Leveraging Indicators to Site Sustainable Business

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Abstract

The Sustainable Business Network (SBN) of Greater Philadelphia is a non-profit network of local triple-bottom-line businesses and social entrepreneurs in the Philadelphia region. SBN is working with its members and other community stakeholders to create a suite of online tools to support locating new business and expanding existing firms by accounting for sustainability factors. The first of these tools is a prototype business siting web application that enables incorporation of sustainability factors. A broad range of "decision factors" are included in the system including proximity to community assets, walkability, public transit, car share, farmers markets, commercial corridors, open space, population density, tax incentive zones, demographics and many more. Each visitor to the website is able to select the sustainability factors important to them, assign relative weights to each factor and then calculate the optimal sites for their business. The web application has been optimized to provide sufficiently rapid feedback that the end user sees and immediate results. The website targeted not only at entrepreneurs but also to home-buyers and renters who wish to consider sustainability factors when selecting a place to live.

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Introduction

Choosing the right geographic location for a new business is an important decision that may ultimately determine not only the success or failure of the business itself, but the collective economic future of the neighbourhoods, residents and businesses that surround it. Most entrepreneurs, franchisees or potential business owners have at least some concept of their target markets and the siting decision factors that will ultimately make their businesses successful. But how can they take all of those factors and apply them to a map in a way that makes sense in order to facilitate the site selection process?

According to a *Business Week* special report on technology in the retail sector (Gogoi, 2005), when the IHOP restaurant chain wanted to open a new location prior to 2005, it would send a real estate agent into the field to collect information on potential neighbourhoods. The agent would spend several weeks looking at the residential composition of prospective neighbourhoods, compiling a list of the other restaurants in the area, visiting any large retail establishments that may need a restaurant, evaluating nearby workplaces and gauging the local traffic patterns. Once the information was collected, it would take the IHOP franchise and development team several more weeks to go through it all manually before a recommendation was made for a new site. This was a time-consuming and costly process.

In 2009 the same restaurant chain was using Geographic Information System (GIS) technology to streamline the site-selection process and facilitate maximum growth potential with minimal siting errors. GIS is state-of-the-art technology for interactive data management, analysis and mapping purposes. It allows users to select and combine the geographic factors inherent in the site selection process, including commercial areas, competing retailers and demographic data, to support location prioritization. The result is a geographic prioritization map showing the best locations for a particular need or use. The same siting data that once took the IHOP real estate agent many weeks to collect and assess can now be accessed and analyzed in only a few seconds. Literally hundreds of site-selection factors can be considered simultaneously in multiple combinations to meet the varied and changing needs of existing and potential businesses.

These are not new ideas. In Ian McHarg's 1969 book, *Design with Nature*, he outlined an approach to land planning that incorporated multiple considerations into a site selection process. Each factor was turned into maps drawn on acetate sheets that could be stacked on top of one another to reveal the best locations for a particular purpose.

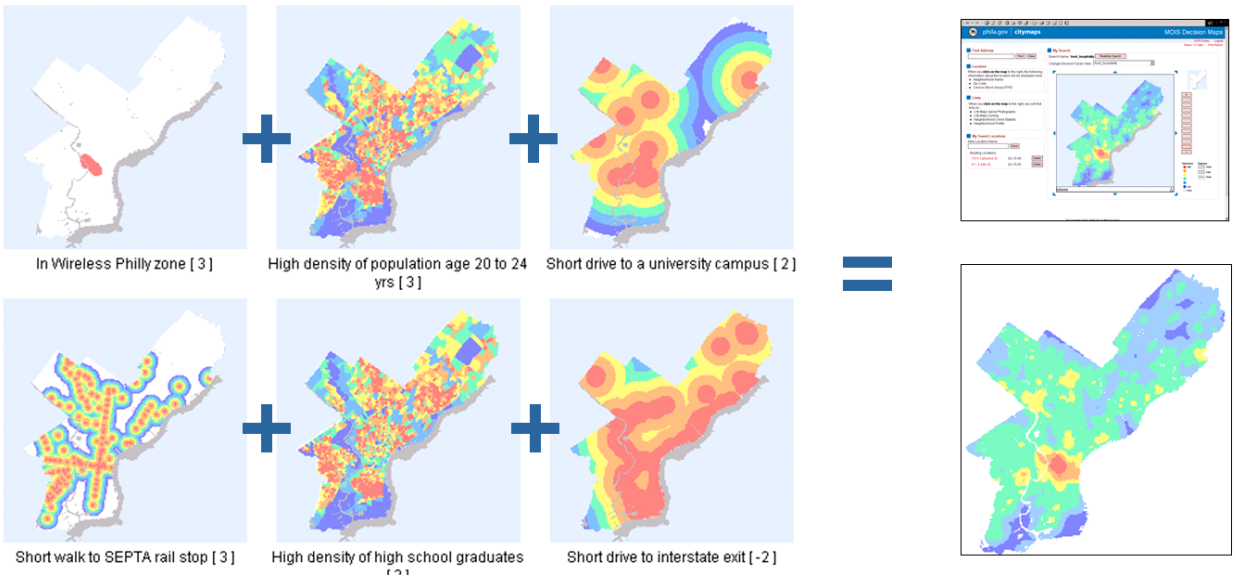

Figure 1: GIS enables existing and potential businesses in the City of Philadelphia to combine geographic factors such as population density and transportation options to create customized "heat maps" that optimize the site selection process. The dark red areas match the selected criteria most closely. The Philadelphia application is web-based and available to users at no cost.

