Identifying Sustainable Businesses for Community Economic Development

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Abstract

CBM was used to set economic development priorities and identify sustainable businesses for Enosburg Falls, Vermont. A modified CBM corrected limitations found in the first study. Results show that business in Depository and Non-depository financial institutions, dairy processing, and industrial machinery & equipment sectors are desirable and compatible for Enosburg Falls to target.

Introduction

Identifying target industry sectors for rural economic development is complex. This paper presents a model that helps a community set its economic, environmental, and social priorities and identify desirable sectors for the community to target based on these priorities.

The Community-Business-Matching (CBM) model was developed to help rural communities and small towns identify appropriate industry sectors for economic development. The model utilizes two measures, *Desirability* (how likely benefits contributed by a business are to meet community goals/priorities) and *Compatibility* (how likely a business is to locate in the community where its needs can be satisfied), to gauge the strength of the match between an individual community and potential industry sectors. The model was pilot tested using data from a site in Richmond, Vermont.

The CBM model proved useful for the pilot case study generally. However, some issues were raised as to the appropriateness of the functional forms of the key measures (*Desirability* & *Compatibility*). A second community, the village of Enosburg Falls in Franklin, Vermont, was studied using the modified CBM model. With the second highest unemployment rate in Vermont with a large population of retired persons, the village hoped that the CBM project would identify sustainable new businesses that could provide quality jobs to local youths in addition to preserving its agricultural traditions.

The limitations of the original CBM model are as follows. First, the functional form of the *Desirability* index assumes that a community has a non-zero baseline value for each of the economic indicators that make up the index, so that the benefit contributed by a new business can be measured as a proportional increase over the baseline. However, no baseline value will be applicable to the case of a new industrial park, for instance, and assuming a zero baseline can result in meaningless values due to division by zero. Second, the AHP (Analytical Hierarchy Process) method used in the Richmond study to obtain aggregate weights of community goals from individual community members' ratings turned out to violate a well-established social choice axiom referred to as the Pareto Optimality (Ramanathan and Ganesh, 1994). As accurate and truly representative weights are crucial in the correct identification of desirable businesses, an appropriate method of aggregation must be found. A third limitation of the model lies in its use of a linear *Compatibility* index, which states that the compatibility measure is proportional to the weights given by businesses to various infrastructural needs. The ordinal Likert scale that was used to obtain business weights, however, does not allow such a cardinal interpretation. The functional form of the *Compatibility* index therefore has to be corrected.

This paper presents the modified CBM model that overcomes the above mentioned limitations. More over, sixty-two major industry sectors (corresponding to the 2-digit SIC groups) are examined for this study, a significant expansion from the first study in Richmond, where only sectors related to agriculture and forestry were included. The next section gives a brief review of literature in the area of community economic development. The modified CBM model framework is introduced next. As a concrete example, data from Enosburg Falls will be presented and analyzed, followed by conclusions regarding the usefulness and limitations of the CBM model.

Literature Review

Tools for Targeting Community Economic Development

Planners and public officials frequently target one or a few industry sectors for community economic development (Galston, 1995; Phillips, 1990). When these sectors are selected by outside decision-makers with minimal inputs from community members, the sustainability of businesses thus targeted is questionable (Mountain Association of Community Economic Development, 1997). Negligence of local preferences for economic development outcomes could result in negative impacts such as weakened community support and business failure (Buescher, 1998).

There are few tools for targeting economic development efforts at specific industries that incorporate local preferences. The most frequently used tools, such as location quotients, shift-share analysis, and input-output models, are all *positive* approaches. The purpose of these tools is to describe the economic situation in a certain location (Blair, 1991), rather than to prescribe what an economy *should* be like. As such, local preferences for economic development are ignored. Moreover, none of these tools consider social and environmental impacts resulting from economic development activities, which constitutes another major limitation of such tools given an increasing global awareness of the importance of sustainable development (Blakely, 1994). Therefore, target industry sectors suggested by these methods are unlikely to be sustainable.

A most recent attempt to explicitly incorporate community preferences in economic development decision-making was made by several researchers in Virginia. Cox (1996), along with Johnson and Alwang (1997), organized local leaders in three counties to identify their economic development goals, using seven indicators of economic, environmental, and social impact. Results suggested that all three counties would be most likely to have their goals met by businesses in the "Pipelines, except natural gas" sector (Standard Industrial Classification [SIC] 46). However, as this sector is highly concentrated in an area excluding Virginia (Barkley and Henry, 1997), the likelihood that the Virginia counties could attract this type of business is marginal. In turn, Cox suggested that their approach be complemented by consideration of the location decision factors of the sectors to be targeted.

The Community-Business-Matching (CBM) model introduced in this paper builds upon the Virginia study by using more indicators of economic development impacts and considering how well a community can accommodate the location needs of targeted businesses.

Small Businesses and Service Sectors as Economic Development Targets

Small businesses (with less than 20 employees) account for almost 90% of US firms, more than 20%

of the nation's employment, and nearly 50% of net new job growth in the US, including most of the growth in high-wage jobs (Kuratko and Hodgetts, 1998). Service sectors also contribute much to the US economy by employing about 34% of the US labor force compared with less than 16% in manufacturing (US Bureau of Census, 1996). These numbers, coupled with the fact that many rural communities have lost edge in attracting large manufacturing firms due to cheaper foreign labor and land (Blakely, 1994), suggest the potential for small businesses and service sectors to become economic development targets in rural areas. CBM considers small businesses in agricultural, manufacturing, and service sectors.

