (384) - *Surgical and Medical Instruments (3841)* , *Surgical Appliances and Supplies (3842)*,
15. Communication Services (489) - *Communications Except Radio (4890)*.

Sectors such as cyclic crudes, industrial organic chemicals, ophthalmic goods, and photographic equipment and supplies were highly ranked with respect to all selection criteria but were

excluded from the list of target industries on the basis of environmental considerations or required resources that are not present in the New River Valley.

Attractiveness of the New River Valley

Among the sectors included in the NEEDS model, those most attracted to the New River Valley are measuring and controlling devices, plastics, hose, belting, gaskets and packing, and electrical components. Attractiveness scores for twelve of the target industries for the eight communities are presented in Table 2. Given the available human, natural and physical resources within each jurisdiction, the relative magnitude of the attractiveness scores (.80 versus .11) indicates that Blacksburg is more attractive measuring and controlling device industries than Pembroke. Since the attractiveness of the New River Valley is at most comparable to the most attractive jurisdiction in the region, the highest attraction score for each industry is noted in the right hand column of Table 2.

There are a number of community variables specified in the NEEDS model for generating attraction scores. The proportion of population over with a college degree, and proportion of population employed in manufacturing are labor quality indicators. Some of the demographic variables featured in the model are male and female labor force participation rates, and proportion of population living in same county in 1 and 10. Distance to Standard Metropolitan Statistical Areas SMSA, complexity of service structure market related variables. The direction of influence (positive or negative these variables have on the formation of attraction scores is presented in Appendix B.

Table 2: Attraction Scores For Industries In The New River Valley

Industries	Blacksburg	Christiansburg	Dublin	Narrows	Pembroke	Pearisburg	Pulaski	Radford	Maximum Score
Measuring and Controlling Devices	0.80	0.24	0.17	0.17	0.11	0.13	0.27	0.41	0.80
Electrical Components and Accessories	0.60	0.19	0.19	0.19	0.13	0.15	0.21	0.33	0.60
Metalworking Machinery	0.23	0.16	0.12	0.14	0.11	0.11	0.22	0.19	0.23
Search, Detection, Navigation Equipment	0.29	0.11	0.08	0.05	0.04	0.06	0.11	0.16	0.29
Fabricated Structural Metal Products	0.39	0.36	0.25	0.23	0.19	0.22	0.37	0.46	0.46
Industrial Machinery	0.12	0.12	0.09	0.07	0.09	0.08	0.11	0.15	0.15
Hose, Belting Gaskets & Packing	0.63	0.61	0.36	0.19	0.38	0.37	0.60	0.50	0.63
Plastic Materials and Synthetics	0.63	0.61	0.36	0.19	0.38	0.37	0.60	0.50	0.63
Motor Vehicles and Equipment	0.27	0.24	0.19	0.20	0.22	0.19	0.28	0.31	0.31

Misc. Plastics Products. N.E.C.	0.63	0.61	0.36	0.19	0.38	0.37	0.60	0.50	0.63
Diagnostic Substances	0.25	0.05	0.05	0.04	0.04	0.04	0.06	0.11	0.25
Wood Building and Mobile Homes	0.45	0.33	0.34	0.34	0.31	0.31	0.35	0.44	0.45

Electrical components and measuring instruments industries demand a high quality work force. Since the college educated account for a large segment of population in the New River Valley, these industries are attracted to the area. Factors which increase the likelihood of attracting measuring instruments is an above average community population, relatively large percent of local population with a college degree, and a high male participation rate in the workforce. Blacksburg and Radford City are attractive to plastic manufactures because of their larger populations. There is a high probability of attracting electrical components sectors because of the Blacksburg and Radford's more urban character, and educated labor force.

The NEEDS model generated attraction scores for 730 nonmetropolitan communities in the Northeastern region of the United States. For each industry, the distribution of these scores is shown in a bar chart (see figures 1 through 10). The number of communities is presented on the vertical axis and the attractiveness index is presented on the horizontal axis. The column shaded in black represents the New River Valley. According to figure 1, nearly 300 nonmetropolitan communities have characteristics which yield a score of .1 or less for the measuring and controlling device industry, whereas, the New River Valley has qualities which will yield a score of .8 for this industry.