Business Siting Decision Factors

Although the business siting decision factors that can be partnered with geography are virtually limitless, there are three important categories that will apply at some level when determining the optimal business site for any new business in any geographic location: demographics, proximity and density.

Demographics – Demographics are the characteristics of a population, such as age, income and employment status. Demographics are often used to help businesses define their target markets and choose a location with population that most closely matches that definition. For example:

- What is the median age of the population where the business will potentially be sited?
- What is the per capita income?
- What is the level of education attainment for those living in the surrounding neighbourhoods?
- What types of households are located there?
- How closely defined are any or all of these factors to the business owner's target market?

For the IHOP restaurant chain referenced in *Business Week*, the ideal demographics are families with children, since they are the restaurant's primary customer base, particularly on weekends (Gogoi, 2005). The same article notes that McDonald's considers hundreds of demographics when making site selections today, as opposed to a time when they considered only age and income.

Proximity – Unless a potential business intends to sell entirely online, proximity to its target market is very important. Another important consideration is how that market will travel to the business location. For example:

- What is the proximity to the major roadways that will bring in potential customers?
- How far will customers have to drive from the nearest interstate exit?
- Are there public transportation options nearby for customers or employees?
- What about walking or biking routes?
- Is there sufficient parking in the area?
- Are there other locations nearby, like university campuses, where potential customers may reside?

There are also other considerations related to proximity that go beyond access to the target market:

- Is the potential business site located within a tax incentive zone?
- Will it have access to existing water, sewer and electricity infrastructure, or will additional costs be involved to obtain this?

Business Week reports that the IHOP restaurant chain considers proximity to residential neighbourhoods with large shopping complexes very important, as well as easy access to major roadways and intersections (Gogoi, 2005), while the Starbucks coffee shop chain looks at proximity to offices and competitor locations.

Density – Proximity and demographics can be further defined by their density. Density is the measure of population or other criteria per unit of area, such as the number of people per square mile. For example:

- How much of the local population is comprised of a targeted demographic?
- Are there multiple roadways providing access to the business site, or only one?
- Is the potential business location in a heavily or sparsely populated area?

In addition to proximity, Starbucks also considers the density of office locations when selecting a new site (Gogoi, 2005).

ESRI, the largest GIS software company in the world, published an article in its *BusinessGeoInfo* newsletter (ESRI, 2009) regarding the use of GIS for more profitable site optimization. GIS provides "location intelligence" that has helped FOCUS Brands, an international franchise firm that owns and operates more then 2,200 units, generate an increase in sales revenue of more than 5 per cent for one of its chains, despite the economic downturn. The same firm has also reduced store closures and created a faster turnaround time for new locations by leveraging GIS technology.

There are other key factors not directly related to demographics, proximity or density that may ultimately impact business siting as well:

- Is the property zoned for commercial use?
- What are the property values in the area?
- What are the local traffic patterns like?
- What are the potential commuting times for employees?

- What is the local crime rate?

GIS enables users to consider multiple factors in less time and create customized maps, charts and reports to facilitate the decision-making process.

The Impact of Business Siting on Local Economic Development

Healthy businesses give back to their communities by creating jobs, providing tax revenue and revitalizing the local economy. The Eastland Economic Development Corporation of Eastland, Texas (2009) suggests that sound economic development must include the following three principles:

- Business attraction
- Business creation
- Business retention and expansion

The collective goal of these principles is to create and sustain jobs that pay more than minimum wage, and to increase investment in the community through sales and market growth. If the job base is diverse enough, the community and the businesses that comprise it are more likely to be sustainable even during harsh economic times.

The importance of a diverse job base to local economic development was accentuated in April 2009 by an MSNBC report on the collapse of the recreational vehicle (RV) industry in Elkhart, Indiana. As recently as June 2007, more than 530,000 workers were directly or indirectly employed by the RV industry in the United States, and 60 per cent of those employees were based in the Elkhart region. By November 2008, over 53 per cent of all RV industry workers were out of a job nationally, and 20 per cent of Elkhart's total workforce remains unemployed. The shuttered factories have had a ripple effect on the bottom line of virtually every other type of local business.

The City of Philadelphia, Pennsylvania is looking at the issues of business attraction, creation, retention and diversity from a less catastrophic and more gradual perspective. The Sustainable Business Network of Philadelphia issued a white paper in 2003 describing the steady decline in population, business and employment growth that have affected the City's local and regional economies over the past fifty years. Commercial corridors throughout the "City of Neighborhoods" that were formerly thriving have been largely decimated by the influx of national big-box retail chains and the mass exodus of many residents to suburban communities.

