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Community Preferences for Types of Businesses: A Case Study of Three Counties

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INTRODUCTION

Local and state governments in the United States have tried to stimulate economic development in rural areas for many years. State and local governments, mostly in the southern United States, began to use direct financial incentives in the 1930s, and by the 1980s almost every state had an economic development policy that included different measures to influence firm location (Isserman). Tools used for industrial development include shell buildings, infrastructure investments, local marketing boards, and incentive programs such as tax abatements and credits. The rationale for these programs is that local job growth and economic expansion can be increased by encouraging local investments from outside firms. Currently, such economic incentive programs are funded at historically high levels (Venable). However, these programs can result in industries locating in an area where they are not wanted. Consequently, economic development literature is rife with debates over the efficacy of these programs.

Surprisingly, considering the magnitude of the dollars being spent on these economic incentive programs, little research has examined community preferences for economic development outcomes. Often, inconsistencies exist between the form of the incentive package and the stated goal. For example, politicians, while claiming to be interested in increasing employment, often choose to subsidize capital rather than training labor (Courant). Do all communities desire more jobs, or do some communities prefer other outcomes such as increases in certain types of jobs, less congestion, and improved environmental quality? A proactive economic development program can use information on what communities desire from economic development to target industries and to structure the development package itself (Cox). The development package, whether a tax abatement program, a shell-building program, or a community marketing program, can affect which industries come to a community and how these industries create outcomes such as changes in environmental quality.

Community preferences should matter. Outcomes of economic development activities, regardless of the program or policy in question, are felt locally in a number of ways. For example, a firm startup creates employment and generates additional income for the community. At the same time, however, the new business will affect public services, congestion, property values, and the like. Measuring community preferences for these different outcomes is difficult and represents a form of multi-attribute decision-making. The critical component of such decision-making is determining the weights to attach to the different attributes. “Weights on objectives should reflect clients’ value judgments about trade-offs among objectives” (Alston, Norton and Pardey, p. 467). When the weighting systems do not adhere to these basic principles, differences in outcomes can be large.

The Analytical Hierarchy Process (AHP), developed by Saaty (1980), is a means of weighting or prioritizing impacts. AHP belongs to the field of analysis called multi-attribute decision-making. Other such techniques include multi-objective goal programming, influence diagrams, and decision trees. AHP has been applied to different problems, including electric utility planning, portfolio management, conflict management, advertising, and resource allocation (for examples see Hämäläinen Seppäläinen, Lauro and Vepsäläinen, Saaty and Alexander; Dyer, Forman, and Mustafa, Saaty, 1980).

This report presents a proactive industry targeting strategy that allows a community to consider its preferences for impacts resulting from a development outcome—in this case a firm location. The strategy involves three steps. Local decision-makers are interviewed in the first step, and the AHP is used to create weights for different local impacts of development outcomes. In the second step, the critical development impacts of industry locations are identified and quantified for each of several

industries that survive an initial screening. The final step involves applying the weights to the measured attributes of each industry to derive a community-specific ordering of preferred industries.

This targeting strategy was applied to three rural Virginia counties: Bath, Halifax, and Montgomery. The results show a diversity of preferences that reflects, to a large degree, the physical and economic differences between these counties. These differences highlight the need for individual counties to undertake a similar exercise. The procedure outlined in this report is fairly complicated and counties with serious interest should contact the Program for Community Vitality, Virginia Tech.¹

WEIGHTING COMMUNITY PREFERENCES: THE ANALYTICAL HIERARCHY PROCESS

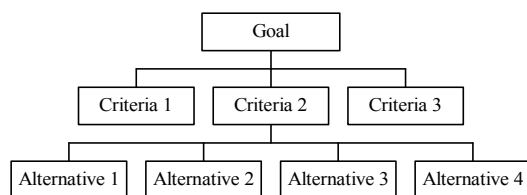
The AHP provides a systematic view of a problem. Using pairwise comparisons, a researcher can measure the relative importance, or weights, of different factors and can explicitly consider tradeoffs between objectives in the pairwise comparisons. Because possible inconsistencies in the judgments can be calculated and reexamined, this process imposes rigor that is missing when directly assigning weights to a number of impacts.

The foundation of the AHP is that human decision-making is not always consistent. Inconsistency arises when the criteria being compared are subjective in nature. The AHP allows for inconsistency and provides a standard by which consistency can be measured. If inconsistency exceeds an established threshold, then participants re-examine their judgments. (See Appendix B for description of Consistency Ratio.)

Structuring the Problem

The first step in the AHP is to identify and prioritize impacts into a dominance hierarchy (Figure 1). The top-most level represents the goal or focus of the problem. Intermediate levels are the criteria on which lower levels are judged, and the lowest level is the list of feasible choices or alternatives (Saaty and Kearns). As many levels as necessary can be used in this technique. Lower levels act as the criteria contributing to the level immediately above.

Figure 1. Levels of a dominance hierarchy



Pairwise Comparison

Each element in the hierarchy is then compared to other elements at that same level, with respect to the level directly above. The questions asked for the second level could take the form “When comparing different criteria, which criterion, one or two, is more important in achieving the goal?” Other kinds of questions Saaty and Kearns suggest that could be asked include “When comparing A

¹ The Program for Community Vitality is a teaching/research/extension program in the Department of Agricultural and Applied Economics, Virginia Tech. Dr. David Lamie should be contacted for more information: (540) 231-5447; lamie@vt.edu.

and B, ‘Which is more important?’ ‘Which has a greater impact?’ ‘Which is more likely to happen?’ and ‘Which is more preferred?’” The specific question asked depends on the goal to be achieved and the level being compared. A scale of relative importance, as recommended by Saaty (1980), is adopted to help participants express their judgments in a consistent manner.