As stated earlier, the success of targeting efforts also depends on a clear understanding of factors influencing business location decisions. Studies have shown that rural communities possess certain assets that make them preferred locations for some businesses, primarily a high quality of life (King, 1997; Blakely, 1994; Glaser and Bardo, 1991; Moore, Tyler & Eliiot, 1991). As there is no definite conclusion as to the importance of this factor and other infrastructures in small business location decision making, a broad range of factors identified in previous business location studies are considered in CBM. These include 9 space and land use factors, 13 physical infrastructure indicators (Crone, 1997; Goetz, 1997; McNamara, et al., 1995; Reeder and Wanek, 1995), 11 economic infrastructure indicators (Crone, 1997; McNamara, et al. 1995; Glaser and Bardo, 1991; Moore, Tyler, and Elliot, 1991; O'Farrell and Hitchens, 1990) and 8 quality of life indicators (King, 1997; Crompton and Witt, 1997; Blakely, 1994; Moore, Tyler, and Elliot, 1991; Glaser and Bardo, 1991). See Appendix B for detailed indicator descriptions.

The CBM Framework

Overview

The objective of the Community-Business-Matching (CBM) model is to assist rural communities in identifying industry sectors that best match their goals and assets for sustainable economic development. Two indices, *Desirability* and *Compatibility*, are used to find such matches. The former gauges how well the benefits provided by a business match the prioritized goals of a community while the latter measures how well the assets of the community provide for the needs of the business. The matching results can suggest short- and long-term economic development strategies for the community as shown Figure 1 and discussed in later sections.

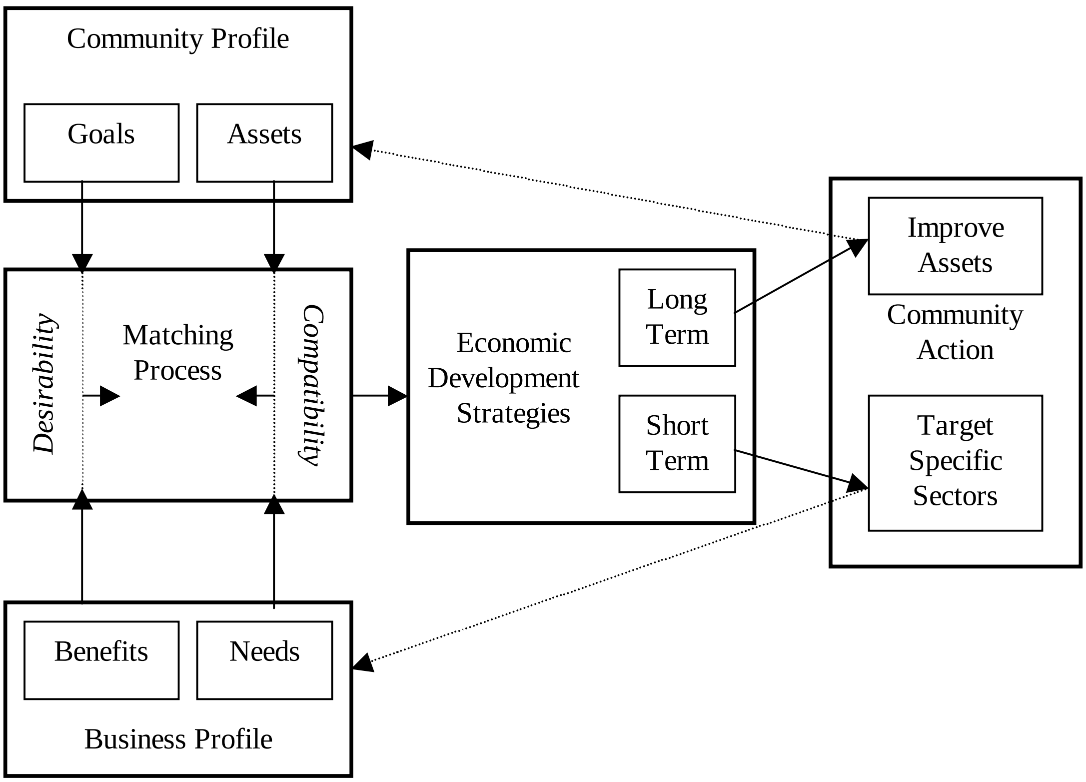

Figure 1. The CBM framework

The Modified Desirability Index

As is shown in Figure 1, *Desirability* measures how well business benefits match a community's economic development goals. Five categories of goals are defined in CBM, each consisting of a number of indicators: Employment Opportunity, Economic Efficiency, Protection of the Environment, Social Equity, and Guaranteed Minimum Existence. Appendix A shows the definition and indicators for each goal category.

The *Desirability* index is calculated for each business according to the following function:

$$D_j = D_j(x_{1j},...,x_{nj}) = \prod_{i=1}^{n} x_{ij}^{\beta_i} \qquad (1)$$

where Dj is the *Desirability* index for business j; x_{ij} is the level of business benefit contributed by business j to the ith goal; βi is the weight given by the community to the ith goal; n=5 is for the five Goals (or Five E's) defined in CBM. Each x_{ij} is calculated in a similar fashion:

$$x_{ij} = \prod_{k=1}^{n_k} x_{ijk}^{\beta_{ik}} \qquad (2)$$

where x_{ijk} is the level of business benefit contributed by business j to the kth indicator of the ith goal; β_{ik} is the weight given by the community to the kth indicator of the ith goal; n_k is number of indicators under the ith goal.