The City of Philadelphia, in conjunction with concerned local organizations such as the Sustainable Business Network, is taking steps that may ultimately reverse this long, downward trend and provide greater opportunities for more people. A City of Philedelphia website directed specifically at current and prospective business owners is an important part of this process. The following information is readily available:

- Local and State regulations
- Tax incentives, credits and abatements
- Grants and loan programs
- Location-based incentives, including

- Renewal communities
- HUBZones
- Keystone Opportunity Zones
- Keystone Innovation Zones

The website also provides guidance for developing business and financial plans, obtaining necessary licenses, and building a competent workforce.

Local economies have an enormous impact on the daily lives of all citizens. The Sustainable Business Network (SBN) is focusing their efforts on attracting and nurturing small, local businesses in Philadelphia that will reinvigorate the local economy. Their research indicates that over the past two decades, small, local businesses are responsible for the majority of new jobs created in the United States (Sustainable Business Network of Greater Philedelphia, 2003). The Sustainable Business Network is also eager to contribute to Philadelphia's branding as a Sustainable City, and to support the economic development and job creation efforts pursued by the Philadelphia Commerce Department.

The Challenges of Integrating Sustainability into Business Siting Decisions

Looking at sustainability solely from a site selection standpoint, the factors that make one business economically sustainable will not necessarily work for other businesses. For example, a surf shop would have a greater need for a coastal location than a software company, and a company relying on walk-up traffic would have a greater need for proximity to a variety of transportation options than a company doing business entirely over the Internet.

The Sustainable Business Network of Philadelphia measures the merits of local businesses not only by their economic success, but by their contributions to the community and impact on the environment. This attention to community, environment *and* business is known as the triple bottom line, or, more alliteratively, "people, planet and profit."

People: The "people" portion of the equation refers to fair and beneficial business practices toward employees, the community and the region. This includes paying fair salaries, maintaining a safe work environment and providing reasonable working hours to employees. It is also important to give back to the community through involvement in local activities that contribute to its growth and vitality. The Global Reporting Initiative (GRI) website (2009) provides guidelines for corporations of all sizes that want to grade themselves on social impact in their communities.

Although it is difficult to quantify the impact of site selection on fair and beneficial business practices, it seems certain that a community that benefits from the involvement of its current business owners will be attractive to future business owners as well.

Planet: This is shorthand for attention to a business's impact on the ecosystem services that enable all of us to exist in a healthy environment. Businesses can mitigate their impact or make a net positive contribution by monitoring and reducing energy consumption, generating energy

using renewable sources, participating in recycling programs, reducing manufacturing waste and disposing of all waste in a safe and legal manner.

While not every business impact can be measured geographically, we can incorporate an impact on energy consumption and other factors in the site selection process. For example, a business located in a neighbourhood where recycling is readily available will be more likely to participate in the program. Choosing a site where the tree canopy will provide protection from the sun in summer and disperse the force of the wind in the winter can potentially reduce heating and cooling costs (City of New York Parks and Recreation, 2006.). A business that is close to public transportation and biking options for its employees encourages additional energy savings by reducing automobile usage.

Profit: Sustainable businesses are still for-profit entities and must turn a profit if they are going to grow and contribute to economic development. Small, local businesses are more likely to see and experience the impact of their own actions within their communities than publicly held corporations that are run from a distance (Sustainable Business Network of Greater Philadelphia, 2003). Responsible business practices can also help attract, motivate and retain a talented and diverse workforce that can increase profitability by improving efficiency.

Software for Sustainable Business Siting

The Sustainable Business Network of Greater Philadelphia seeks to strengthen, promote and connect locally-owned independent businesses in Philadelphia by improving deteriorating neighbourhood commercial districts; attracting and retaining young entrepreneurs; revitalizing local industry; improving workforce development; and protecting and restoring the environmental resources that impact social equity, quality of life and long term financial growth in the city. Their net goal is to create not only sustainable businesses, but truly sustainable communities that are economically viable, environmentally responsible and mutually beneficial.

In 2009 SBN received funding from the William Penn Foundation to develop a prototype for a web-based GIS application that simplifies the site selection process based on sustainability factors and encourages the growth of small businesses in the Philadelphia region. The proposed application is based on Avencia's DecisionTree® software framework.

DecisionTree is a set of innovative web-based geographic decision-making tools that enable business owners, citizens or government agencies to weigh multiple geographic factors and generate maps that highlight the optimal locations for their needs. DecisionTree enables the user to define a set of decision factors for location siting (Figure 2), and choose the importance of each decision factor by moving the appropriate slider bar from the neutral (0) position to a preference value ranging from -5 (avoid proximity) to 5 (prefer proximity) (Figure 3). Decision factors can be selected and valued in any combination to provide truly customized site selections. DecisionTree then returns a heat map highlighting the areas that best match the specified criteria, and users can zoom in to view additional layers of data that can further enhance their decision-making powers.

