Indianapolis Community Metrics
Empowering Communities and Planners with Equal Access to User Friendly Data Analysis

A CREATIVE PROJECT SUBMITTED TO THE GRADUATE SCHOOL
IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE
MASTER OF URBAN AND REGIONAL PLANNING

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Introduction

*Indianapolis Community Metrics* is a web application that offers community-level data relevant to planning and development in a format easy enough for the public to use, but powerful enough to be useful to community development and planning professionals. The application fills two needs: It opens up access to information, and it empowers non-profit organizations and municipal staff to better target resources.

The most significant outcome of this project is the application itself, which is the principle subject of this creative project. The introduction addresses why this application was developed, while the literature review and methodology chapters explain how it was developed. *Conclusions* explains how the tool is effective in identifying where to invest limited community development resources. *Lessons Learned* address improvements to the application and offers critiques of the research behind the application.

**Broad Access to Information**

Broad access to information and broad opportunity for impact on planning and development are two of eight aspirational principles in the Code of Ethics of the American Institute of Certified Planners. *Indianapolis Community Metrics* is a web application that seeks to advance both goals.

The application is an implementation of academic research into neighborhood indicators, principally by Galster, et al (2005). Essentially, the application uses common (and mostly free) data sources combined with GIS mapping to give a detailed picture of neighborhood health, decline, and growth. In making this information user friendly and freely available online, *Indianapolis Community Metrics* opens up community-level data to everyone, including the general public, community development corporations, neighborhood organizations, and city planners.
The AICP Code of ethics states that, “We shall provide timely, adequate, clear, and accurate information on planning issues to all affected persons and to governmental decision makers” (AICP Code of Ethics, 1d). *Indiana Community Metrics* advances this goal by opening detailed community-level data to everyone with access to the internet. This includes the public, non-profit organizations, and municipal staff. Citizens working outside the planning and development fields obviously have almost no access to GIS data unless it is served to them. There are portals at the county level, but the data is served parcel by parcel, rather than summarize information by tract or into trends.

Through web apps and mobile apps, everything from weather data to real estate listings has been offered as user friendly GIS applications. *Indianapolis Community Metrics* offers community development data in the same format. Through this tool, citizens could gather information before public meetings or view changes in their neighborhood over time when making election decisions, for example.

Community development and neighborhood organizations only have access to detail, GIS-based neighborhood data if they can afford to purchase the necessary software and manpower. Even then, they may be limited by resources to only investigate their own local area. *Indianapolis Community Metrics* expands organizations access to data beyond their own locale, giving a comprehensive view of the whole city. This can reveal how a neighborhood compares to other areas nearby or other key neighborhoods across the city.

Even city planners can benefit from *Indianapolis Community Metrics*. While most cities have devoted resources to GIS in specific departments, many departments do not have the technology, training, or manpower to develop a tool as comprehensive as this. For a city planning office or community development office, *Indianapolis Community Metrics* is an example of how software-as-a-service can expand municipal capabilities easily, without requiring extensive new overhead or training.
Expanding access to technical and GIS data is clearly in line with AICP’s goals and has clear benefits in terms of access and democracy, but there are some risks in expanding the public access of GIS data. Though it is counter-intuitive, increased access to GIS data can actually exclude some members of the public. As more and more CDCs and citizens think in terms of formalized data, those who are unfamiliar or not yet equipped to deal with such data are excluded from the conversation. This predicament is addressed in the literature review.

**Need for Targeted Community Development**

At a time of scarce resources, it is crucial to strategically target community development efforts, and neighborhood indicators are a powerful tool to accomplish this. In Indianapolis, the scarcity of resources is increasing for both neighborhood planning and community development. The local government has a shrinking planning department with less resources to focus on neighborhoods, and neighborhood organizations face chronic funding scarcity. (Community Development Block Grant funding for entitlement communities has fallen by 15.7 percent since 2008 [HUD 2015].)