As mentioned in Introduction, the original *Desirability* index of CBM assumes that the community has a non-zero baseline value for each indicator that comprises the index, and that the business benefit can be measured as a proportionate change over the baseline. However, this method of measuring business benefits fails in situations where the theoretical baseline is zero or unavailable. To accommodate such situations, the modified *Desirability* index uses the difference between a target and a baseline value, instead of a sole baseline, as the reference point against which the business contribution is evaluated. As such, the new contribution of a business can be measured as the proportional progress it accomplishes toward meeting the unmet community target. While the baseline value is the current situation in the community, the target can be any practical value the community desire to achieve. For example, suppose the community currently has 10 employees at the site for development, and the desired number of employees is 20. A new business that hires 5 previously unemployed people (new contribution) will achieve a benefit level of .5 (5 over 10) for the indicator "number of jobs available to local residents". Besides the ability to accommodate the "zero-baseline" situation, the new functional form of *Desirability* permits comparison of indicators measured on different scales (such as the degree of contribution given by five new jobs vs. 3 additional educational programs, etc.).

The *Desirability* score of a sector is obtained as the arithmetic mean of the *Desirability* scores of the businesses surveyed[1] within that sector. Community economic development inevitably involves tradeoffs among goals. For example, a manufacturer that provides high-pay jobs may also incur high levels of pollution. The convexity of the Cobb-Douglas function ensures that a balanced mix of goals is preferred to a dominating goal approach. The limitation of a Cobb-Douglas functional form is that *Desirability* always increases with an increasing level of a certain business benefit. However, in reality, technology constraints, resource availability, and other restrictions will not allow an infinite increase in one or two particular business benefits. Therefore, the limitation of a Cobb-Douglas function should not adversely affect the functionality of the CBM model.

How desirable a certain industry sector is to a given community depends on how well it matches the goals of the community. *Ceteris paribus*, sectors that contribute to the goals most important to a community receive a higher *Desirability* score. The weights of the goals (β's) are obtained by aggregating individual community member's judgments on the relative importance of the community goals using the Analytic Hierarchy Process, which will be introduced shortly.

The Analytical Hierarchy Process as a Community Priority Setting Method

CBM employs the Analytical Hierarchy Process (AHP) developed by Saaty (1986) to place weights on the economic, environmental and social goals of a community. Frequently used in complex priority setting

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[1] A mail survey to 5,000 small and medium sized businesses in the six New England States and New York were sent out in 1996 ant 1998.

problems, the AHP is one of the most straightforward and structured methods that can easily accommodate subjective judgments in a group decision-making context (Dyer 1992).

To obtain the weights, a group of around 15 to 20 community representatives is selected to perform the task of priority setting. The size of the group is recommended by Saaty (1986) to maximize the effectiveness of the AHP method. For every indicator that constitutes each of the five goals, a 9-point Likert scale is used to rate its importance with respect to the goal it measures. The arithmetic mean of the ratings is taken as the group ratings. The next step is to ask the group members to weigh the five categories of Goals against each other in pairwise comparisons. An example is given in Table 1 to show the results from one individual. The arrow points to the category of goal that is rated as more important. For example, in the example given, “Environment” is considered 3.7 times as important as “Employment”, while “Employment” is considered 1.9 times as important as “Efficiency”.

Each individual's evaluations are recorded as a reciprocal pairwise comparison matrix $A = [a_{ij}]$, where $a_{ij} = 1/a_{ji}$, for i,j = 1, 2 , ... , 5. Each entry of the matix, a_{ij}, is interpreted as an estimate ratio of weight between goal i and j, w_i / w_j, taken to the nearest integer. Given the individual matrices, there are two alternatives to aggregating them into the group weight of the Five E's. One of the methods, commonly referred to as the Geometric Mean Method, aggregates the individual matrices into a group matrix using the geometric mean of corresponding entries, and then computes the weights of the items being compared, using a right eigenvector method described by Saaty (1986). A number of researchers, including Saaty himself, recommended this approach in a group decision-making context (Aczel and Saaty, 1983; Saaty and Kearns, 1985; Willet and Sharda, 1991; Benjamin et al., 1992). The first study of CBM also used this method. An alternative method first transforms the pairwise comparison matrix into weights given by each individual using the right eigenvector method and then computes the arithmetic mean of the weights to represent the group evaluation (Arrington, 1984).

Table 1. Individual Pairwise Comparisons of the Five E's

	Environment	Efficiency	Equity	Existence
Employment	⇑ 3.7	⇐ 1.9	⇑ 1.1	⇑ 1.3
Environment		⇐ 1.8	⇐ 3.3	⇐ 2.6
Efficiency			⇑ 1.4	⇑ 2.4
Equity				⇑ 2.7

Arrows (⇐ or ⇑) point to the category that was rated as more important.
Numbers indicate how much more important, using the following scale

SCALE:	1	The two categories are equally important.
	3	One category is moderately more important than the other.
	5	One category is strongly more important than the other.
	7	One category is very strongly more important than the other.
	9	One category is extremely more important than the other.
	2, 4, 6, 8	Intermediate ratings for compromise.