Computing the Weights

Judgments from these pairwise comparisons are entered into a judgment matrix and analyzed (Appendix A). This judgment matrix, representing the community-specific weights or preferences for each of the outcomes, may contain inconsistencies. The inconsistencies can be attributed to using subjective judgment rather than exact measurement. Human error can also cause inconsistencies: the prior rankings of each pair of elements are difficult for people to remember as they compare other criteria.

Structure of the Problem for Evaluation of Economic Development Outcomes

The goal or first level for the AHP is to target the industries with the most favorable total impact on a locality. The second level represents the criteria by which the top level is judged. The criteria consist of potential impacts that a firm can have on a locality. Based on a review of findings from other studies and a survey of economic development directors in Virginia, Bailey² identified the following impacts: number of jobs created, average wage or salary, average level of capital investment, average level of utility requirements, environmental impacts, effect on population growth, and impact on property values. Community representatives (respondents) are asked to weight these impacts.

The number of newly created jobs is often highlighted as an indication of success in economic development. Localities are interested in job quality, and the average wage or salary is an indicator of quality. Capital investment is important because it shows commitment to the community, and it increases the stream of property tax revenues. Property values are important to the local government primarily because increased property values increase the tax base. Utility requirements are a measure of the importance of local utility capacity constraints. Economic development professionals indicated that water and sewer demands are a concern when granting incentives to prospective industries (Bailey). The cleanliness of industry is an indication of the importance of environmental considerations to community decision-makers. The impact of population growth is a measure of several of the costs, such as congestion, associated with economic development.

Impacts of Industries

How the industry will affect a particular community must be known in order to rank industries using the weights derived from the AHP. For example, to measure how industry X will affect environmental quality in the community, several steps are followed. First, a score is determined for the environmental impact of each industry on the community. The score is the estimated level of change in environmental quality associated with the industry. The industry scores are indexed for each impact, with the industry with the largest environmental impact receiving a score of -100 (for the negative factors). This produces an index where each remaining industry is the percentage of that industry’s impact relative to the largest impact level. For example, if industry A receives an environmental score of -500, industry B a score of -300, and industry C a score of -100, industry A is

² Economic Development directors are not elected officials in Virginia, and their preferences are not likely to correspond to the preferences of a representative resident. The economic development directors were surveyed by Bailey to understand which firm attributes made the firm likely to receive an incentive package. Bailey’s results were used to define the universe of plausible firm impacts on the community and are not assumed to reflect “community values.”

indexed as -100, industry B as -60, and industry C as -20. These scores are later multiplied by the weights for each score derived using the AHP.

Because industry targeting involves selecting among many potential industries, the method used to measure industry impacts needs to be simple, replicable, and systematic. In Cox's study, 100 potential industries, varying by county, were identified based on their total economic impact on the county in question.

Measuring Impact Levels

The average number of jobs, average wage or salary, average level of capital investment, and average level of utility requirements are calculated for each industry using the economic analysis data contained in IMPLAN (Box 1). IMPLAN data list total employment, total compensation to employees, payments to proprietors, and total output for each sector. Obtaining the average number of jobs per dollar of output by industry is straightforward. Total employment includes local direct, indirect, and induced employment for each sector, as calculated by IMPLAN. Average wage or salary and utility requirements per dollar of output for each industry were also calculated using IMPLAN (Appendix B).

Box 1. What is IMPLAN?

IMPLAN (Impact Model for PLANning), an input-output modeling system developed by the U. S. Forest Service, was used to generate community-specific estimates of a number of the impacts considered in this study. An increase in the demand for an existing sector's (or industry's) output, or the location of a new firm in the region, will result in increased output in many other sectors of the economy. These resulting effects are quantified by calculating input-output multipliers. The IMPLAN system provides the data necessary to construct an input-output model of any county, or grouping of counties, in the country. IMPLAN contains 528 economic sectors, some or all of which may exist in a given region. When a new firm is anticipated in a sector for which there are no current firms, the IMPLAN system can be adjusted to include the new firm (Lamie).

Environmental impacts were measured using the 1993 Toxic Release Inventory (U.S. Environmental Protection Agency), which lists releases of 316 chemicals from manufacturing facilities into the environment and chemicals transferred to other locations for disposal or recycling. The sum of releases and transfers is used to represent the environmental impact of each industry. Industries using more of the chemicals included in the EPA report receive larger negative scores.

These environmental data have several limitations. First, they do not include all chemical pollutants in existence. Second, chemical use does not necessarily directly correlate with higher health or environmental risk and is certainly only one of a number of possible measures of environmental quality. Third, the data are only available at the two-digit Standard Industrial Classification (SIC) code level. Fourth, the data do not include pollutants from non-manufacturing industries. Agricultural and mining industries were eliminated from the set of possible target industries *a priori*; therefore, pollutants from these industries are not a concern. It seems reasonable that, given the nature of service industries, they do not contribute much pollution to the environment; these industries were given an environmental score of zero.³ Despite these limitations, the data represent the best systematic summary of environmental impacts by industry.

³ In fact, some service sectors are associated with toxins. Examples include dry cleaners and automobile service centers.

The population growth and the impact on property value indices used in the study are measures of a mismatch between ideal population distributions and those found in the county. Arguably, as the county population distribution differs from that required by the industry, migration will occur. This migration will change the local population and affect property values. (See Appendix C for an explanation of how these indices were calculated.)