In this climate, a set of "robust, parsimonious neighborhood indicators" (Galster, 2005) can help planners at the local government level, as well as staff at the neighborhood level. With the right indicators, a planner could watch neighborhoods for signs of real estate markets "heating up" or "cooling off," and thus use such data to create early interventions. Proactive community preservation, rather than reactive community development could be even less resource intensive. Still, many neighborhoods will need reactive intervention. Indicators could help planners track intervention efforts by comparing statistics over time and across neighborhoods. Measuring success can help attract increased funding for programs, while measuring failures will lead to strategic adjustments, meaning future use of resources will ideally be more efficient. In all cases, monitoring neighborhood indicators in all neighborhoods over time leads to efficient resource use and informed decision making.
Neighborhood organizations could use such data to convince funders, both public and private, of the efficacy of the organization. Also, data could effectively argue the case for organizational needs. As organizations approach the local, state, and federal government for funding, the organizations could use evidence drawn from neighborhood indicators to attract more resources.

Planning literature has explored neighborhood indicators and arrived at important conclusions (discussed in Literature Review, below). While the subject deserves further scholarly attention, the value to individual communities is in implementation of these ideas. This project seeks to build a user-friendly, web-based application to track and explore neighborhood indicators for all Indianapolis neighborhoods. The software developed for this project is translatable to other communities around the country—nationally available indicators are selected for this purpose (see Methodology)—so while the current results apply to Indianapolis only, implementation could be widespread.

In order to develop this tool, the current literature on neighborhood indicators and tracking community development interventions was reviewed. A review of geographic information systems (GIS) literature was also conducted to explore the potential empowerment/disempowerment such a tool could cause. The methodology is in two parts, the selection of reasonable indicators, and the technical development of the software. Methodology of indicator selection will be discussed in depth, while the technical aspects of the software are relegated to the appendix for those who find them important. The general technological methodology will be generally outlined for the average reader.
Literature Review

Measuring Neighborhood Condition and Intervention

In order to measure neighborhood condition, indicators need to be available that are reliable, meaningful, and affordable, and frequent—"robust" and "parsimonious" (Galster, 2005). Census info is reliable, meaningful, and affordable, but infrequent, which presents a challenge for its use in measuring neighborhood trends. The American Community Survey offers annual data releases, but this data is only available in multi-year averages and its reliability is often questioned. Some cities collect detailed administrative information, such as welfare usage rate, teen-birth rate, tax-delinquent parcels, and vacancy, but data collection is expensive and difficult to expand to all cities. Additionally, datasets are often not compatible (different departments use different databases).

Commercially available data through the Home Mortgage Disclosure Act, DataQuick, and Dunn and Bradstreet offer affordable and frequent indicators, but are they meaningful and reliable? Galster compares census data and administrative data to these "generic indicators" and finds that particularly indicators from commercial sources substantially approximate the results of a set of indicators that is much more robust (but more difficult to implement).

Census and administrative indicators tended to fall into six factors (obtained via factor analysis). Galster calls these factors neighborhood dimensions. The dimensions are:

- Social disadvantage
- Housing type and tenure
- Prestige
- Business and Employment
- Crime
- Housing Vacancy

Data from the Home Mortgage Disclosure Act (HMDA) offers indicators that are predictive of several neighborhood dimensions, but much cheaper than administrative indicators and more
frequently updated than census data. Dimensions predicted by HMDA indicators are presented in Table 1.

Table 1. Dimensions Approximated by HMDA Indicators

<table>
<thead>
<tr>
<th>Factor</th>
<th>Indicator</th>
<th>R² value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social Disadvantage</td>
<td>Mortgage approval rate</td>
<td>0.38</td>
</tr>
<tr>
<td></td>
<td>Median dollar amount of mortgages approved</td>
<td>0.28</td>
</tr>
<tr>
<td></td>
<td>Share of mortgages intended for home purchase</td>
<td>0.22</td>
</tr>
<tr>
<td>Prestige</td>
<td>Mortgage approval rate</td>
<td>0.45</td>
</tr>
<tr>
<td></td>
<td>Median dollar amount of mortgages approved</td>
<td>0.74</td>
</tr>
<tr>
<td></td>
<td>Share of mortgages intended for home improvement</td>
<td>0.28</td>
</tr>
<tr>
<td>Crime</td>
<td>Mortgage approval rate</td>
<td>0.22</td>
</tr>
<tr>
<td>Housing Type and Tenure</td>
<td>Number of loan application records</td>
<td>0.27</td>
</tr>
</tbody>
</table>

DataQuick offers median sales price as an indicator for Social Disadvantage and Prestige (r² is .25 and .72, respectively), but is less predictive than HMDA's corresponding median dollar amount of mortgages approved (which has an r² value of .74). Dunn and Bradstreet offers indicators for the Business and Employment dimension. The indicators are number of businesses (r²=.95) and number of jobs (r²=.94). No generic indicators were predictive of the Crime or Housing Type and Tenure neighborhood dimensions (factors). However, Galster developed these findings before implementation of the American Community Survey (ACS). Vacancy data could be obtained from the ACS, but only down to the block group level, as the ACS is estimated data and grows more inaccurate with increased geographic detail.