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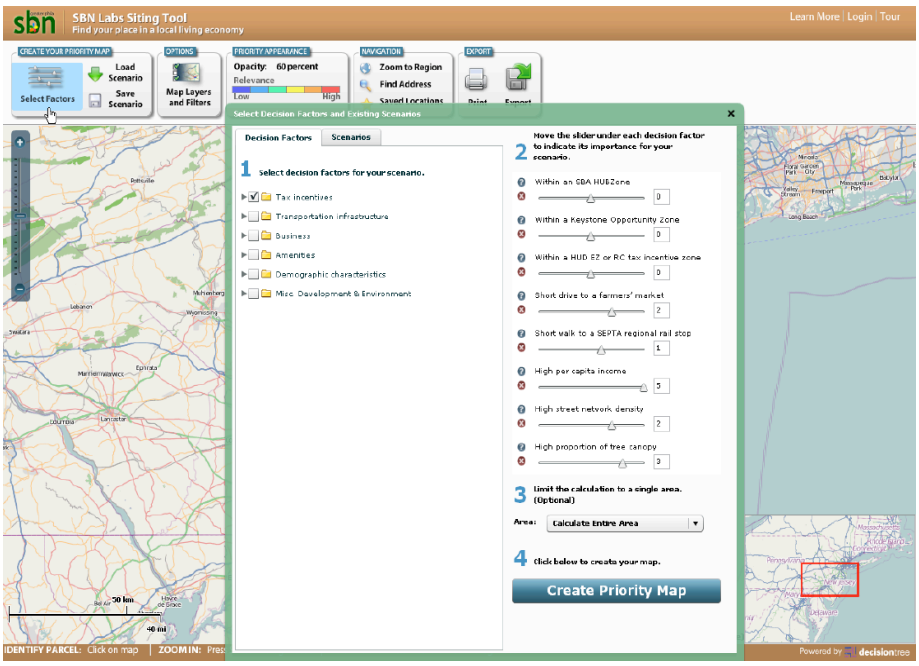

Figure 2: The Sustainable Business Network leveraged the DecisionTree framework to assist residents and businesses in Philadelphia with the site selection process. In this example, decision factors are selected to create a business siting scenario in Philadelphia.

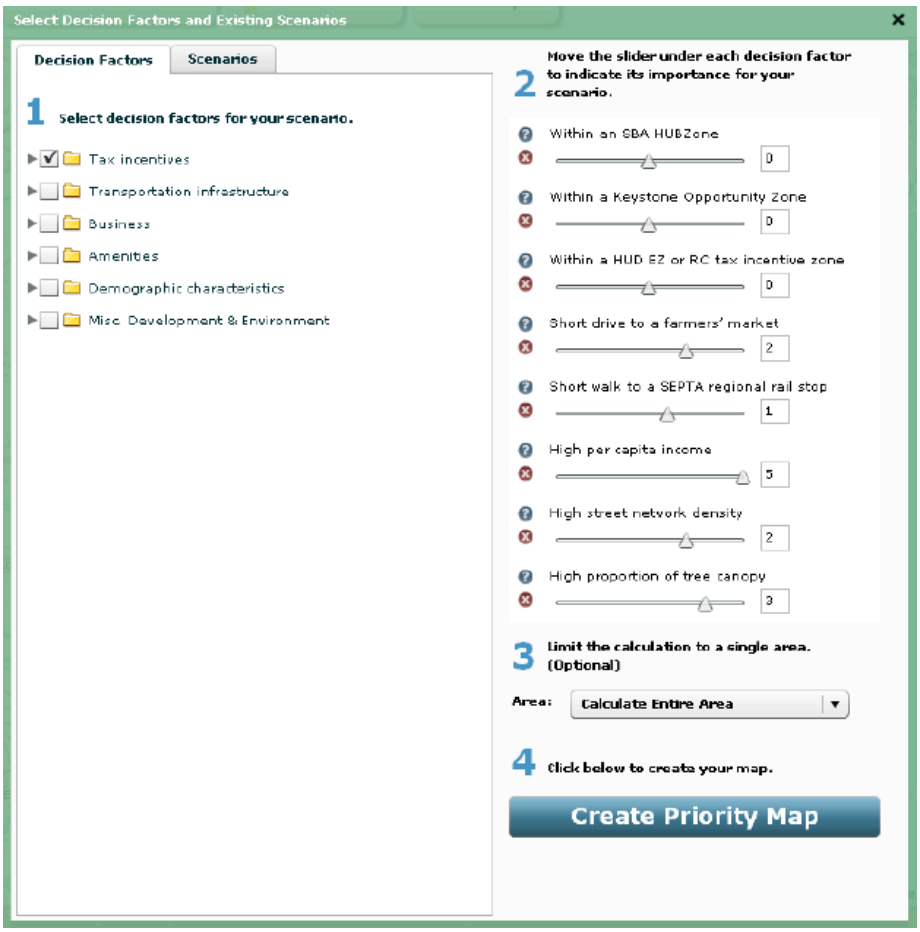

Figure 3: A closer look at the decision factors for tax incentives. Slider bars allow the user to weigh each decision factor in the site selection process by level of importance and create customized mapping scenarios to meet the user's needs. A negative number indicates a desire to avoid a particular factor, and a positive number indicates a preference for a factor.