According to Ramanathan and Ganesh (1994), the Geometric Mean Method violates the Axiom of Pareto Optimality[2]. We can show that the arithmetic mean method is the only method appropriate for calculating community weights in CBM (see Appendix C for mathematical proof).

The Modified Compatibility Index

Just as communities will find different businesses more or less desirable, businesses will find different communities more or less attractive as a location site. Measuring the *Compatibility* of a particular sector involves two steps. First, a business indicates its location needs on a five-point Likert scale (0 means not important and 4 very important), including those for Acreage and Space, Physical Infrastructure, Economic Infrastructure and Quality of Life (see Appendix B for details). These needs are matched with the level of community assets, which indicates the availability of these resources at the chosen site for development.

The *Compatibility* index is calculated according to the following function:

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[2] Pareto Optimality, one of the well-established axioms of social choice, states that if all the individuals in a group prefer A to B, then it must be true that the group as a whole prefers A to B.

$$C_j = C_j(y_1,...,y_m) = \alpha_j \sum_{i=1}^{m} y_i \cdot |y_i|^{1-\delta_{ij}} \quad (3)$$

where Cj is the *Compatibility* index for business j; y_i is the level of the i^{th} community asset; α_j is the acreage and space coefficient for business j; δ_{ij} is the weight placed on the i^{th} asset by business j; m=32 is the number of community assets defined by CBM categorized into Physical Infrastructure, Economic Infrastructure, and Quality of Life. See Appendix B for a detailed description of the definition and indicators of the assets.

The functional form in Equation 3 is the sum of weighted community asset levels multiplied by a sector-specific acreage and space coefficient, the value of which ranges from 0 to 1. The maximum value of 1 is assigned to a business whose spatial needs will be completely satisfied by the site. "Acreage and Space" are necessary to any business operation. Therefore the acreage and space coefficient (α_j) is multiplied with the rest of the Compatibility score so that any value of this coefficient that is less than one will render that particular business less compatible then would be the case if all its space and land needs can be satisfied. The level of a particular asset (y_i) in a community is assumed to be a random variable following the normal distribution whose mean and variance are derived from national data. The best possible level among all communities is 1 and the worst possible level is –1. A positive sign of the asset level indicates that the community possesses a relatively strong asset while a negative sign indicates a shortage. In the case of an asset i of a positive level, if business j regards this asset as highly important (indicated by a high weight δij), then the component compatibility score from asset i will be high, thus enhancing the overall *Compatibility*. On the other hand, if the highly important asset is insufficient in the community, suggested by a negative asset level, the overall *Compatibility* will be significantly subtracted from due to the lack of that asset. Given a certain level of an asset (y_i), the *Compatibility* component ($y_i \cdot |y_i|^{1-\delta_{ij}}$) for that asset increases with the business weight (δ_{ij}) at an increasing rate when y_i is positive, and decreases at an increasing rate when y_i is negative (see Appendix D for mathematical proof). This form of the *Compatibility* index is better than the one used for the first case study ($C_j = C_j(y_1,...,y_m) = \alpha_j \sum_{i=1}^{m} \delta_{ij} y_i$), as it generates *Compatibility* components that are more dispersed and distinguishable among businesses and sectors. In addition, it does not impose cardinal interpretations on the ordinal scale ratings given by businesses, which was the case previously. The rank orders of the businesses and sectors by *Compatibility* do not change significantly under the two different functional forms (p-value of a Spearman's Rho test less than 0.001).

Sector *Compatibility* is the arithmetic mean of the business *Compatibility* scores within that sector. The degree to which a community's stock of a particular asset meets the business's need for that asset determines how compatible that business is with the community. The weights δ_{ij} are derived from a mail survey data on 5,000 small and medium sized enterprises in the six New England states and New York. Each business surveyed was asked to rate the importance of each indicator of Business Needs on a Likert scale from 0 (not important) to 4 (very important). The ratings were then proportionally reduced to a scale of 0 to 1 in calculation of *Compatibility*.

Finding the Best Match

The CBM matching process identifies businesses/sectors suitable for targeting (see Figure 2). Industry sectors (denoted by circles) in the Northeast corner of the diagram are ideal for attraction, since they are both desirable and compatible with the community; those with a relatively high score on *Compatibility* but not on *Desirability* are prospective short-term targets, because they are likely to find the community an attractive location where their business needs can be satisfied. At the same time, the community can negotiate for better terms from the approaching businesses so as to improve their immediate contribution to achieving the community goals. In the long run, the community can initiate strategic plans to improve its assets so as to become more compatible with the businesses that they highly desire to attract or retain.