In terms of forecasting neighborhood decline, Williams (2013) found that completed home foreclosures was the strongest indicator. From a slew of indicators, it was the only one found to be a reliable predictor of neighborhood decline. Other indicators both preceded decline and occurred after, and relationships to too complicated to be useful for forecasting.
According to Galster, et. al (2006), measuring the effect of planning interventions in distressed neighborhoods often falls into two categories, post-intervention, absolute change approach and post-intervention, relative change approach. In the absolute change approach, any change in neighborhood metrics after an intervention are attributed to the intervention. Therefore, the null hypothesis is no change or negative change. This fails to count as a success a neighborhood that stopped declining or declined slower than before an intervention. If property values in a neighborhood declined by 5 percent annually before an intervention, but 2 percent annually after, the intervention could have been a measured success. Additionally, the analysis does not consider confounding variables—there is no control group. For example, the neighborhood may have improved because several new employers move to the city, improving the market in the city overall. The relative change approach is an improvement because of the addition of a control group. In this approach, changes in neighborhood metrics after an intervention are compared to changes in control neighborhoods in the same period. The null hypothesis is no difference between the change in the target neighborhood and the change in control neighborhoods.

Neither of these post-intervention approaches consider the trends before intervention. Therefore, the better method is what Galster calls the adjusted interrupted time series model, which measures trends before and after intervention in the target neighborhood and control neighborhoods.

Galster implemented this model in a study of Richmond, Virginia’s Neighborhoods in Bloom program, a series of targeted investments using CDBG and Local Initiative Support Coalition (LISC) funding. The findings suggest that CDBG funding should be focused and geographically targeted. Their research also showed that there seems to be a tipping point in turning around neighborhoods. Collection of data before the intervention and for control neighborhoods allowed for these findings. In Richmond, using single family homes sales as the measure of effective intervention, Galster found that blocks where CDBG and LISC resources were focused increased in property value much faster than Richmond overall, while control neighborhoods increased at the same rate.
He also found that a median public investment of $30,000 per block over 5 years was a significant threshold. Blocks above the median performed significantly better than blocks below the median.

Other studies have echoed the evidence of a tipping point in community development investment. Taub, Taylor, and Dunham (1984) indicated that property owners in blighted Chicago neighborhoods would only undertake renovations if at least one third of neighboring owners did the same. Additionally, Galster, Walker, Hayes, & Boxall (2004) measured impact of CDBG in 17 cities and found that CDBG intervention did not change neighborhood trajectory unless expenditures exceeded the sample mean expenditure.

A web-application to track indicators across Indianapolis neighborhoods over time allows the effects of similar investments to be measured in Indianapolis. Again, this data can attract future funding, or aid in adjusting strategy and possibly increasing the tactic of highly targeted CDBG investment.

**Empowerment/Disempowerment via Public Participation GIS**

Public Participation GIS, or “PPGIS,” is a concept of geographic information systems with an emphasis on public-knowledge, alternative knowledge, or indigenous knowledge, as well as public use of GIS. This conceptualization of GIS counters its current status as a technical, expert-controlled tool create and used by “largely white males employed in academic and governmental institutions in North America and Europe” (Obermeyer, 1998: 65). As the concept of PPGIS is now nearly 20 years old, scholars have begun summarizing its principles and development. In one such review, Dunn defines PPGIS (and closely allied concepts, such as participatory GIS) as “a more socially aware type of GIS which gives greater privilege and legitimacy to local or indigenous spatial knowledge” (2007). Brown (2012) offers this background and definition: “The term public participation geographic information system (PPGIS) was conceived in 1996 at the meeting of the National Center for Geographic Information and Analysis (NCGIA) in the United States to describe how GIS technol-
ogy could support public participation for a variety of applications with the goal of inclusion and empowerment of marginalized populations.”