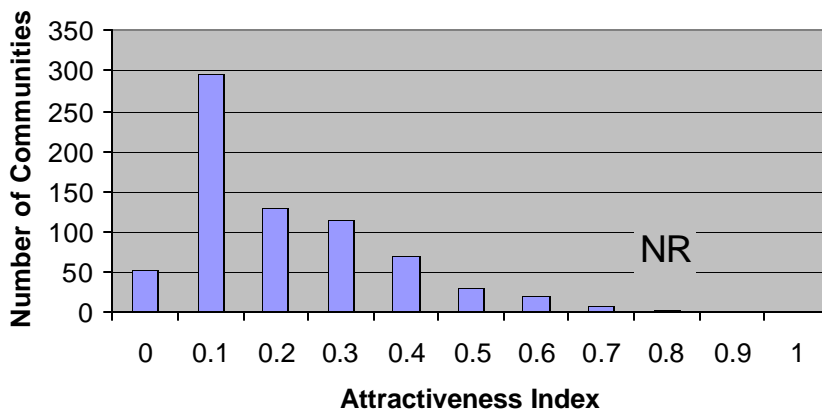


Figure 1: Attractiveness Indices for Measuring and Controlling Devices

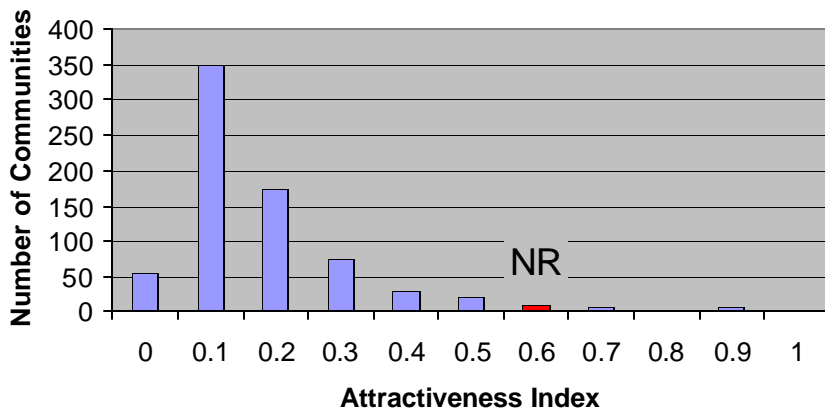


Figure 2: Attractiveness Indices for Electrical Components

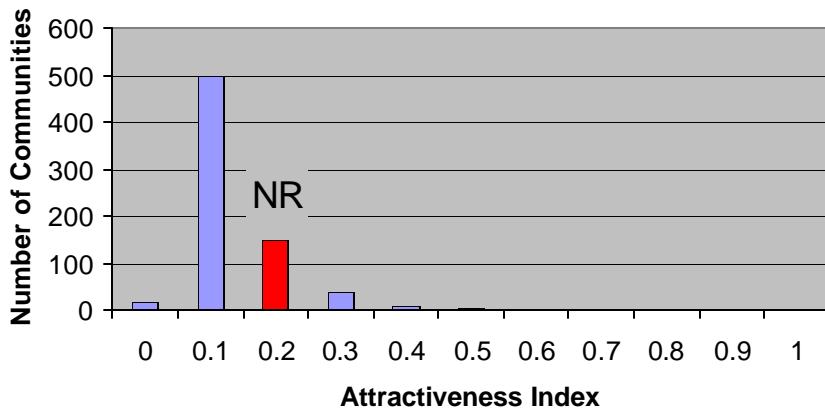


Figure 3: Attractiveness Indices for Metalworking Machinery

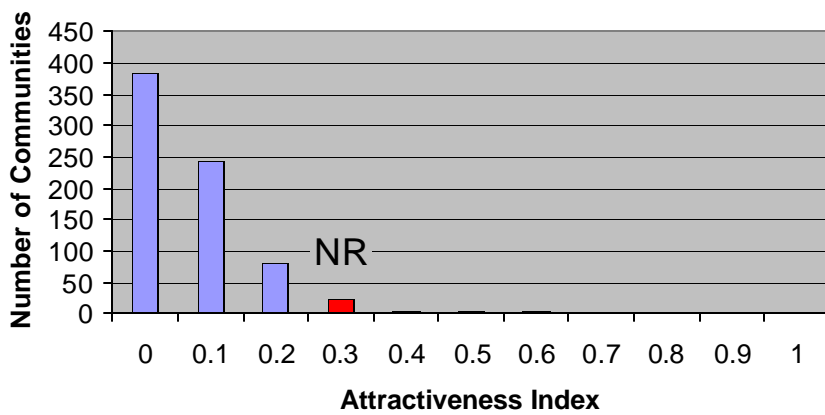


Figure 4: Attractiveness Indices for Search, Detection and Navigation Equipment

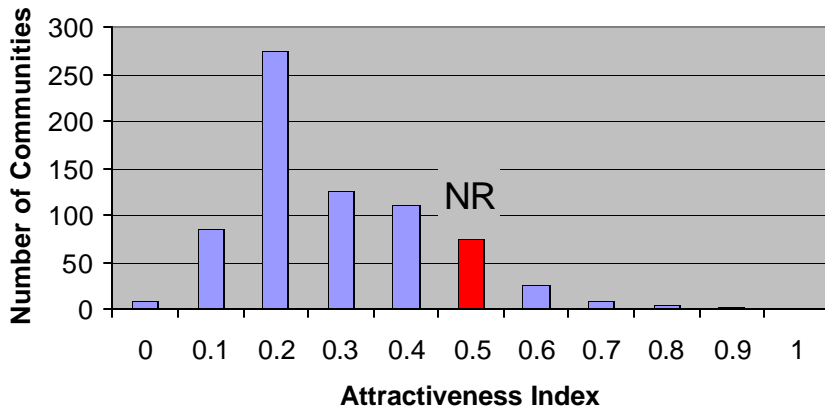


Figure 5: Attractiveness Indices for Structural Metal Products

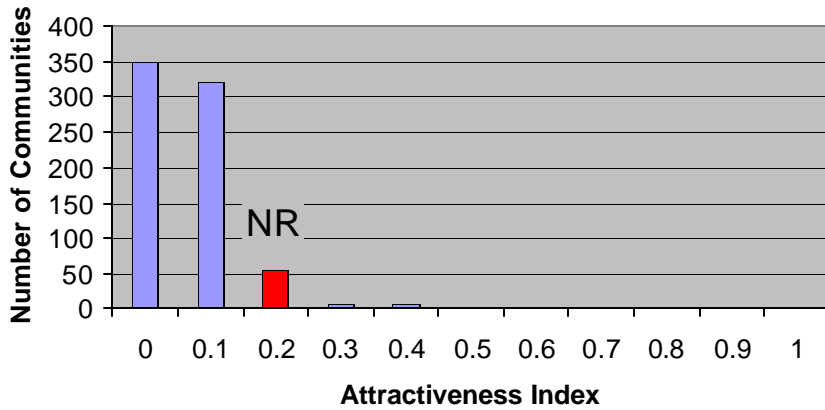