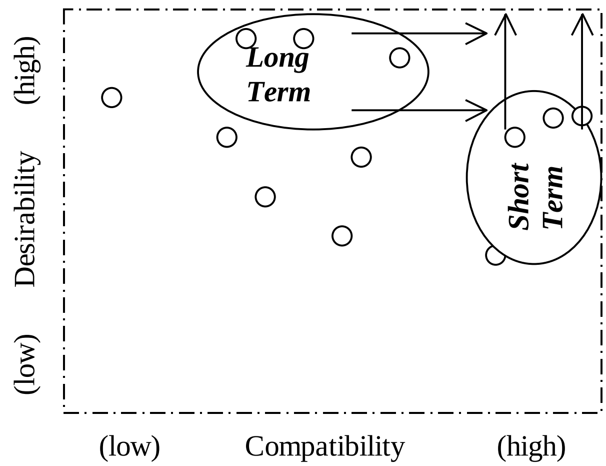

Figure 2. Short-term and long-term targets

Data Analysis and Results

Data

Data from the case study of Enosburg Falls, Vermont are used in this section to illustrate the usefulness of the modified CBM model. With the second highest unemployment rate in Vermont (9% in 1998) and a large population of retired persons (over 50% aged 65 or above), the village hoped that CBM would identify sustainable new businesses that could provide quality jobs to local youth in addition to preserving its agricultural traditions.

Information regarding business needs and benefits were gathered through a self-administered mail survey distributed to 5000 small- and medium-sized businesses in the six New England states and New York. A response rate of 13.2% was achieved following a Dillman (1978) method. Table 2 presents the descriptive statistics of the survey respondents, such as number of respondents by industry sector, average annual sales and average number of employees per business.

Table 2. Summary Statistics of Survey Respondents by Sector

Industry Sector	# of Respondents	Avg. Annual Revenue ($)	Avg. # of Employees
Agriculture	157	413,015	6
Construction	15	697,870	10
Manufacturing	245	2,450,002	16
Transportation, Communication, Utilities	8	828,750	6
Wholesale Trade	4	1,962,500	6
Retail Trade	44	908,873	6
Finance, Insurance, and Real Estate	22	2,839,409	8
Other Services, For Profit	59	312,374	16
Other Services, Non Profit	3	127,556	13
All Businesses	557	1,456,575	12

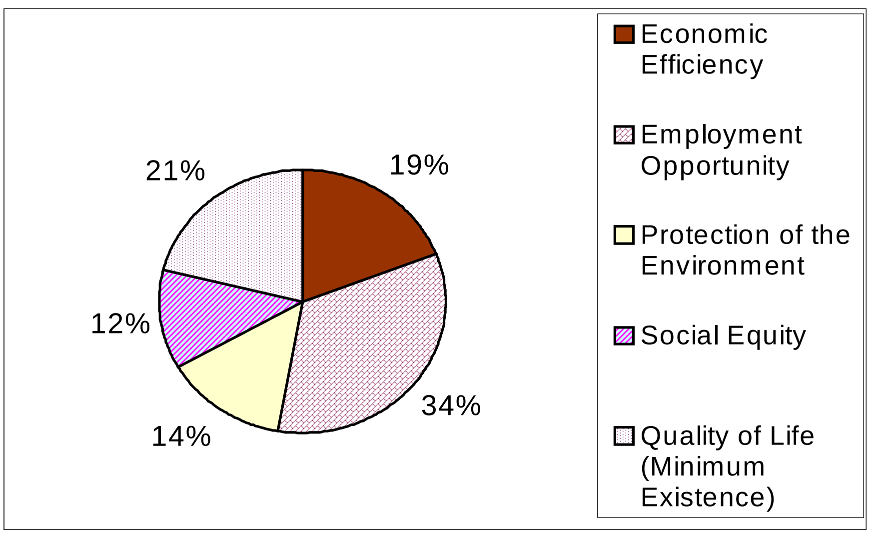

Figure 3. Weights of goals: Enosburg Falls Village (1998)

The result of the weights of the Community Goals for Enosburg Falls is summarized in Figure 3. Thirty-four percent of the total weight goes to the goal of Employment Opportunity, followed by Guaranteed

Minimum Existence (21%), Economic Efficiency (19%), Protection of the Environment (14%), and Social Equity (12%). Employment Opportunity is about three times as important as the goal with the lowest priority (Social Equity). Guaranteed Minimum Existence and Economic Efficiency have almost equal weights of around 20%.

The weights of the indicators of each Goal will not be shown due to space limitation. It is found that of all the indicators, the ones with the highest weights are "Percent of local residents earning a livable wage" (8.1%), "Number of jobs available locally" (7.5%), and "Percentage of jobs that are full-time, permanent positions" (7.0%). The latter two indicators belong to the category of Employment Opportunity. The indicator with the highest weight of 8.1% belongs to the category of Quality of Life.

The Village of Enosburg Falls has a total of 795 acres of land and 25,000 square feet of space available for new businesses. The overall value for Physical Infrastructure of Enosburg Falls is fairly strong (0.574) followed closely by Economic Infrastructure (0.441), while the Quality of Life value is weaker (0.273).

Findings

As shown in Figure 4, there are four industry sectors that score high in both *Desirability* and *Compatibility* (>=0.5 in both scores). They are Depository and Non-Depository Credit Institutions, Woodlots, Dairy Processing, and Security & Commodity Brokers. There are a number of sectors that are even more compatible than the previous four sectors, but not as desirable, such as Animal & Veterinary Services and Insurance Agents, Carriers, & Brokers. Other highly compatible sectors are Health & Social Services, Business & Engineering Services, and Industrial Machinery & Equipment. The finding that service sectors account for two out of four most desirable and compatible sectors identified for Enosburg Falls seems to suggest the potential for such sectors to be rural economic development targets.