Traditionally, the definition of GIS is related, or even confined, to software and hardware. Goodchild defines GIS as “a computing application capable of creating, storing, manipulating, visualizing, and analyzing geographic information” (2000). While many definitions of GIS exist and a single interpretation is elusive, most center on the concept of a technological tool. A definition of PPGIS is similarly difficult to pin down, “although it is clear that recognition of PPGIS as more than a technology is essential” (Dunn, 2007).

As summarized by Dunn, “Aberley and Sieber (2002) have devised 14 guiding principles for PPGIS including, inter alia: aspects of community development, capacity building and public access to official data; inclusion of marginalized groups; organizational application through partnerships and practical implementation through a range of formats and data types; and links to social theory and qualitative research tools.”

Much of PPGIS literature focuses on the creation of indigenous geographic knowledge, or local knowledge, but some also focuses on the effects on power dynamics of implementing GIS with neighborhood organizations for the purpose of community development. According to Elwood (2003), community organizations are increasingly responsible for neighborhood planning and revitalization efforts, and GIS can play an important role in these efforts.

However, GIS data can serve to both advance state priorities and advance, establish, or legitimize local priorities and neighborhood vision. These advancements are due to policy shifts that have decreased the state’s direct role in planning, while increasing the state’s oversight role of local organizations. These conditions present a duality of opportunities for neighborhood organizations. As Elwood summarizes (2003),

The provision of financial resources allows for more community-based neighborhood planning and revitalization efforts, and for community actors to insert their
local knowledge, needs, and priorities into the urban policy agenda. GIS use creates possibilities for community organizations to develop alternative knowledge and engage in alternative urban development practices (Masucci, 1999; Sieber, 2002; Stonich, 2002). In contrast, other commentators have argued that the close embedding of community initiatives in state structures occupies community actors in the service of state priorities and strategies, and de-politicizes institutions of civil society. In this view, GIS use serves as a mechanism through which community organizations are incorporated into the state’s planning and service system.

Elwood (2002) has examined specific ways in which implementing GIS at the community level can change power dynamics between residents, the community organization, and the state. Her research involves a case of a Minneapolis neighborhood organization, Powderhorn Park Neighborhood Association (PPNA). Because of neoliberal trends in planning policy, discussed above, and due to citizen outcry about overspending redevelopment funding on the downtown, Minneapolis shifted planning responsibilities from municipal staff to the neighborhood level. TIF district funding was also transferred, along with planning power, from downtown projects to the neighborhoods. PPNA was the recipient of such power, responsibility, and funding.

Elwood explores empowerment in three dimensions, distributive, procedural, and capacity-building. Elwood (2002) defines distributive dimensions of empowerment as “individuals and organizations expanding their opportunities for involvement.” PPNA’s use of GIS both restricted and expanded opportunities for residents to be involved, while the use of GIS was entirely positive for the organization’s own power relationship to the city. The adoption of GIS changed the discourse at community meetings. Language became increasingly technical, creating some barriers to participation by excluding those residents with less technical expertise. Such exclusion tended to fall along racial and class lines, which in this neighborhood, further emphasized existing gaps in neighborhood relationships. However, while GIS knowledge led to some exclusion, it also empowered residents
with more information. PPNA used the GIS database to answer questions about problem properties when residents would call in, and even offered suggestions about who to call for problem resolution (perhaps with an absentee landlord).

In terms of PPNA’s power relationship to the city, the neighborhood and community organization was clearly empowered by its use of GIS. In discussions with city officials, data collected in PPNA’s database held more weight than qualitative or anecdotal data. Also, the wealth of data allowed PPNA to make specific recommendations to the city, accompanied by evidence in the “same language” that the planning department spoke. The ability to offer specific data points and specific recommendations clearly increased PPNA’s ability to influence municipal decision making. The organization was thus empowered and, to the degree that PPNA represents the neighborhood, the neighborhood itself was empowered.

Elwood also notes changes in procedural dimensions of empowerment. The language of participation in neighborhood planning has changed drastically, and it applies to zoning recommendations. Decisions changed from being based on language such as “tarps hanging off” of a multi-family property and “pigeons making a home there and everything” before GIS was the norm, to “consistent zoning land use patterns” and “commercial nodes” once the technology was well established. This again empowers the neighborhood organization in its relationship to the local government, but disempowers those residents without this type of knowledge.