AHP Interviews

The AHP was applied to three rural Virginia counties: Bath, Halifax, and Montgomery. These localities were chosen because they are broadly representative of county types in rural Virginia. Bath County is heavily dependent on natural resource-based tourism, faces economic stagnation, and contains a relatively high proportion of poor households. Halifax County is a mixed agricultural-manufacturing county typical of Southside, Virginia. County government has been fairly successful in nurturing light furniture manufacturing firms and now faces the challenge of declining incomes due to disruption in tobacco sales. Montgomery County has grown rapidly in recent years and faces challenges of growth management.

Four people from the County Planning Commission participated in the study in Bath County. In Halifax County, participants were the Director of the Industrial Development Authority, two members of the Halifax County Economic Development Committee, and a representative of the local Chamber of Commerce. In Montgomery County, participants were the Blacksburg town manager, the Industrial Attraction Committee's Chairperson, the New River Valley Economic Development Alliance's Regional Marketing Director, the Board of Supervisors Chairperson, and Virginia's Center for Innovative Technology's Regional Director.

The objectives and methods of the AHP, the industry impacts, and the scale of relative importance were explained to participants from each county before the pairwise comparison exercise began.

Participants were asked to consider every possible pairwise combination of industry impact upon the county and then select the one from the pair that was more attractive. For example, how important was impact A over impact B for county X? If immediate consensus occurred among the respondents, the response was entered into the judgment matrix. If not, a discussion ensued of the assumptions individuals used when making their value judgments. At the end of the discussions, individuals would be convinced enough to change their judgments, or the group would agree on a compromise.

Calculation and Reevaluation of the Comparisons

After the initial judgment matrix was filled, the priority outcomes were calculated. The consistency ratio (CR) then was calculated (see Cox for details). If the CR was above 0.2, the judgment matrix was reexamined.

To reexamine the judgment matrix, the ranking and weights for each impact were presented to the group. By reexamining weights that were incongruous, the group's attention was focused on inconsistencies in their value judgments. This process allowed the participants to rethink their judgments and further discuss the assumptions behind the judgments. The matrix was reevaluated following revision of judgments. This process was repeated until the CR was less than 0.2 and participants were satisfied that the ranking and weights adequately represented their preferences. This process not only helped ensure consistency, but also helped participants understand the reasoning behind alternative weighting schemes. Because of its structure, the process itself helped create consensus.

Results of AHP

In general, the participants were comfortable using subjective judgments based on experience, knowledge, and intuition to obtain a priority ranking of development impacts.

Experience with the interviews varied by county, but the priority weightings and rankings were reasonably consistent across counties. In two of the three counties, reexamining the pairwise comparisons was necessary due to initial inconsistencies in the judgment matrix. The rankings are shown in Table 1. ***Differences in rankings highlight the location-specificity of development preferences: different counties have different preferences. These preferences should be considered explicitly when making development decisions.***

Table 1. Final Ranking and Weights by Impact, Three Virginia Counties

Rank	Bath County		Halifax County		Montgomery County	
	Impact	Final Weight (%)	Impact	Final Weight (%)	Impact	Final Weight (%)
1	Cleanliness of Industry	51	Cleanliness of Industry	49	Average Wage or Salary	35
2	Average Wage or Salary	16	Level of Capital Investment	23	Cleanliness of Industry	24
3	Impacts on Property Values	13	Average Wage or Salary	13	Level of Capital Investment	16
4	Number of Jobs	6	Number of Jobs	6	Number of Jobs	12
5	Level of Capital Investment	5	Impacts of Population Growth	5	Impacts of Population Growth	7
6	Level of Utility Requirements	5	Level of Utility Requirements	3	Impacts on Property Values	4
7	Impacts of Population Growth	4	Impacts on Property Values	2	Level of Utility Requirements	2
CR		0.196		0.275		0.142

Montgomery County participants only ranked the outcomes once and did not need to go through the re-weighting process. They felt the order and weights obtained during the first attempt adequately represented their preferences, and the CR of 0.14 obtained is well below the 0.2 threshold. Bath County respondents, having an initial CR of 0.29, reexamined the weights and pairwise comparisons. Changes were made following discussion among the participants. The reexamination led to only slight changes in the weights, a CR of 0.196—just below the CR threshold, and no change in rankings.

Respondents in Halifax County felt that the rank and weight calculated for each impact adequately represented their priorities. However, the CR was 0.27. The difficulty in pinpointing possible inconsistent comparisons causing the high CR was not reexamined due to the two-hour time constraint and the respondents' satisfaction with their original comparisons. Thus, the weighting results from Halifax County (Table 1) should be interpreted with caution as the underlying judgments are not within normal bounds of consistency.

Preferences for Outcomes

Participants in all three counties had a strong preference for a clean environment: environmental quality was ranked a strong first in Bath and Halifax counties and second in Montgomery County (Table 1). Bath County's desire to maintain an attractive environment is primarily the result of the

heavy reliance on tourism: the Hot Springs area and its associated spas and resorts form the backbone of the county economy. The high weight placed on industry cleanliness in Halifax County is surprising because the county has aggressively recruited industry for more than a decade. Decision-makers expressed the view that “smokestack chasing” was a strategy of the past. In both counties, environmental quality received more than double the weight of the next-preferred outcome.