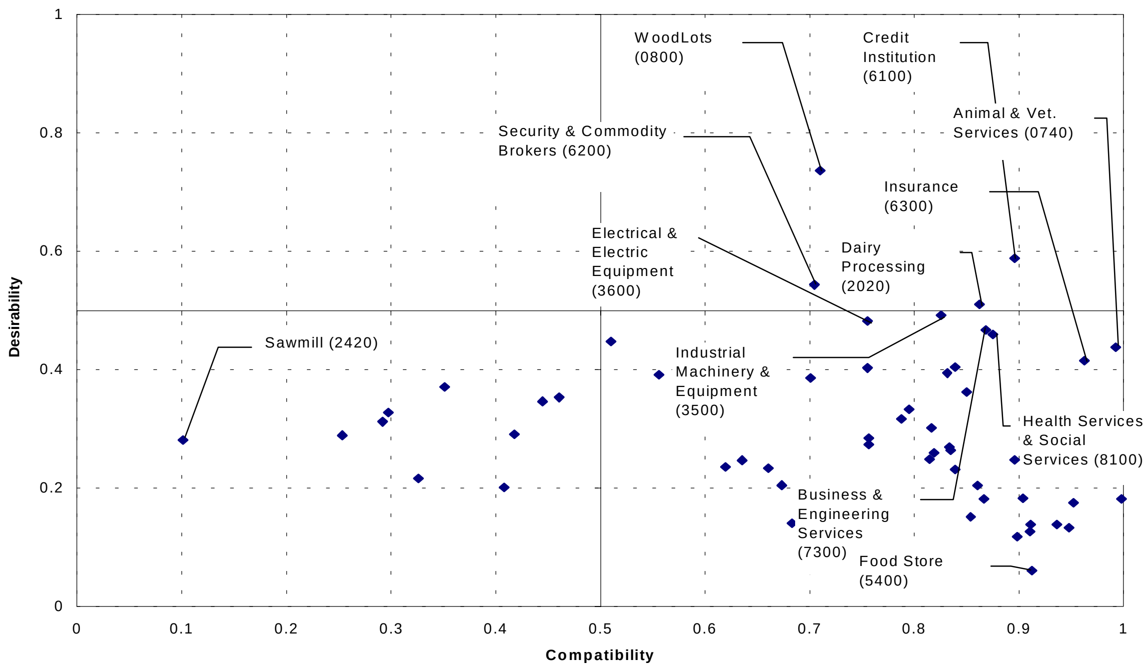

Figure 4. The CBM matching results for Enosburg Falls (1998)

The ten most compatible sectors are listed in Table 3. Except for Animal & Veterinary Services and Insurance Carriers, Agents, and Brokers, all of them score well below 0.5 in Desirability on a scale from 0 to 1. Further analysis shows the reason: none of these sectors contribute even modestly to the increase in the percentage of households earning a livable wage ($25,712), they don't provide enough employment benefits, and relatively few new local jobs are offered by these sectors. However, people in Enosburg Falls regard these as the three most important goals for their community.

Table 3. Ten Most Compatible Sectors for Enosburg Falls

Sector	Description	Compatibility*	Desirability*
6500	Real Estate	1.00	0.18
0740	Animal and Veterinary Services	0.99	0.44
8600	Membership Organizations	0.97	0.23
6300	Insurance Carriers, Agents, and Brokers	0.96	0.42
5300	General Merchandise Stores	0.95	0.18
5600	Apparel and Accessory Stores	0.95	0.13
5700	Furniture and Home Furnishing Stores	0.94	0.14
5900	Miscellaneous Retail	0.93	0.21
0780	Landscape Services	0.93	0.26
5400	Food Stores	0.91	0.06

*Values are rounded up to the hundredth decimal place.

Table 4 shows the ten most desirable sectors for Enosburg Falls. All of them, with the exception of Fabricated Metal Products, are also very compatible.

Table 4. Ten Most Desirable Sectors for Enosburg Falls

Sector	Description	Desirability*	Compatibility*
800	Woodlots	0.74	0.71
6100	Depository and Non-depository Credit Institutions	0.59	0.90
6200	Security and Commodity Brokers	0.54	0.70
2020	Dairy Processing	0.51	0.86
3500	Industrial Machinery and Equipment	0.49	0.83
3600	Electrical and Electric Equipment	0.48	0.76
7300	Business and Engineering Services	0.47	0.87
8100	Health Services and Social Services	0.46	0.87
3400	Fabricated Metal Products	0.45	0.51
740	Animal and Veterinary Services	0.44	0.99

*Values are rounded up to the hundredth decimal place.

However, an in-depth examination shows that while their overall *Compatibility* scores are high, each of these sectors has unmet needs in the community. For example, the unmet needs of the four most desirable industry sectors are summarized in Table 5. The more asterisks, the more inadequate an asset listed on the left is relative to the need of a particular sector.

Among the things that the highly desirable sectors all need yet not adequately provided by the community are (most inadequate first): A low local tax rate, social and cultural opportunities, availability of local customers, availability of local suppliers, unskilled labor, access to natural gas pipeline, and a low cost of living. While the community may not have control over the availability of local customers and suppliers or cost of living, it can improve upon the rest of the identified weaker assets through proper investments. As a matter of fact, were these constraints removed, the community would become highly compatible with most of the top ten desirable sectors.