Figure 6: Attractiveness Indices for Industrial Machinery

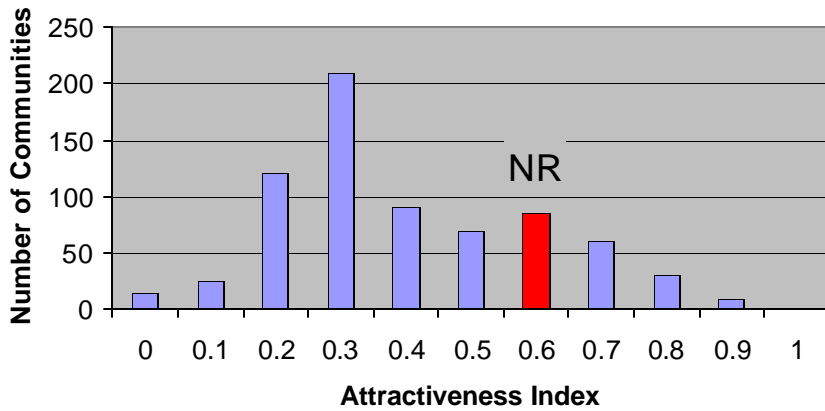


Figure 7: Attractiveness Indices for Hose, Belts, Gaskets and Packing

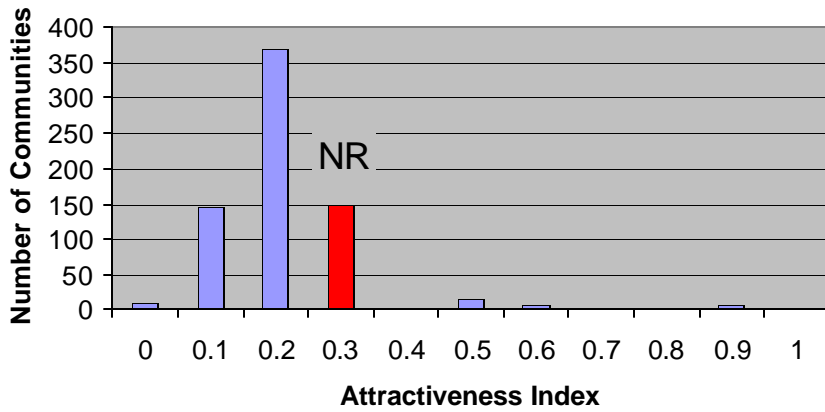


Figure 8: Attractiveness Indices for Motor Vehicles and Equipment

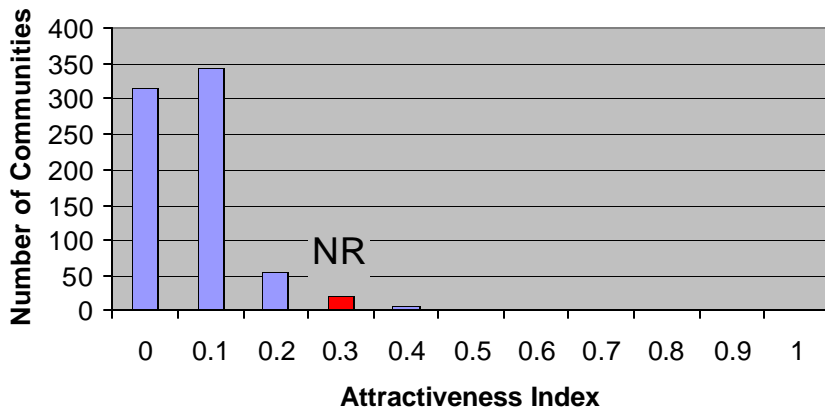


Figure 9: Attractiveness Indices for Diagnostic Substances

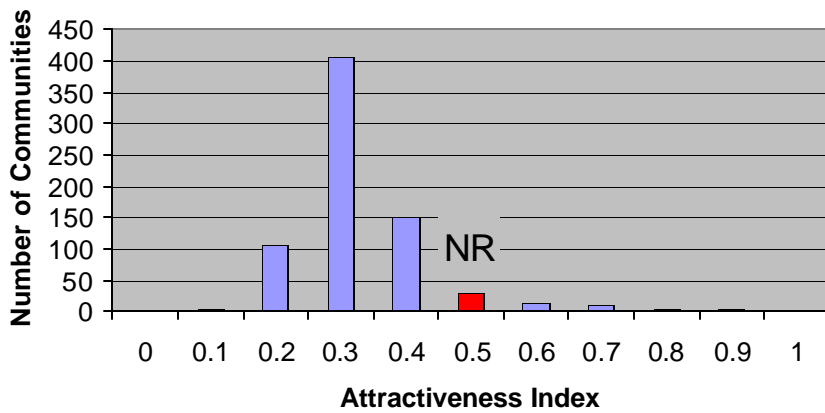


Figure 10: Attractiveness Indices for Wood Building and Mobile Homes

Economic Impacts Analysis

The economic importance of an industry in the New River Valley was described in terms of its total output, direct contribution to total income, direct contribution to gross state product or value added, and total employment. Total output is the dollar value of goods and services produced. It is the sector's total revenues. Income is the amount paid in employee compensation and to property owners in profits and rent. Value added is contribution to Gross State Product (payments to labor and capital, and indirect taxes), or the value of total sales less input purchases. Thus, value added is always less than total sales, but greater than personal income.