Contrary to popular perception, in these counties, the number of jobs associated with a development event is substantially less important than cleanliness of the firm and the quality of jobs. The number of jobs was ranked only fourth most important in each county, with a weight ranging from 12 percent in Montgomery to about 6 percent in the other counties. Although their unemployment rate is higher than the state average, Bath County respondents reasoned that the number of unemployed is small because of their small population. Consequently, creating a large number of jobs locally is not viewed as essential. Average wage or salary was the most important consideration for Montgomery County, with a priority weight of 35 percent. Participants felt firms offering higher pay were more attractive since the presence of Virginia Tech gives Montgomery County a more educated work force, and decision-makers sought to increase the number of head-of-household type jobs. Decision-makers in the other two counties ranked average wages high and stated directly that higher pay is associated with a higher quality job. Respondents in Halifax County reasoned that recently the county had made great strides in increasing the number of local jobs and that it was time to focus on job quality rather than quantity.

Respondents in all counties value the contribution of the development event to the local tax base. Capital investment is ranked second in Halifax County (23 percent) and third in Montgomery County (16 percent), but it ranked fifth in Bath County. Participants from Halifax and Montgomery counties considered tax revenues associated with higher capital investment to be important. Firms with large capital investments were also believed to be less likely to relocate in the future. However, they placed low weights on changes in property values. In contrast, Bath County respondents consider property values very important because the county has no sales and use tax, making property taxes the only local source of revenue for the county, and they argued that the best way to effect increases in property tax revenues was by increasing local property values. They put a low weight on capital investment, reasoning that capital investment was associated with heavy industry and such industry might damage the tourism base of the economy.

Impacts on utility requirements and population changes received low priority weights in all counties. In Bath County, utility requirements received a relatively low score because water, sewer, and electricity use are currently far below capacity. Montgomery and Halifax County respondents decided that if a firm had desirable characteristics, the county would expand its sewer and water capacity to meet industry needs.

The negative impact of population growth was somewhat important to the respondents from Montgomery County (7 percent), primarily because of the increase in traffic along US-460, and the resulting congestion occurring in the past several years. Bath and Halifax County respondents decided the schools, roads, and other facilities are more than adequate for the current population. In all counties, population increases were not viewed favorably, but in the latter two counties, such increases were accorded small weights.

Scoring the Impacts

The *level* of each impact associated with an industry was calculated and converted to a score (described below). Details for Bath County are given in Appendix Table D1; comparable results for the other counties are found in Cox. Scored impacts are multiplied by the priority weights in Table 1 to calculate the adjusted score for each industry and the county-specific rankings of industry.

The priority weighting (community preferences) have a strong effect on the ranking of industries (Table 2). In Bath County, the first-ranked industry without priority weighting (shown in column 1, Table 2), *Research, Development and Testing*, falls to number 11 once the rankings are introduced. This fall is mainly due to the lower average wages associated with the sector. Knit underwear falls from the top 20 industries because of its adverse effect on the environment; Fluid Power Pumps does not fall very much. The latter sector has high wages that offset, to a large degree, its adverse effect on the environment.

Table 2. Top Twenty Industries Identified for Targeting, Bath County.

Raw Score Rank	Weighted Rank	SIC Code	Sector Name	Ave. Number of Jobs (per \$ million output)	Ave. Wage or Salary (\$/year)	Value-Added Effect (total Va./ \$ output)
2	1	4600	Pipe Lines, Exc. Natural Gas	2	58,113	0.9011
7	2	4010	Railroads & Related Services	8	61,152	0.7776
5	3	4810	Comm., except Radio & TV	6	49,516	0.9074
13	4	4910	Electric Services	3	54,112	0.7027
15	5	7370	Comp. & Data Proces. Serv.	13	33,780	0.9108
4	6	15,16,17	New Gov. Facilities Maint. & Repair Oil & Gas	10	36,410	0.7366
3	7	15,16,17	Wells	27	21,658	1.1702
14	8	3571	Electronic Computers	6	63,525	0.7947
65	9	--	Federal Gov. - Non-military Distilled Liquor, except	21	47,933	1.1401
43	10	2085	Brandy	2	57,072	0.9805
1	11	8730	Research, Dev. & Testing	24	27,336	0.9992
68	12	--	State & Loc. Electric Utilities	4	44,098	0.7019
28	13	5000	Wholesale Trade	13	36,095	1.0206
9	14	7320	Other Business Services	21	16,709	0.9860
8	15	4720	Arrangement of Pass. Trans.	22	20,393	0.9595
22	16	4730	Transportation Services	13	29,108	0.7744
50	17	--	State & Local Gov. - Non-ed.	32	31,637	1.3026
11	18	3594	Fluid Power Pumps & Motors	18	46,088	1.1166
6	19	15,16,17	Maint. & Repair, Residential	13	23,717	0.7337
--	20	4311	U.S. Postal Service	18	42,275	0.8909

Environmental quality, as shown earlier, has a major effect on industry rankings. None of the top 9 and only 2 of the top 20 industries ranked for Bath County had any adverse environmental impact (Table D1). Sectors that moved up in ranking were those with relatively low impacts on the environment and high wages (*Distilled Liquor, except Brandy; Federal Government, Non-military*). All the industries shown in Table 2 are highly linked to the local economy and have favorable overall impacts.

The most preferred industry for all counties is SIC 4600, *Pipelines, excluding Natural Gas* (Table 3). This industry had high average wages, represented the largest proportional capital investment, and had no adverse environmental impact. Other industries, such as SIC 4810 (Communications, except radio and TV) and SIC 4910 (Electric Services), were also considered favorable for all counties, while some, such as *Distilled Liquor, except Brandy*, were only highly ranked by one county.