Table 5. Unmet Business Needs by Most Desirable Sectors

Indicator	Woodlots	Credit Institutions	Security & Commodity Brokers	Dairy Processing
Access to natural gas pipeline	**	**	*	***
Availability of social and cultural opportunities	***	***	***	***
Availability of local customers	***	**	***	***
Favorable local tax rate	***	***	***	***
Availability of managerial or professional workers	**			**
Availability of unskilled labor	**	**	*	***
Availability of local suppliers	**	*	**	***
Low cost of living	**	**	**	**
Outdoor recreation opportunities	**		**	**
Possibility for future expansion	**		**	*
Quality of local schools	**			
Nearby access to a railroad			**	
Favorable local labor costs	*			*
Availability of quality health care	**			**
Availability of skilled labor	*		*	
Local crime rate	*	**		
High environmental quality			*	
Space for development (Manufacturing/Office)	**		*	

Conclusions and Limitations

This paper has presented a modified Community-Business-Matching model and its application in the village of Enosburg Falls, Vermont. The most important economic development goal for Enosburg Falls was

Employment Opportunity, followed by Guaranteed Minimum Existence, Economic Efficiency, Protection of the Environment, and Social Equity. Combining the community weights obtained through an AHP process, data on community assets, and business benefits and location needs information, the CBM model generated *Desirability* and *Compatibility* scores for 557 businesses in 62 industry sectors. The industry sectors identified as highly Desirable and Compatible include Depository and Non-Depository Credit Institutions, Woodlots, Dairy Processing, and Security & Commodity Brokers. Factors particularly contributing to the high *Desirability* of these industries are tax contribution, availability of local jobs, enhancing the local economic diversity and low impact on environment. These sectors are also highly *Compatible* compared to other sectors because the businesses attach great importance to environmental quality, low crime rate, development assistance, and other infrastructures that are strong assets in Enosburg Falls.

Results also illustrate the weaker assets of Enosburg Falls that need improvement in order for the community to become a more attractive place for all businesses in the long run. These include high local tax rates, lack of social and cultural opportunities, and lack of unskilled labor. Based on such information, the community may take actions to improve needed assets, such as offering lower tax rates to desirable businesses, enriching cultural opportunities by renovation of local historical sites, or establishing training centers to supply employers with needed labors.

The second case study of CBM proved the generalizability of the model and the flexibility of the CBM approach to accommodate unique situations that different communities may have. However, the CBM approach has its limitations. The information presented so far is based on an average business in an industry. It is possible for a specific business to be much more *Desirable* and/or *Compatible* than the average. Therefore, the results of CBM matching should be interpreted with that limitation in mind. Depending on the sector, the variation in contributions and needs of an industry sector can be great. One other drawback is that in some sectors the number of businesses responding to the survey is quite small, in which case the profile created for that sector may be less representative.

Nevertheless, CBM provided useful information for Enosburg Falls. Results were reviewed by community members and incorporated into the sustainable economic development strategy in the community. More over, with the development of an easy-to-use software that implements the matching process, the CBM model has the potential to become a tool for effective planning at the local or regional level.

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Appendix A. Community Goals (Business Benefits)

Definition	Indicators
<u>Employment Opportunity</u> The number and quality (wage level and benefits) of jobs available in the community and to the local citizens; the match to existing skills; and opportunities for education and training to improve skills.	• Number of jobs available locally • Percentage of jobs that are permanent, full-time positions • Average wages • Benefits as a percentage of wages • Amount spent on training programs
Protection of the **<u>Environment</u>** Stewardship of natural resources within the community, including the quality of air, water, and soil, plant and animal life.	• Land-use patterns • Energy consumption • Waste disposal costs • Use of transportation • Air and Water Quality impacts
Economic **<u>Efficiency</u>** The sustainable use of physical and human assets that best balances business and community goals for economic return, effort, expense, and waste.	• Employment multiplier • Purchases from local suppliers • Diversity of economic base • Level of capital investment
Social **<u>Equity</u>** Creating or sustaining social conditions that are compatible with community values and character, and which provide equal access to economic and social opportunities for all members of the community.	• Value of charitable contributions by business • Percentage of jobs provided by business that pay a living wage • Proprietor income as a percentage of average salary (wage distribution) • Income distribution in local community
Guaranteed Minimum **<u>Existence</u>** (Quality of Life) A commitment to providing resources sufficient to cover the basic human needs of the community as a whole.	• Does the business provide educational programs? • Business contribution to local tax revenues • Percentage of community residents earning a living wage

Appendix B. Community Assets (Business Needs)

Definition	Indicators
<u>Acreage and Space</u> The operational space required by any business	• Land available, building and other development • Land available, harvest cropland • Land available, woodland • Land available, pasture and rangeland • Land available, conservation and wetland • Space available, warehouse / inventory • Space available, manufacturing / operation • Space available, office • Space available, retail / sales
<u>Physical Infrastructure</u> Things such as transportation, communications, and utility to which most businesses wish to have access.	• Nearby access to the interstate • On a freight-bearing road • Nearby access to railroad • Nearby access to a commercial air-port • Port facilities • Access to 3-phase electric power • Access to natural gas pipeline • Access to ISDN / high speed telecommunication lines • High volume water supply • High wastewater capacity • Availability of high-volume solid waste disposal • Access to ponds and streams • Possibility for future expansion (differ by business)