Elwood (2002) says of capacity building dimensions of empowerment, “Expansion of the capacity of individuals and communities to take action on their own behalf could occur through development of new skills, production of new knowledge…, or development of a new understanding of community conditions that motivates further action.” In the example of PPNA, the use of GIS caused empowerment and disempowerment for different groups at different scales. At the individual scale, skill development empowered the staff of the community organization, but did not empower the residents overall, who were not “power users” of the software and had neither the time nor the
resources to become such. At the community level, however, knowledge production was greatly empowering. Before GIS, PPNA relied on the memories of staff and residents (both often changing), but since GIS a more robust and long-term data solution is possible. This empowers PPNA in its relationships to the local state and to other funders. PPNA was also able to use knowledge created from GIS to develop a new understanding of conditions, which subsequently informed revitalization strategy.

**Methodology**

**Theory of Neighborhood Investment**

The data behind this application is largely based on the research by Galster, as described above. Galster arrived at a set of neighborhood dimensions that represent a significant portion of what one would want to know about a neighborhood. These dimensions could be represented most accurately with census data and administrative data directly from municipal departments. However, this is resource intensive (in the case of administrative data) or infrequent (in the case of census data), and therefore not useful to community development professionals or the public in tracking neighborhoods frequently. Data from HMDA and Dunn & Bradstreet (what Galster calls “generic indicators”) could substitute, with varying success, for administrative and census data.

The goal of *Indianapolis Community Metrics* was to put this research to work in a useful tool, even while the research itself and this implementation of the research could be critiqued. This is not intended to be the most scientifically infallible implementation, simply the best yet. In other words, perfection should not stand in the way of progress.

With this philosophy in mind, a methodology developed to turn this HMDA data and Dunn & Bradstreet data into indexes that represent each of Galster’s neighborhood dimensions. As shown above, Galster determined the degree to which each generic indicator could explain the variance in the neighborhood dimensions. The resulting r-squared values (shown in Table 2) are used in this ap-
Figure 1. Primary Data
Sources: Ideal Structure of Neighborhood Score

Overall Score

Combine dimensions based on importance to neighborhood development. (Requires research as to which dimensions are most important, as well as equal accuracy among dimensions.)

Social Disadvantage
- Income
- Education Level
- Incarceration Rates
- Female Headship
- Racial Makeup
- Home Price
- Etc.

Prestige
- Income
- Education Level
- Professional Jobs
- Home Price
- Etc.

Housing Type
- Single Family Homes
- Tenure of Residents
- Code Violations (plumbing, electric)
- Etc.

Crime
- Crime Incidents
- Personal Crime
- Property Crime
- Violent Crime
- Etc.

Business and Employment
- Businesses
- Jobs
- Etc.

Data is precise and accurate. It comes from census and city departments. However, this is impractical/impossible because the census is available every 10 years and administrative data is difficult to combine across departments.

Figure 2. Proxy Data
Sources: Practical Structure for Neighborhood Score

Overall Score

Combine dimensions based on a combination of strength, accuracy, and importance.

Social Disadvantage
- Median Mortgage Amount
- Mortgage Approval Rate
- Pct. of New Loans for Home Purchase

Prestige
- Median Mortgage Amount
- Mortgage Approval Rate
- Pct. of New Loans for Home Improvement

Housing Type
- Total Home Purchase Loan Apps

Crime
- Total Home Purchase Loan Apps

Business and Employment
- Total Number of Businesses
- Total Number of Jobs

Data is imprecise and varies in accuracy. Proxy data sources only approximate primary data sources, but are available cheaply and frequently. While this is theoretically inferior to Figure 1, it can actually be implemented. Therefore, it is pragmatically superior.
plication as the basis for calculating generic indicators relative importance in an index. The more an indicator explains the variance in a neighborhood dimension, the more importance it is given in the index.

To calculate the relative importance of each indicator, its r-squared value was calculated as a proportion of the “total” r-squared values. For example, mortgage approval rate explains 38 percent of the variance in the Social Disadvantage dimension, median mortgage amount explains 28 percent, and the percent of new loans that are intended for home purchase explains 22 percent of variance (in other words, r-squared values are 0.38, 0.28, and 0.22, respectively). The other indicators (shown in Table 2) have r-squared values totaling 0.32. The sum of r-squared values for the Social Disadvantage Index is 1.2. Clearly this does not mean that these indicators explain 120 percent of the variance in Social Disadvantage, but this is a useful figure for determining each indicator’s relative strength. Compared to the other indicators, mortgage approval rate makes up 31.7 percent of the sum of the r-squared values (0.38 / 1.2 = 0.317). The same calculation is performed for each indicator as it relates to each neighborhood dimension. The resulting indexes, along with the weight of each indicators, is shown in Table 2.