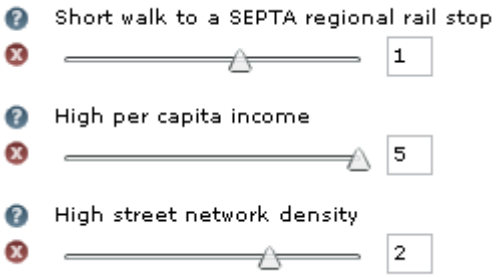

Figure 4: Decision-makers can select their own criteria and assign relative weights to each factor by moving a slider bar.

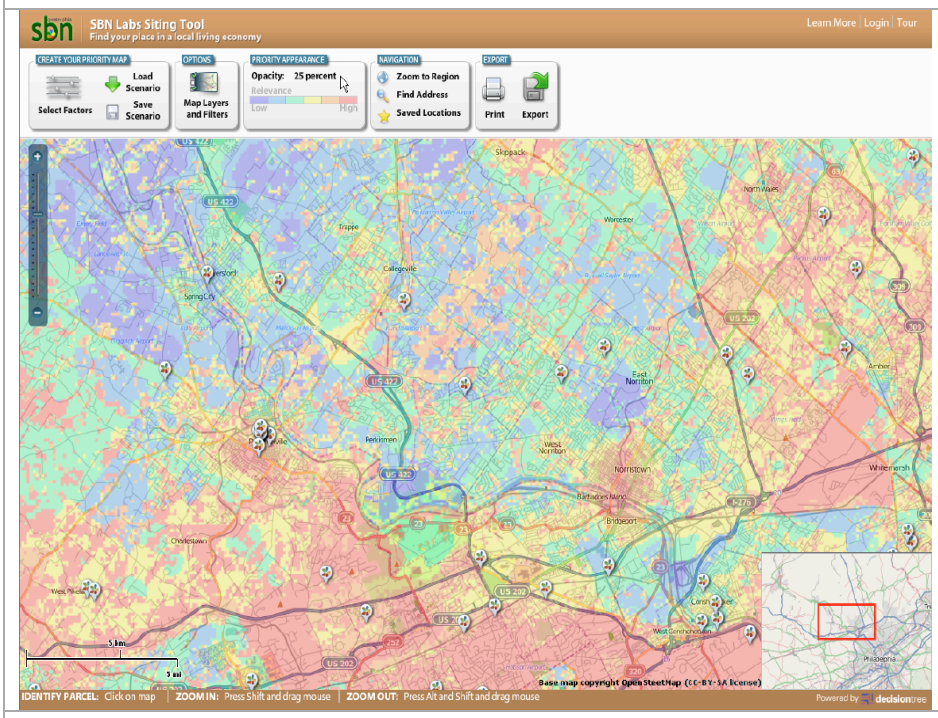

Figure 5: After the decision factors are defined and the weights assigned, a map is generated to show the assessment of the factors in combination with each another. In this example, the red areas are more closely matched with the user's decision factors than the blue areas.

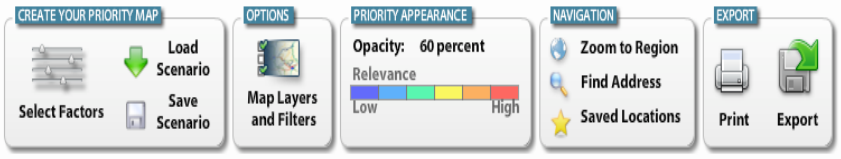

Figure 6: An intuitive user interface makes the application easy to navigate.

Figure 7: Simple step-by-step instructions guide users through the application. No GIS experience is necessary, and users do not need to install any special GIS software in order to access and use the web-based application.

DecisionTree organizes each of the sustainability decision factors as "raster" data set in order to perform its analytical functions. Raster data is comprised of a matrix of grid cells of uniform shape and extent, as opposed to vector data, which is comprised of points, lines and polygons that define specific map features, such as hydrant locations, street networks and parcel boundaries. Raster data is ideally suited for analyzing datasets that vary widely across the entire extent of the grid, such as population density or proximity to transportation. In addition, because raster data is not confined to pre-specified boundary lines, such as zip code boundaries or census tracts, data can be analyzed across any combination of grid cells at any extent that meets a users specific needs, and there are no issues with combining datasets from differently-sized vector extents that might otherwise result in overlapping coverages that are geographically incomplete in some areas. Raster GIS enables the user to both see data as a continuous surface and enables the combination of the layers to occur very rapidly (see Figure 8).