An input-output model of the New River Valley was formulated to measure sectoral economic impacts of proposed direct changes in employment for selected target industries. A change in final demand for the goods and services of a given industry will exert direct, indirect, and induced effects on the local economy. The indirect effect is the level of inputs produced to support the direct production, while the induced effect is the impact of household spending of the income earned in the direct and indirect production. Two distinct measures of these effects are evaluated: (1) the multiplier effect of each sector's industrial linkages (the direct plus indirect effects), and (2) the multiplier effect of each sector's industrial linkages as well as the induced impacts of household expenditures resulting from increased income (the direct, indirect and induced effects).

The extent to which industries contribute to the regional economy can be measured in terms of both backward and forward linkages. Backward linkages refer to the input purchases by the firms, as well as profits and labor costs. Forward linkages refer to the sales of a sector. The size of backward linkages can be inferred from the relative magnitude of the input-output multipliers. A high multiplier suggests strong backward linkages with other sectors. Forward linkages are more difficult to estimate. A description of the forward and backward linkages, for the twenty target industries, is presented in Appendix D.

Impacts of the Target Sectors

Using the input-output model, economic impacts of the target sectors defined earlier were estimated. Total in retail sales, employment number and total income are presented in Table 3. These results were subsequently used in the VIP model to measure the fiscal consequences of attracting proposed target industries. The fiscal impact results are presented in Tables 3 through 7. Sectors whose economic linkages appear to be the strongest are noncellulosic organic fibers, diagnostic substances and semiconductors and related devices.

Fiscal impacts of Target industries

Increasing employment in any of the target industries by 100 full-time equivalents will result in structural shifts in retail sales, total income, and real and personal property tax bases in the New River Valley. Fiscal impact projections for each jurisdiction, for the year 2003, based on initial changes in retail sales, total income, total employment, and tax bases are presented in Tables 3 through 7. For instance, the VIP model demonstrates that expansion of the semiconductor sector in Montgomery County will increase annual retail sales (over the projected

2003 baseline) by \$2.6 million, increase annual per capita income by \$101, increase employment by 294, and increase population by 49. Furthermore, net public service benefits and fiscal cash flow changes that stem from this economic stimulus are \$305,431 and \$108,425, respectively. In other words, positive increases in net public service benefits and reductions in tax-burden on the former real property 1<1X base suggests that local residents will receive higher valued public services, while the tax bill may be reduced.

Table 3: Total Economic Effects Of Increasing The Number Of Direct Jobs By 100, For Selected Target Industries

SIC	Target Industry	Total Change in Retail Sales (\$Million)	Total Change in Employment Number	Total Change in Total Income (\$Million)	Direct Change in Real Property (\$Million)	Direct Change in Personal Property (\$Million)
2452	Prefabricated Wood Buildings	2.1433	207	6.3928	0.916142	1.005512
2824	Organic Fibers, Noncellulosic	2.3783	231	10.1879	2.546608	13.703720
2835	Diagnostic Substances	3.0440	293	10.3416	0.937374	1.179259
3053	Gaskets, Packing, and Scaling	1.7483	168	6.5142	0.768662	2.713732
3080	Misc. Plastics Products	2.1130	206	6.9528	0.779958	2.780010
3443	Fabricated Plate Work	1.8437	179	6.4037	1.018365	2.490080
3471	Plating and Polishing	1.7713	173	4.6907	0.525316	1.760619
3543	Industrial Patterns	1.6813	164	4.7132	0.345349	2.010465
3545	Special Dies and Tools and Accessories	1.7020	166	4.6133	0.584528	2.777972
3562	Ball Bearing and Roller Bearings	1.8043	174	5.9580	1.137940	5.220596
3599	Industrial Machine	1.7413	169	5.1012	0.420578	2.356830
3674	Semiconductors and Related Devices	2.5617	249	8.0320	2.412839	6.843716
3713	Truck and Bus Bodies	1.6670	163	5.7394	0.624603	1.599206
3812	Search and Navigation Equipment	1.7367	169	7.4696	1.028885	2.115106
3827	Optical Instruments and Lenses	2.1013	204	7.6955	0.710189	1.702642
3822	Automatic Temperature Controls	1.7067	167	4.7576	1.194030	2.359701
3829	Mechanical Measuring Devices	1.7663	172	6.8674	0.776098	2.013902
3841	Surgical and Medical Instruments	1.9230	184	5.5849	1.088372	2.279207
3842	Surgical Appliances and Supplies	2.0117	195	5.9157	0.884204	1.870828
4890	Communications, Except Radio	2.0790	200	12.4128	N/A	N/A