(continued on next page)

Appendix B. Community Assets (Business Needs, Continued)

Definition	Indicators
<u>Economic Infrastructure</u> It involves all elements related to the costs of conducting business in a particular location.	• Availability of managerial and professional workers • Availability of skilled labor • Availability of unskilled labor • Availability of transportation for workers • Favorable local labor costs • Favorable local tax rate • Availability of local suppliers (differ by sector) • Availability of local customers (differ by sector) • Availability of job training programs • Availability and costs of commercial loans • Availability of development assistance
<u>Quality of Life</u> The amenities that a community has to offer a business.	• Low crime rate • Low cost of living • High environmental quality • Outdoor recreation opportunities • Social and cultural opportunities • Access to retail shopping • Quality of local schools • Availability of quality health care

Appendix C. Comparing Two Aggregation Methods Used with AHP

Ramanathan and Ganesh (1994) have proved that using weighted arithmetic means of the individual weights satisfies all the axioms of social choice except that of Independence of irrelevant alternatives, while the geometric means method recommended by Saaty violates the axiom of Pareto optimality. However, as first violation originates from the dependence of the AHP itself on irrelevant alternatives, the weighted arithmetic mean method is still regarded as superior to other methods in terms of its satisfaction of the social choice axioms. Unlike Ramanathan and Ganesh, the authors of this paper strongly believe that the weights assigned to each member in the group should be the same, i.e. a simple arithmetic mean of the weights given by each individual ought to serve as the group consensus weight. There is no reason to differentiate between individuals when they have equal rights to voice their preference in the community economic development decision making process. Considering the fact that the criteria involved in weighting the Goals in CBM are straightforward, it is also unnecessary to arbitrarily distinguish stakeholders on the basis of their "expertise" since experience has it that the "average" citizens are fully capable of understanding the economic structure in their communities (Highlander Research and Education Center, 1997). The mathematical proof of the validity of the simple arithmetic mean method is given as follows:

Let P_{ik}, $i \in [1,5]$ denote the weights on the five goals obtained from the AHP using the k^{th} individual's pairwise comparison ratings, $k \in [1,N]$, where N is the number of group members doing the weighting exercise. Thus the aggregated weights are

$$\beta_i = (P_{i1} + P_{i2} + \cdots + P_{iN}) / N \qquad \text{(C-1)}$$

and substituting (C-1) into (1), we get

$$D_j(x_{1j},...,x_{nj}) = \prod_{i=1}^{n} x_{ij}^{\beta_i}$$

$$= \prod_{i=1}^{n} x_{ij}^{(P_{i1} + P_{i2} + \ldots + P_{iN})/N}$$

$$= (\prod_{i=1}^{n} \prod_{k=1}^{N} x_{ij}^{P_{ik}})^{1/N}$$

$$= (\prod_{k=1}^{N} \prod_{i=1}^{n} x_{ij}^{P_{ik}})^{1/N}$$

$$= (\prod_{k=1}^{N} D_j^k)^{1/N} . \qquad \text{(C-2)}$$

This proves that under the simple arithmetic mean method, the *Desirability* index of business j using the group preference of the community's goals is the geometric mean of the *Desirability* indices calculated using each individual member's preferences. Thus it is an appropriate procedure. This method also supports equal participation by community stakeholders which is essential to sustainable economic development. Therefore, using the simple rather than weighted arithmetic mean of individual weights is chosen as the most appropriate aggregation method for CBM.

Appendix D. Compatibility Component as an Increasing Function of Business Weight: Mathematical Proof

The Compatibility index, is calculated according to the following function:

$$C_j = C_j(y_1,...,y_m) = \alpha_j \sum_{i=1}^{m} y_i \cdot |y_i|^{1-\delta_{ij}}$$

where Cj is the *Compatibility* index for business j; y_i is the level of the i^th community asset; αj is the acreage and space coefficient for business j; δij is the weight placed on the i^th asset by business j; m=41 is the number of community assets defined by CBM.

Let $C_{ij} = y_i \cdot |y_i|^{1-\delta_{ij}}$ stand for the *Compatibility* component with respect to the i^th asset and business j.

For $y_i \in [0,1]$, $\delta_{ij} \in [0,1]$, $C_{ij} = y_i \cdot (y_i)^{1-\delta_{ij}} = y_i^{2-\delta_{ij}}$. The first and second derivatives of C_{ij} with respect to δij are:

$$\frac{\partial C_{ij}}{\partial \delta_{ij}} = (-1) \cdot y_i^{2-\delta_{ij}} \cdot \ln y_i \qquad \text{(D-1)}$$

$$\frac{\partial^2 C_{ij}}{\partial \delta_{ij}^2} = (-1)^2 \cdot (\ln y_i)^2 \cdot y_i^{2-\delta_{ij}} \qquad \text{(D-2)}$$

The two derivatives are positive for any asset level greater than zero and less than one. When an asset as a level of one, the corresponding *Compatibility* component will be one regardless of business weight. Therefore it is proved that the *Compatibility* component increases at an increasing rate with business weight when the asset level is positive.

Likewise, it can be proved that when the asset level is negative (meaning the asset is extremely lacking), the *Compatibility* component decreases at an increasing rate (the first and second derivatives of the *Compatibility* component with respect to business weight are both negative).