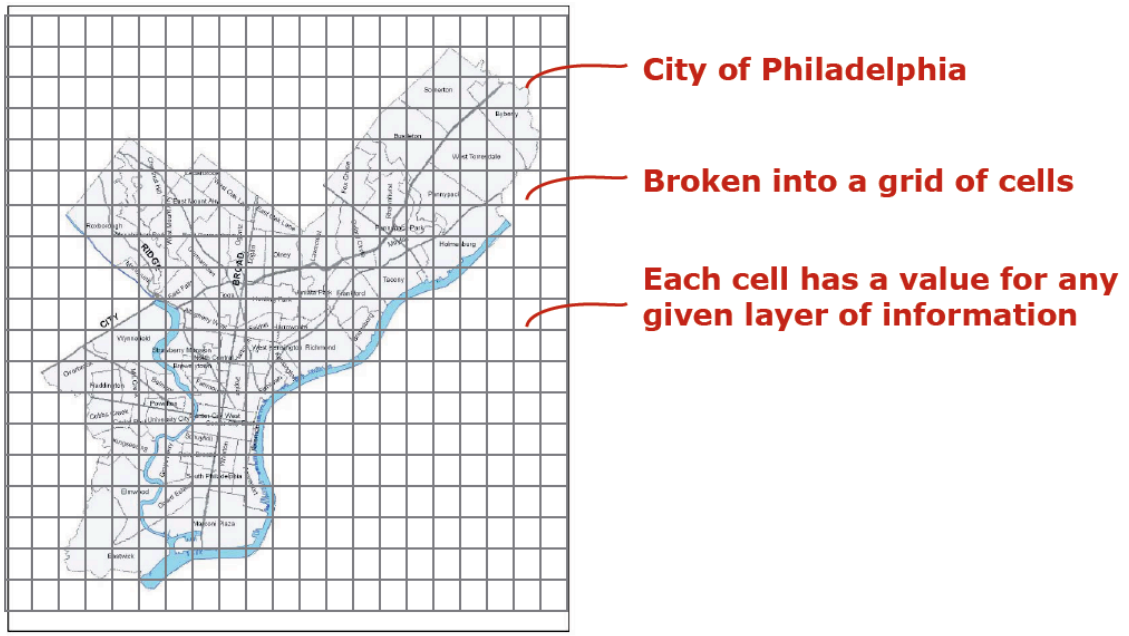

Figure 8: Looking at the grid system inherent in raster data.

The technology behind DecisionTree was originally developed under a grant from the U.S. Department of Agriculture (USDA) to support economic development in rural areas. The grant supported development of an innovative set of processing techniques that could turn a process that would require from 30 seconds to one minute into something that could be performed in under one second, enabling it to be used in a web application. The first implementation of the new technology was in the City Asheville, North Carolina as an economic development tool called Priority Places (http://gis.ashevillenc.gov/mapasheville/priorityplaces/).

Integrating Sustainability Factors

In keeping with their core mission of facilitating vibrant communities that form the foundation for viable and sustainable businesses, the SBN wanted a mix of decision factors that would meet the needs of a diverse group of business owners, citizens, non-profit organizations and government agencies that were expected to need siting assistance in the Philadelphia region.

Many of the decision factors that are conducive to siting a sustainable business, such as local demographics and proximity to transportation, are also conducive to locating a new home in a sustainable community. Other decision factors, such as proximity to libraries, parks and grocery stores, are almost entirely exclusive to home selection, whereas decision factors, such as tax incentives and commercial land use, are almost entirely exclusive to business siting.

As this initial implementation is intended as a prototype, a variety of factors were selected related to transportation, tax incentives, business, amenities, education, demographics and density of human settlement. The categories and decision factors included in the application, as well as the general purpose of each one, are briefly outlined in Table 1.

Category	Decision Factor	General Purpose
Transportation	Proximity to Car Share	*Proximity to transportation is critical to businesses that cater to customer traffic or want to facilitate employee commuting times. It is also important to aspiring residents that must likewise be within commuting distance of their employers.*
Transportation	Proximity to Rail Transit Stops	
Transportation	Proximity to Bus Lines	
Transportation	Proximity to Bicycle Routes	
Transportation	Short drive to PHL Airport	
Transportation	Short drive to Regional Airports	
Transportation	Short drive to Interstate Exits	
Tax Incentives	Renewal Communities	*Tax incentives can be very important to new businesses with minimal start-up capital. They also encourage redevelopment in deteriorating commercial districts.*
Tax Incentives	HUBZones	
Tax Incentives	Keystone Opportunity Zones	
Tax Incentives	Keystone Innovation Zones	
Business	Density of SBN members	*Businesses may choose to be near SBN members that have proven successful. Land-use designations and proximity to a town centre can also be important success factors.*
Business	Industrial Land Use	
Business	Commercial Land Use	
Business	Near a town centre	
Amenities	Proximity to Parks	*Prospective homeowners need proximity to a variety of everyday amenities, particularly if they will not have access to a car. Proximity to one or more amenities may also assist potential businesses, particularly in the hospitality, education or recreational industries.*
Amenities	Proximity to Libraries	
Amenities	Density of Restaurants	
Amenities	Proximity to Farmers Market	
Amenities	Proximity to Local Farms	
Amenities	Proximity to Grocery Stores	
Amenities	Proximity to River or Stream	
Amenities	Proximity to University Campus	
Amenities	Tree Canopy	
Amenities	Proximity to Open Space	
Education	High School Diploma, density	*Some businesses will need access to potential employees with a specified educational skillset. Potential homeowners may seek neighbours with similar education and interests.*
Education	Some college, density	
Education	College Graduates, density	
Education	Some Graduate School, density	
Demographics	Population, Age 0-14	*The demographics of a business's target market are a critical component of its success. A business or service catering to senior citizens will need to be closer to an aging population than a business catering to families with young children. Prospective residents will have similar expectations for their communities.*
Demographics	Population, Age 15-19	
Demographics	Population, Age 20-24	
Demographics	Population, Age 25-34	
Demographics	Population, Age 35-44	
Demographics	Population, Age 45-54	
Demographics	Population, Age 55-64	
Demographics	Population, 65+	
Demographics	Per Capita Income	
Development	Population Density	*Businesses may look for a greater level of density in their target neighbourhoods, whereas residents may prefer a more median level.*
Development	Street Network Density	
Development	Owner-occupied housing, density	
Development	Renter-occupied housing, density	