Table 4: Fiscal Impacts Of Target Industries, In Giles County

Industry	Population	Employment	Per Capita Income	Retail Sales	Net Public Service Benefits	Cash Flow
Automatic Temperature Controls	33	197	267	2,233,184	206,457	44,632
Ball Bearings and Roller Bearings	34	206	334	2,361,298	271,860	71,449
Communications, Except Radio	39	236	696	2,726,449	530,308	11,167
Diagnostic Substances	58	346	579	4,010,292	435,737	38,519
Fabricated Plate Work	35	212	359	2,414,595	218,598	44,709
Gaskets, Packing and Scaling	33	199	365	2,286,348	285,323	43,551
Industrial Machines	33	200	286	2,218,251	220,648	35,901
Industrial Patterns	32	194	264	2,198,986	202,300	31,363

Industry	Population	Employment	Per Capita Income	Retail Sales	Net Public Service Benefits	Cash Flow
Mechanical Measuring Devices	34	203	385	2,311,945	297,408	36,954
Miscellaneous Plastic Product. '	41	243	390	2,773,664	301,329	45,999
Optical Instruments and Lenses	40	241	431	2,757,463	329,459	35,199
Organic Fibers Noncellulosic	46	273	571	3,126,224	493,568	169,955
Plating and Polishing	34	204	263	2,318,974	199,479	31,609
Prefabricated Wood Buildings	41	345	358	2,812,583	268,524	31,473
Search and Navigation Equipment	33	200	419	2,272,453	325,104	40,714
Semiconductors and Related Devices	49	194	450	3,370,459	365,060	105,500
Special Dies and Tool Accessories	33	196	259	2,226,532	201,414	41,424
Surgical and Medical Instruments	36	217	313	2,518,187	240,958	44,322
Surgical Appliances and Supplies	39	230	332	2,637,985	252,462	38,331
Truck and Bus Bodies	32	193	322	2,180,233	246,285	30,688

Table 5: Fiscal Impacts of Target Industries, In Floyd County

Industry	Population	Employment	Per Capita Income	Retail Sales	Net Public Service Benefits	Cash Flow
Automatic Temperature Controls	32	194	362	2,137,953	195,550	31,847
Ball Bearings and Roller Bearings	34	202	454	2,260,230	257,923	52,762
Communications. Except Radio	39	233	945	2,606,854	503,178	(\$6,821)
Diagnostic Substances	57	341	787	3,825,050	412,734	19,435
Fabricated Plate Work	35	208	488	2,310,447	264,099	29,680
Gaskets, Packing and Scaling	33	195	496	2,189,290	270,576	28,500
Industrial Machines	33	197	389	2,181,112	209,021	23,856
Industrial Patterns	32	191	359	2,105,667	191,574	20,524
Mechanical Measuring Devices	33	200	523	2,212,908	281,995	22,446
Miscellaneous Plastic Products	40	240	529	2,650,850	285,566	29,980
Optical Instruments and Lenses	40	237	586	2,635,736	312,254	19,912
Organic Fibers, Noncellulosic	45	269	775	2,985,553	469,081	130,162
Plating and Polishing	34	201	357	2,219,425	188,820	20,828
Prefabricated Wood Buildings	40	241	487	2,688,347	254,230	18,648
Search and Navigation Equipment	33	197	569	2,175,479	308,369	24,857

Industry	Population	Employment	Per Capita Income	Retail Sales	Net Public Service Benefits	Cash Flow
Semiconductors and Related Devices	48	290	611	3,217,204	346,236	79,025
Special Dies and Tool Accessories	32	193	351	2,131,804	190,779	29,175
Surgical and Medical Instruments	36	214	425	2,409,524	228,251	30,562
Surgical Appliances and Supplies	38	227	450	2,522,474	239,091	24,993
Truck and Bus Bodies	32	190	437	2,087,761	233,392	18,640