Table 2. Relative Importance of Generic Indicators in Indexes

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Social Disadvantage</th>
<th>Prestige</th>
<th>Housing Type and Tenure</th>
<th>Business and Employment</th>
<th>Crime</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>R²</td>
<td>Wt.</td>
<td>R²</td>
<td>Wt.</td>
<td>R²</td>
</tr>
<tr>
<td>Median Mortgage Amount</td>
<td>0.28</td>
<td>23.3%</td>
<td>0.74</td>
<td>40.2%</td>
<td>0.09</td>
</tr>
<tr>
<td>Mortgage Approval Rate</td>
<td>0.38</td>
<td>31.7%</td>
<td>0.45</td>
<td>24.5%</td>
<td>0.08</td>
</tr>
<tr>
<td>Pct. of Loans for Home Purch.</td>
<td>0.22</td>
<td>18.3%</td>
<td>0.08</td>
<td>4.3%</td>
<td>0.06</td>
</tr>
<tr>
<td>Pct. of New Loans for Home Imp.</td>
<td>0.19</td>
<td>15.8%</td>
<td>0.28</td>
<td>15.2%</td>
<td>0.03</td>
</tr>
<tr>
<td>Total Home Purchase Loan Apps.</td>
<td>0.07</td>
<td>5.8%</td>
<td>0.12</td>
<td>6.5%</td>
<td>0.27</td>
</tr>
<tr>
<td>Total Number of Businesses</td>
<td>0.03</td>
<td>2.5%</td>
<td>0.10</td>
<td>5.4%</td>
<td>0.03</td>
</tr>
<tr>
<td>Total Number of Employees</td>
<td>0.03</td>
<td>2.5%</td>
<td>0.07</td>
<td>3.8%</td>
<td>0.02</td>
</tr>
<tr>
<td>Sum</td>
<td>1.2</td>
<td>100.0%</td>
<td>1.84</td>
<td>100.0%</td>
<td>0.58</td>
</tr>
</tbody>
</table>

Source: Galster, et. al (2005)
In order to actually compute the indexes, each indicator needs to be compared on the same scale. Comparing, for instance, a 7 percent approval rate to a $135,000 median mortgage is like comparing apples to oranges. In order to compare these numbers on the same scale, each indicator is converted into a z-score. As a z-score, each indicator shows how the neighborhood compares to Indianapolis overall. Once converted, these indicators can reasonably be combined into an index that expresses a neighborhood’s strength in a given dimension in comparison to the rest of Indianapolis.

When the indexes are “rolled up” into the Overall Neighborhood Score, they are each weighted equally. However, the indexes are not equal in their reliability. For example, the indicators behind the Business & Employment Index are much more reliable than the indexes that make up the Crime Index (see Table 2). Index reliability in shown in the web-app, even though it does not affect the importance of that index in the overall score.

Index reliability is higher if the underlying indicators are higher. Therefore, the index reliability is calculated from the r-squared values of its underlying indicators. The sum of the r-squares for each indicator is the measure of an index’s reliability.

<table>
<thead>
<tr>
<th>Index</th>
<th>Reliability Measure</th>
<th>Category in App</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business and Employment</td>
<td>2.14</td>
<td>3-out-of-3</td>
</tr>
<tr>
<td>Prestige</td>
<td>1.84</td>
<td>3-out-of-3</td>
</tr>
<tr>
<td>Social Disadvantage</td>
<td>1.2</td>
<td>2-out-of-3</td>
</tr>
<tr>
<td>Crime</td>
<td>0.73</td>
<td>1-out-of-3</td>
</tr>
<tr>
<td>Housing Type and Tenure</td>
<td>0.58</td>
<td>1-out-of-3</td>
</tr>
</tbody>
</table>

By this measure, the Business and Employment Index and the Prestige Index are comparable in strength. This is reliability is displayed graphically in the web-app as 3-out-of-3. Social Disadvantage lies in the middle, with a reliability measure of 1.2. It is shown in the app as 2-out-of-3. Lastly, the
Crime Index and Housing Type and Tenure Index are the least reliable. They are shown in the app as 1-out-of-3.