Table 1: Categories and decision factors included in the SBN's application

Additional Features to Facilitate Business Siting Decisions

In addition to the core function of generating geographic priority maps, the prototype included several features to assist with the business siting process. These features enable users to geocode addresses, print results, turn on optional map layers and generate demographic and business activity reports. The latter feature was created by leveraging a third party "web service" called "Business Analyst Online" (http://www.esri.com/software/arcgis/arcgisonline/bao-api.html), maintained by ESRI. The demographic reporting service can generate reports on-the-fly for any location on topics that include:

- *Demographic and Income Profile* – summarizes the Census 2000, current-year estimates and five-year forecasts of household data to reveal trends in demographics and income
- *Census 2000 Summary Profile* – a comprehensive demographic snapshot of the selected area in the year 2000
- *Retail Goods and Services Expenditure* – shows the total dollar amount and average amount per household spent on retail goods and services categorized by apparel, computer, food, finance, health and insurance
- *Tapestry Area Profile* – compares the top twenty Tapestry lifestyle segments in an area, ranked by household percentage, to their national counterparts
- *Housing Profile* – detailed profile of the housing choices and trends in a designated trade area, of special interests to real estate professionals, financial institutions and residential home builders
- *Graphic Profile* – an illustrated overview of current year demographic estimates that use pie charts and graphs to describe variables such as households, population by age, households by income and race

Other Sustainable Applications

The DecisionTree calculation engine and the weighted overlay of multiple decision factors used in the SBN prototype application can be used for a variety of other siting applications related to sustainability.

Walkability: Walkable neighbourhoods are more sustainable neighbourhoods and are often more valuable as well. Efforts such as WalkScore (http://www.walkscore.com/) have sought to turn walkability into something that can be measured. But just as there are differences in the decision factors business owners select for siting businesses, there are also a number of variables involving the locations that individual residents would prefer to be walkable in their neighbourhoods. For example, a family with children would want schools and playgrounds to be within walking distance, whereas an elderly resident might be more concerned with the medical care, grocery stores and social activities.

In addition, existing approaches to determining walkability generally measure the straight-line distances to assets and do not consider impediments to walking in a particular area, such as rivers, highways, extreme topography and even crime incidence. Avencia has recently completed an R&D project to create a walkability calculation methodology that enables both an individual end-user to decide which factors they want to incorporate into the walkability metric and considers barriers and impediments to walking through an urban landscape. Under this approach, a map layer of "friction" is created with each cell in a raster grid given a coded value

representing the difficulty that would be encountered by a pedestrian attempting to walk within that grid cell extent. For example, cells on an interstate highway or river would have a very high friction level, while cells on the sidewalks or parks would have a much lower friction level.

The new web project, Walkshed (http://www.walkshed.org), enables a visitor to determine their own walkability map based on the factors they think are important. Amenities in the Walkshed application include locations such as farmer's markets, transit stops, grocery stores and restaurants.