Table 3. Top Twenty Industries for Each County.

	Bath County	Halifax County	Montgomery County
Rank	-----Description-----		
1	Pipe Lines, Exc. Natural Gas	Pipe Lines, except Natural Gas	Pipe Lines, except Natural Gas
2	Railroads & Related Services	Other Business Services	Electric Services
3	Comm., except Radio & TV	Maint. & Repair Oil/Gas Wells	Comm., except Radio & TV
4	Electric Services	Pleating & Stitching	Railroads & Rel. Services
5	Comp. & Data Proces. Serv.	Advertising	Electronic Computers
6	New Gov. Facilities	Arrangement Of Pass. Trans.	State & Local Electric Utilities
7	Maint. & Repair Oil & Gas Wells	Electric Services	Fluid Power Pumps & Motors
8	Electronic Computers	Flavor. Extracts & Syrups	Federal Gov. - Non-military
9	Federal Gov. - Non-military	Research, Dev. & Testing	New Gov. Facilities
10	Distilled Liquor, Except Brandy	New Gov. Facilities	Complete Guided Missiles
11	Research, Dev. & Testing	Computer & Data Processing Services	Research, Dev. & Testing
12	State & Local Electric Utilities	Comm., except Radio & TV	Printing Trades Machinery
13	Wholesale Trade	Maint. & Repair, Residential	Industrial Patterns
14	Other Business Services	Maint. & Repair Other Fac.	Instrum. to Measure Electricity
15	Arrangement of Pass. Trans.	State & Local Electric Utilities	Radio & TV Broadcasting
16	Trans. Services	Trans. Services	U.S. Postal Service
17	State & Local Gov. - Non-ed.	Motor Freight Trans. & Warehousing	Phonograph Records & Tape
18	Fluid Power Pumps & Motors	Hardwood Dimension & Flooring	Industrial Gases
19	Maint. & Repair, Residential	Pottery Products, N.E.C.	Wholesale Trade
20	U.S. Postal Service	Bread, Cake, & Related Products	Special Dies, Tools & Accessories

As already noted, these rankings are all community specific, and only represent the weighted rankings of a small subset of the county's population.

CONCLUSIONS

Economic and political forces are placing increased pressure on governments in rural areas. Economic liberalization, exemplified by the North American Free Trade Agreement (NAFTA), broadens the geographic scope of firm and industry location. Such broadening means that local governments may need to become more proactive in their industry recruiting programs. Proactive means that the county should decide, in advance, which industries are most desirable, and then formulate means of attracting or building the industries locally. Community marketing and incentive packages are two means of attracting industry. Communities should not sit back and wait for a prospective firm to knock on its door. At the same time, political changes require increased local leadership in addressing local needs and concerns. County governments need the ability to make decisions about which types of firms or industries they find most desirable and which fit best into their vision of their future. Firm locations, however, have impacts across a variety of dimensions, and comparing these diverse impacts can be difficult.

Counties in rural Virginia are remarkable in their diversity and this diversity extends to how citizens feel about the outcome of economic programs. State government should recognize this diversity and involve local leaders at the early stages of the industry recruiting process. County decision-makers need a means of incorporating these preferences into their decisions. Otherwise, it is impossible to make consistent decisions.

The AHP gives local leaders a way to include their preferences for economic, public, and environmental impacts that a new or expanding firm might have on the area. The AHP can be easily built into a proactive industry recruiting or firm retention program. The AHP could also be used to develop a preference ranking during a planning or visioning exercise. The diversity between each community's preferences and the need to discuss the assumptions underlying the preferences during the process of making pairwise judgments highlight the need for individual counties to conduct such exercises. The discussion of the assumptions, biases, and reasoning of each person's preferences works towards building the consensus that is needed to make policy decisions.

In general, rankings of industries changed dramatically once community preference weights were introduced. An industry that has potentially high economic impacts may, in fact, not be preferred by a community because of its non-economic impacts. In the three counties studied, impacts such as cleanliness or average wage or salary had greater effects on preferences toward an industry than the number of jobs.

Identifying industries that are attractive to residents is the first step in the industry recruitment process. Community leaders need to assess what resources are required or expected by each industry and make a decision whether to provide the resources. These resources include local infrastructure, worker skills, and local services such as schools, police, and fire protection. If a community is unable to finance the improvements necessary to successfully attract the targeted firms, state money might be made available.

Some of the preference rankings common to each county also indicate areas where the state can make policy changes. In each case-study area, creating high-paying jobs while keeping the environment as clean as possible were considered the two most important impacts contributing to the attractiveness of a firm. Therefore, state programs need to be structured so that incentives are available for the types of firms that are environmentally friendly and offer higher wages. One potential way to structure an incentive policy would be to specifically target firms with pollution levels below a pre-specified limit. In order to provide more choices of industries to target, the state might also choose to help firms make their level of waste more acceptable to the area in which the firm wants to locate, rather than have a community dismiss dirty firms out of hand.

To help identify the impacts that affect an industry's attractiveness to a community, this research included variables that seek to represent economic and non-economic impacts of the firm. Specifically, the number of jobs, the average wage or salary, and the level of capital investment of a firm measure economic considerations. The levels of public service are represented by the impacts of population growth, the impacts on utility requirements, and the impacts on property values. The population growth and property value impacts may also affect the quality of life in an area. The cleanliness of industry impact is also used as a measure of the changes in quality of life that may result from a firm's relocation. Localities wishing to subsidize industry need to be able to predict how that industry will impact the local economy, public services, and the quality of life of residents.