Table 6: Fiscal Impacts of Target Industries, In Montgomery County

Industry	Population	Employment	Per Capita Income	Retail Sales	Net Public Service Benefits	Cash Flow
Automatic Temperature Controls	33	197	60	1,536,222	171,018	42,349
Ball Bearings and Roller Bearings	34	206	75	1,663,812	227,680	71,799
Communications. Except Radio	39	236	156	2,028,476	44,662	25,957
Diagnostic Substances	58	346	130	3,310,963	359,836	46,715
Fabricated Plate Work	35	212	80	1,717,237	231,410	45,983
Gaskets, Packing and Sealing	33	199	82	1,588,854	237,440	45,409
Industrial Machines	33	200	64	1,581,029	182,774	34,877
Industrial Patterns	32	194	59	1,501,978	167,240	29,608
Mechanical Measuring Devices	34	203	86	1,614,776	247,041	39,510
Miscellaneous Plastic Products	41	243	87	2,076,067	250,003	48,244
Optical Instruments and Lenses	40	241	97	2,059,747	272,978	39,125
Organic Fibers, Noncellulosic	46	273	128	2,428,153	418,407	177,957
Plating and Polishing	34	204	59	1,621,879	164,510	29,538
Prefabricated Wood Buildings	41	245	80	2,114,641	221,263	32,331
Search and Navigation Equipment	33	200	94	1,575,307	270,496	44,464
Semiconductors and Related Devices	49	294	101	2,672,179	305,431	108,425
Special Dies and Tool Accessories	33	196	58	1,529,493	166,986	39,272
Surgical and Medical Instruments	36	217	70	1,820,296	199,524	43,662
Surgical Appliances and Supplies	39	230	74	1,940,345	208,621	38,369
Truck and Bus Bodies	32	193	72	1,483,306	204,003	30,999

Table 7: Fiscal Impacts of Target Industries, In Pulaski County

Industry	Population	Employment	Per Capita Income	Retail Sales	Net Public Service Benefits	Cash Flow
Automatic Temperature Controls	32	190	130	2,052,930	193,883	30,211
Ball Bearings and Roller Bearings	33	198	163	2,175,415	255,290	52,296
Communications. Except Radio	38	227	340	2,525,012	497,407	(\$14,088)
Diagnostic Substances	56	333	283	3,754,358	409,043	14,634
Fabricated Plate Work	34	203	176	226,538	261,525	27,265
Gaskets, Packing and Scaling	32	191	179	2,103,607	267,809	26,104
Industrial Machines	32	192	140	2,095,980	207,181	22,086
Industrial Patterns	31	186	129	2,020,144	189,962	18,733
Mechanical Measuring Devices	33	195	188	2,128,286	279,122	19,435
Miscellaneous Plastic Products	39	234	191	2,570,427	282,899	27,629
Optical Instruments and Lenses	39	232	211	2,554,849	309,224	16,434
Organic Fibers, Noncellulosic	44	262	279	2,907,970	463,517	132,919
Plating and Polishing	33	196	129	2,135,055	187,331	18,938
Prefabricated Wood Buildings	39	235	175	2,607,547	252,095	15,480
Search and Navigation Equipment	32	192	205	2,090,462	305,078	21,524
Semiconductors and Related Devices	47	283	220	3,141,861	342,879	78,791
Special Dies and Tool Accessories	31	189	126	2,046,520	189,163	27,925
Surgical and Medical Instruments	35	209	153	2,325,527	226,251	28,503
Surgical Appliances and Supplies	37	221	162	2,440,420	237,042	22,579
Truck and Bus Bodies	31	185	157	2,002,218	231,172	15,970

Table 8: Fiscal Impacts of Target Industries, In Radford City

Industry	Population	Employment	Per Capita Income	Retail Sales	Net Public Service Benefits	Cash Flow
Automatic Temperature Controls	33	197	275	2,147,047	148,639	(\$6,571)
Ball Bearings and Roller Bearings	34	206	344	2,269,597	199,536	26,566
Communications. Except Radio	39	236	717	2,619,027	384,978	(\$155,535)
Diagnostic Substances	58	346	597	3,847,687	312,354	(\$105,242)
Fabricated Plate Work	35	212	370	2,320,626	201,729	(\$26,866)
Gaskets, Packing and Scaling	33	199	377	2,197,860	207,325	(\$27,995)
Industrial Machines	33	200	295	2,190,147	158,908	(\$25,660)
Industrial Patterns	32	194	273	2,114,309	145,165	(\$28,208)