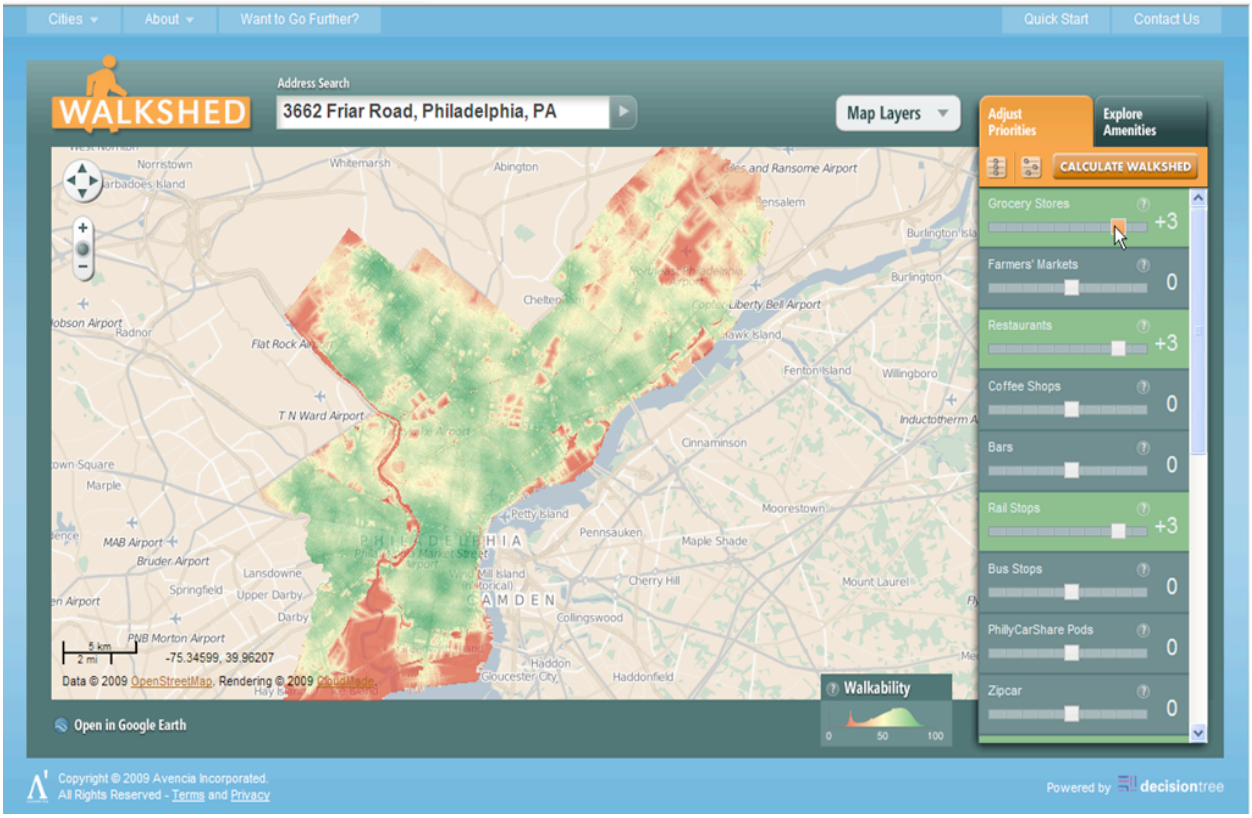

Figure 9: Selecting decision factors for neighbourhood amenities that are within walking distance of the specified address Walkability is an important component of a sustainable neighbourhood.

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Land Conservation and Responsible Land Use: Prioritization of land use through the use of multiple geographic decision criteria is a powerful mechanism for making land-use decisions. In addition to business siting and walkability, the same techniques have been applied to prioritization of land for preservation as well as to assist communities with the difficult questions that are often inherent with sustainable land use planning:

- What is the best site for a new wind farm?
- Where should the community invest in open space preservation?
- What areas are overdeveloped?

Planning utility infrastructure, managing overdevelopment, designing optimal public transit routes, providing better sidewalk networks and bike lanes, and protecting natural habitats are just

a few of the ways that GIS technology can help local communities operate in a more responsible and sustainable manner.

Conclusion

Sustainable local economies are economically viable, socially responsible and interdependent on sustainable local businesses. The Business Alliance for Local Living Economies (BALLE) asserted in 2003 that sustainable global economy is dependent on sustainable local economies. By these criteria selection of a site for a new business, housing development, rail station or public facility takes on enormous significance. These decisions are complex, however, and technology tools can help us weigh multiple considerations simultaneously and thereby support more effective decisions. The SBN business siting prototype leverages this type of technology to assist SBN with meeting its goal of building a local living economy that becomes self-regenerating.

References

City of New York Parks and Recreation. (2006). "Calculating Tree Benefits for New York City." New York: City of New York.

City of Philadelphia, Pennsylvania. (n.d.). Business pages. Retrieved December 2009 from: http://business.phila.gov/Pages/Home.aspx?type=All%20Business%20Types.

Global Reporting Initiative. (n.d.). Download G3 Guidelines. Retrieved December 2009 from: http://www.globalreporting.org/Home.

Gogoi, P. (2005). The new science of siting stores. *Business Week.*

MSNBC. (2009, April 8). A city struggles: "We are back at square one." Retrieved April 2009 from: http://www.msnbc.msn.com/id/30066873/ns/us_news-the_elkhart_project/.

McHarg, I. (1969). *Design with nature*. Natural History Press. Retrieved December 2009 from: http://www.msnbc.msn.com/id/30066873/ns/us_news-the_elkhart_project/.

Sustainable Business Network of Greater Philadelphia. (2003). White paper on regional economic development, competitiveness and prosperity through local business ownership. Retrieved December 2009 from: http://www.sbnphiladelphia.org/resources/SBNWhitePaper.pdf.

Wicks, Judy. (2003). *Local living economies: The new movement for responsible business.* Bellingham, WA: Business Alliance for Local Living Economies.