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APPENDIX A: MEASURING INCONSISTENCY IN AHP

If community preferences were known for all the impacts related to industry recruitment, then scoring each of the industries would be straightforward. However, community preferences are seldom known and, when elicited, are often inconsistent. Prioritizing these preferences is also necessary to be able to show which industries are preferred by a locality. To prioritize preferences, researchers have developed a weighting scheme, the Analytical Hierarchy Procedure (AHP).

Inconsistencies in responses can be attributed to the limitations put on the comparison by the scale being used, which is based on subjective judgment rather than on exact measurement. Human error can also cause inconsistencies: prior rankings of each pair of elements are difficult for people to consider as they compare other criteria. An example of an inconsistency follows. Suppose pairwise comparisons are being conducted for three outcomes: A, B, and C. Suppose outcome A is preferred to outcome B by a wide margin, and outcome B is preferred to outcome C by a similarly wide margin. Consistency would say that outcome A should be preferred to outcome C by a very wide margin. If, during the pairwise comparison, A is only slightly preferred to C (or C is preferred to A), then an inconsistency is said to have arisen.

AHP is unique in that it allows a certain amount of inconsistency in judgment. It also provides a straightforward means of determining whether observed inconsistency falls within established bounds (Saaty and Kearns suggest a consistency ratio (CR) between 0.1 and 0.2.). If the CR does not fall below 0.2, then adjustments are required. Furthermore, understanding the degree of inconsistency and its implications is helpful. A measure of inconsistency can be found by using the CR, a description of which is found in Cox.

APPENDIX B: CALCULATING UTILITY REQUIREMENTS, INDUSTRY WAGES, AND CAPITAL INVESTMENT USING IMPLAN

IMPLAN model data were used to calculate average utility requirements per dollar of output for each industry. Each column of IMPLAN's Direct Coefficients Matrix represents the purchases made by one sector out of all other sectors in the economy needed to produce one dollar's worth of that sector's output. For example, an industry's use of water and sewage systems is approximated by its purchases from IMPLAN's sector 512, *Other Local Government Enterprises*. Sector 512 includes the local supply of sanitation, sewerage, water, gas, water transport and terminals, airports, housing and community development, and liquor stores (Lindall and Olson). Because of the inclusion of airports, housing and community development, and liquor stores, sector 512 might overstate utility usage. However, utility usage would be inflated for all industries in the study, although not equally.

The IMPLAN data base was also used to calculate average wage or salary requirements of each industry. The IMPLAN variable "Payments to Proprietors" was used to calculate the average level of capital investment for each industry per dollar of output. This variable represents the returns on capital investment accruing to the owners, shareholders, and lenders of each industry.

APPENDIX C: CALCULATING THE IMPACT OF INDUSTRIES ON COUNTY POPULATION AND PROPERTY VALUES

The population growth and the impact on property value indices used in the study are measures of a mismatch between ideal population distributions and those actually found in the county. As the county population distribution differs from that required by the industry, migration will occur, changing the local population and affecting property values.

The impact of population growth is a measure of the level of in-migration that might occur as a result of new industry. Two factors are included in the index: the average number of employees of a typical plant in each industry and the difference between the demand for each skill level by the industry relative to the supply of those skill levels in the community. A similar index is created for the impacts on property values. For both impacts, an industry is penalized for having worker skill-level requirements that differ from the existing worker skill-level structure in the county. Such a mismatch is assumed to induce changes in property values and migration.

The first step in creating the population growth index is to determine the employment associated with a typical firm in each industry. The total number of employees in each industry was divided by the total number of firms in that industry. The majority of the data for this calculation came from the *1992 Census of Manufacturing Preliminary Report Summary Series*. Data for the non-manufacturing industries were obtained from the *1992 County Business Patterns for the United States*. Data for government industries were obtained from the *1994-95 Virginia Statistical Abstract*.⁴

The second step is to determine demand in each industry for workers of different skill levels. The United States Department of Labor uses seven job classifications for occupations. These classifications are collapsed into three categories: high-, semi-, and low-skilled to reflect the amount of training and education required to perform the tasks of a particular job (Broomhall, 1991). Occupations in Classes 1 and 2 require the highest levels of education, defined in this study as needing at least a four-year college degree. Classes 3 and 4 require at least some training or education beyond a high school diploma. Classes 5, 6, and 7 may or may not require a high school diploma. These classes represent the demand by the industry for workers of each skill level.

Local supply of workers for each skill level was determined using educational attainment data, by county, from the *1994-95 Virginia Statistical Abstract*. The distribution of industry labor demands for the industries are then compared to the supply of labor in each county, and the population growth index by industry by community is created: as the proportion of skilled jobs demanded changes, the proportion of skilled people in the area is also assumed to change. The more mismatch between industry and county, the more migration is expected.⁵

The impact of industry location on property values is calculated in a similar fashion. Migration is assumed to be the main means by which industry location affects property values.⁶ As more people want to purchase housing, the property values in an area will increase. Labor demanded by industry

⁴ IMPLAN data were not used because the number of firms represented in IMPLAN is unknown. To measure migration, the average number of employees *per firm* was needed, but not for measuring the average employment (per dollar of output) calculated earlier.

⁵ Potential retraining is not accounted for with this measure.