Industry	Population	Employment	Per Capita Income	Retail Sales	Net Public Service Benefits	Cash Flow
Mechanical Measuring Devices	34	203	397	2,222,402	215,465	(\$43,816)
Miscellaneous Plastic Products	41	243	402	2,664,269	217,697	(\$35,524)
Optical Instruments and Lenses	40	241	445	2,648,747	237,613	(\$62,724)
Organic Fibers, Noncellulosic	46	273	589	3,001,655	369,923	144,444
Plating and Polishing	34	204	271	2,229,140	142,506	(\$29,612)
Prefabricated Wood Buildings	41	245	369	2,701,473	191,685	(\$56,665)
Search and Navigation Equipment	33	200	432	2,184,607	236,280	(\$43,342)
Semiconductors and Related Devices	49	294	464	3,235,399	267,384	(\$48,172)
Special Dies and Tool Accessories	33	196	267	2,140,670	145,201	(\$9,814)
Surgical and Medical Instruments	36	217	323	2,419,705	173,425	(\$20,750)
Surgical Appliances and Supplies	39	230	342	2,534,400	181,074	(\$36,345)
Truck and Bus Bodies	32	193	332	2,096,372	177,499	(\$40,590)

For all jurisdictions in the New River Valley, the fiscal consequences of attracting a noncellulosic organic fibers industry are more significant than those attributable to recruiting industrial machines or industrial patterns manufactures, for example. On average, the level of net public service benefit stemming from the expansion of noncellulosic organic fibers in the New River Valley is \$442,900, while the level of cash flow (additional public revenues less additional public expenditures) is expected to be \$151,000. Similarly, the level of net public service benefit stemming from the expansion of industrial patterns in the region is only \$179,248, and the level of cash flow may be as low as \$14,404. In both cases, the value of additional public services provided is greater than the taxes collected to fund public expenditures.

By recruiting the target industries to the City of Radford, the city may realize comparable net public service benefits to surrounding communities. However, city residents may expect to pay higher taxes in order to defray the cost of public services. The negative cash flows in Radford may be attributable to relatively low tax rates.

CONCLUSIONS

This study suggested that the most beneficial employers for the New River Valley would be manufacturers and service firms in the information, technology, biological, medical, educational, and research areas. According to this Economic Opportunity Analysis, the ideal firm would provide a relatively small number of high paying jobs and but would invest relatively large amounts in facilities, capital, technology and training per full-time equivalent job created. They would generate good levels of tax revenues directly and indirectly but both the firms and their employees would demand high quality public services, and infrastructure.

The study suggested that the region's future lies in the protection and improvement of its strengths as well as the correction of its weaknesses. Its strengths are its rural nature, quality of life, quality environment, its skilled and educated labor force, its existing industries, and its infrastructure. Ironically, its greatest weaknesses are its relative isolation, the unskilled segments of its labor force, its declining existing industries, and certain aspects of its infrastructure.

The Virginia Impact Projection model, a fore runner of the Community Policy Analysis System (COMPAS), proposed by Johnson and Scott (1997), helped address the information needs of this type of economic opportunity analysis because the model has the capacity to estimate the impact of employment and income growth on population and property values. A national effort, through the Community Policy Analysis Network (CPAN), has been underway to develop these impact models (Scott and Johnson, 1999). The increased capacity to estimate impacts at the local level will enhance the utility of this type of analysis.

Data on environmental impacts, or the cleanliness of an industry, are not generally available, particularly by type of industry. However, once the number of potential industries is limited using the methods described, obtaining more detailed environmental data about the top-ranked industries would be a likely extension. With a limited number of industries to consider, the cost of obtaining more specific environmental impact data would be significantly less.

Overall, including community preferences through the AHP promises to be a valuable tool for community decision support. It accommodates the diversity of communities and the inherent diversity of values within them. AHP provides a means choosing among multiple alternatives while accommodating multiple objectives and multiple decision-makers. Finally, the use of economic impact tools provides a more comprehensive and consistent basis for comparing different sectors.

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