⁶ Other factors, such as industry pollution levels, are also important. Refinements to better estimate the effect firms have on property values are left for future studies.

is again divided into high-, semi-, and low-skilled categories. Because of the different average pay received by each worker class, the high- and semi-skilled workers are assumed to be more likely to purchase a home, while low-skilled workers are more likely to rent. Another index of mismatch is created, this time with high- and semi-skilled categories combined. The distribution of industry labor demands for high- and semi-skilled workers is compared to the distribution of high- and semi-skilled labor in each county. The difference between industry distribution and the county distribution indicates the number of people who will purchase a home.

Both indices are scaled into percentages of the maximum value for all industries considered for the county. Neither index incorporates all factors affecting migration and property values, but they are highly correlated. More work is needed to determine how the location of different industries affect counties with different distributions of educational attainment and worker skills.

APPENDIX D: INDUSTRY SCORES IN BATH COUNTY

The scores for the different impacts by industry were calculated for each county. These scores were then weighted using the AHP-derived preference weights. The Bath County scores for 75 sectors are presented here. (See Cox for Halifax and Montgomery counties.)

Table B.1. Raw Scores for Each Industry and Each Impact, Bath County

Rank Using Raw Score	Sector Name	RAW SCORES							
		Ave. No. of Jobs	Ave. Wage or Salary	Level of Capital Invest.	Impact of Pop. Growth	Level of Utility Require	Environ. Impact	Impact on Property Values	Total Score
1	Research, Dev. & Testing	71.54	40.37	22.51	-12.80	-12.02	0.00	100.00	209.60
2	Pipe Lines, Except Nat. Gas	6.77	85.83	100.00	-3.06	-4.64	0.00	7.93	192.84
3	Maint. & Repair Oil/Gas Wells	88.00	31.99	28.73	-5.61	-5.05	0.00	27.02	165.08
4	New Government Facilities	31.25	53.78	34.28	-3.87	-4.23	0.00	49.32	160.52
5	Comm., Except Radio And TV	19.10	73.13	54.14	-11.56	-7.38	0.00	24.18	151.61
6	Maint. & Repair, Residential	39.24	35.03	31.98	-3.87	-7.51	0.00	49.32	144.18
7	Railroads And Rel. Serv.	24.33	90.32	18.53	-7.71	-13.25	0.00	30.87	143.10
8	Arrangement Of Pass. Trans.	67.32	30.12	32.66	-2.27	-14.21	0.00	22.75	136.37
9	Other Business Services	62.32	24.68	58.57	-0.27	-14.89	0.00	4.64	135.05
10	Knit Underwear Mills	100.00	32.90	9.99	-1.73	-3.42	-8.76	1.65	130.62
11	Fluid Power Pumps & Motors	53.11	68.07	16.81	-4.91	-0.82	-10.57	8.80	130.49
12	Pleating And Stitching	68.43	26.78	42.94	-3.37	-3.01	-6.10	3.19	128.87
13	Electric Services	8.88	79.92	61.56	-12.90	-30.19	0.00	18.47	125.74
14	Electronic Computers	19.07	93.82	27.32	-4.91	-8.06	-10.57	8.80	125.48
15	Comp. & Data Process. Serv.	38.94	49.89	40.58	-0.27	-9.84	0.00	4.64	123.94
16	Marking Devices	66.15	39.11	34.10	-0.19	-2.60	-15.55	0.68	121.71
17	Phonograph Records And Tape	35.69	73.28	48.27	-6.97	-1.37	-34.90	7.21	121.21
18	Industrial Patterns	45.81	65.42	16.68	-4.91	-3.55	-10.57	8.80	117.69
19	Maint. & Repair Other Facil.	36.35	4.15	32.53	-3.87	-5.19	0.00	49.32	113.28
20	Printing Trades Machinery	28.97	68.51	24.16	-4.91	-4.37	-10.57	8.80	110.60
21	Pottery Products, N.E.C.	71.75	27.88	26.52	-0.19	-6.28	-10.51	1.23	110.39
22	Transportation Services	38.28	42.99	33.52	-2.27	-27.87	0.00	22.75	107.40
23	Ammun., Except Small Arms	39.13	65.84	24.41	-0.71	-6.28	-16.29	1.29	107.39
24	Special Dies & Tools & Accs.	43.90	59.98	17.10	-4.91	-9.56	-10.57	8.80	104.75
25	Spec. Prod. Sawmills, N.E.C.	58.26	28.81	21.06	-0.15	-1.50	-6.68	2.54	102.33
26	Newspapers	43.15	42.28	42.21	-1.42	-8.33	-19.19	3.43	102.13
27	Bread, Cake, & Rel. Products	24.04	49.85	45.82	-0.18	-13.52	-5.65	1.15	101.51
28	Wholesale Trade	39.81	53.31	18.29	-2.87	-25.41	0.00	17.84	100.98
29	Fast., Buttons, Needles, Pins	49.33	43.71	26.61	-0.19	-4.10	-15.55	0.68	100.51
30	Auto. Temp. Controls	48.39	55.58	22.91	-12.94	-5.05	-18.90	10.20	100.18
31	Misc. Publishing	23.61	50.10	50.74	-1.42	-7.38	-19.19	3.43	99.90
32	Dolls	45.63	53.53	17.38	-0.19	-1.78	-15.55	0.68	99.72
33	Hardwood Dimension & Floor	57.39	29.45	24.13	-0.15	-8.33	-6.68	2.54	98.35
34	Brooms And Brushes	39.41	35.22	41.47	-0.19	-3.28	-15.55	0.68	97.77
35	Wood Kitchen Cabinets	45.34	32.89	29.37	-0.15	-6.01	-6.68	2.54	97.30
36	Cutlery	22.99	63.32	41.49	-0.71	-15.30	-16.29	1.29	96.81
37	Inst. To Measure Electricity	25.48	75.60	21.15	-12.94	-5.87	-18.90	10.20	94.71
38	Cigarettes	3.48	100.00	47.21	-34.78	-7.38	-19.58	5.69	94.65
39	Greeting Card Publishing	20.72	47.09	50.76	-1.42	-6.97	-19.19	3.43	94.42

Table B.1. Raw Scores for Each Industry and Each Impact, Bath County (continued)

Rank Using Raw Score	Sector Name	RAW SCORES							
		Ave. No. of Jobs	Ave. Wage or Salary	Level of Capital Invest.	Impact of Pop. Growth	Level of Utility Require	Environ. Impact	Impact on Property Values	Total Score
40	Wood Office Furniture	42.45	40.72	27.61	-2.03	-5.05	-17.02	7.50	94.18
41	Leather Goods, N.E.C.	56.62	30.04	24.24	-0.25	-3.55	-15.80	2.37	93.65
42	Bookbinding & Related	64.64	34.96	17.64	-1.42	-7.92	-19.19	3.43	92.13
43	Distilled Liquor, Exc. Brandy	5.92	84.29	16.75	-0.18	-10.38	-5.65	1.15	91.90
44	Wood TV & Radio Cabinets	52.98	36.83	16.23	-2.03	-2.73	-17.02	7.50	91.75
45	Costume Jewelry	46.94	30.70	37.40	-0.19	-8.33	-15.55	0.68	91.65
46	Food Products Machinery	28.30	59.17	22.74	-4.91	-12.43	-10.57	8.80	91.09
47	Typesetting	48.71	45.73	19.88	-1.42	-6.42	-19.19	3.43	90.73
48	Luggage	36.69	35.70	33.14	-0.25	-2.32	-15.80	2.37	89.52
49	Optical Inst. & Lenses	30.66	66.84	18.60	-12.94	-5.19	-18.90	10.20	89.26
50	State & Local Gov. - Non-ed.	94.74	46.73	0.00	-100.00	0.00	0.00	46.18	87.64
51	Canvas Products	49.63	33.76	14.44	-3.37	-4.10	-6.10	3.19	87.47
52	Wood Pallets And Skids	53.04	25.35	16.07	-0.15	-3.01	-6.68	2.54	87.16
53	Household Furniture, N.E.C.	57.01	34.43	9.88	-2.03	-3.69	-17.02	7.50	86.08
54	Apparel From Purch. Materials	47.58	28.01	20.02	-3.37	-3.55	-6.10	3.19	85.79
55	Shoes, Except Rubber	51.15	32.03	19.06	-0.25	-3.01	-15.80	2.37	85.54
56	Mach. Tools, Metal Cut. Types	32.31	62.14	9.91	-4.91	-12.16	-10.57	8.80	85.53
57	Wood Partitions & Fixtures	40.58	44.66	17.24	-2.03	-6.15	-17.02	7.50	84.78
58	Wood Containers	50.83	27.82	12.89	-0.15	-2.87	-6.68	2.54	84.38
59	Narrow Fabric Mills	48.76	36.33	13.49	-1.73	-5.46	-8.76	1.65	84.27
60	Complete Guided Missiles	18.56	89.61	26.77	-23.59	-5.19	-33.50	10.20	82.85
61	Plate Making	30.98	65.77	11.30	-1.42	-8.33	-19.19	3.43	82.53
62	Women's Hosiery, Exc. Socks	48.10	36.09	13.78	-1.73	-7.79	-8.76	1.65	81.34
63	Musical Instruments	46.36	35.89	27.62	-0.19	-14.21	-15.55	0.68	80.61
64	Advertising	47.18	6.22	49.38	-0.27	-27.05	0.00	4.64	80.10
65	Federal Gov. - Non-military	62.53	70.79	0.00	-100.00	0.00	0.00	46.18	79.50
66	Cut Stone & Stone Products	47.98	36.33	15.99	-0.19	-11.34	-10.51	1.23	79.49
67	Ophthalmic Goods	42.96	48.40	24.76	-12.94	-15.03	-18.90	10.20	79.45
68	State & Local Electric Utilities	11.61	65.13	65.86	-12.90	-69.54	0.00	18.47	78.63
69	Misc. Fabricated Wire Products	36.80	47.12	24.06	-0.71	-14.07	-16.29	1.29	78.21
70	Mach. Tools, Metal Form. Types	32.57	61.01	7.48	-4.91	-16.80	-10.57	8.80	77.58
71	Fabric. Plate Work	32.83	56.92	13.70	-0.71	-10.25	-16.29	1.29	77.50
72	Millwork	36.50	37.34	23.63	-0.15	-18.85	-6.68	2.54	74.33
73	Furniture & Fixtures, N.E.C.	19.89	46.10	24.10	-2.03	-4.64	-17.02	7.50	73.90
74	Wood Products, N.E.C.	51.25	29.11	25.03	-0.15	-29.51	-6.68	2.54	71.59
75	Small Arms	24.04	53.31	24.14	-0.71	-14.48	-16.29	1.29	71.30

Note: Scores are computed as ratios of the actual score by industry divided by the actual score of the largest score for all industries. For example, Knit Underwear Mills employ the largest number of people per firm of all industries; Small Arms firms employ on average 24 percent of the number employed in the Knit Underwear sector.