**Method of Implementation (Software Development)**

**Description of User Interface.** The primary goal of the web-app was the accurate delivery of the above information in a user-friendly interface. The application shows a map of the census tracts in Indianapolis (by default showing the Overall Neighborhood Score), along with a panel where you can select the data to display and view the data for each census tract selected on the map (shown in Figure 1).

When a user selects a census tract, a “snapshot” of that tract is shown, as well as information about how the tract has changed over time. The snapshot shows the statistic graphically in comparison to Indianapolis overall. The data can also be viewed over time, with a graph of the statistic for the past five years, the tract’s change over five years, and Indianapolis’ average change over five years. (See Figure 2 for more details.)

The left panel also features options to change the look of the map. The transparency of the census tracts can be changed to show the basemap more clearly. The basemap can also be changed to either an unobtrusive gray map, a topographic map, or satellite imagery. The satellite imagery is useful for interpreting the character of neighborhoods. For example, a user may see that a tract has a high density of businesses and employees, but with satellite view the user can determine the character of the businesses. Are the businesses mostly neighborhood retail (narrow 19th century buildings creating density and a distinct street wall, as in Fountain Square), or suburban office parks (larger building footprints set in the middle of parking lots, as in 86th Street). On the right side of the map there are options to search for an address, find your current location (using GPS or the location of your internet connection), and show the maps legend.
With so many options and so many statistical concepts, many users will need help to use and understand the application. The “Need Help?” button in the upper-left corner of the map offers three options. Users can view a brief tour that points out and explains the features described above. There is also an option to view a slideshow explaining the data sources and the meaning of the indicators, indexes, and overall score.

**Potential Improvements to the Interface.** While the application is, on the whole, very user friendly, some improvements could still be made. First, the extensive list of options when users select what data they want to view can be overwhelming. (For each indicator, you can map the statistic itself, the Z-score, or the change. This is in addition to option to map the five indexes and the overall score. Second, the legend currently does not display units. It is difficult for a user to understand the legend at first glance because of this deficiency.

**Technical Notes on Development.** This application involves three major technical phases to build: 1) data processing (in Microsoft Excel), 2) data mapping (in ArcGIS), and 3) web development (using Javascript, HTML, and CSS).

In order to facilitate the incorporation of new data into the application, a template spreadsheet was developed to summarize the raw HMDA data (listed mortgage by mortgage, usually numbering around 50,000 mortgages county-wide) for each census tract. This summarized data is then imported in ArcGIS and joined (by census tract number) to a spatial data layer showing census tract boundaries. At this point, the summarized data can be viewed spatially in a GIS application. In order to develop this into a public web application, the data is uploaded to ArcGIS Online (which offers a server for spatial data). By using ArcGIS Javascript API (a package of Javascript commands and objects that facilitates the development of mapping applications), a website could be developed to access and display this spatial data.

**Notes About Data Over Time.** HMDA data from before 2012 uses the geography from the 2000 Census, which differs form the 2010 Census boundaries in many Marion County census
Figure 1. Overall view of web application.
Figure 2. The Snapshot view (left) shows details about the selected census tract for the current year. For indicators, the statistic itself is shown, as well as the z-score of that data point (how that census tract compares to the mean across Indianapolis). To make the application as user-friendly as possible, the statistic is shown on a colored scale ordered from, in this example, the lowest approval rate to the highest. Z-score is displayed so that a score of zero, or the absolute average, shows in the center of the bar. For indexes, the indicators that make up the index are shown in detail, including their scores and their weight. For the the Overall Neighborhood Score, the five indexes are shown, including their value, their weight (all equal) and a graphic representation of their reliability.

The Over Time view (right) shows how the selected statistic has change for the census tract from 2009-2013. It shows the total change compared with the average change for all Indianapolis census tracts.
tracts. In order to show change over time, data for the old geography must be bridged to the new geography via interpolation.

Their are two interpolation methods used, depending on how exactly the census tract boundaries have changed. There are two boundary change scenarios: either a 2000 census tract is divided to create multiple 2010 census tracts, or multiple 2000 census tracts are combined to create one 2010 tract. In the first scenario, an earlier tract dividing into the current tracts, some data can be simply transferred to the 2010 geography, while other data must estimated using areal interpolation.

Specifically, any percentage or dollar amount is simply transferred from the single 2000 census tract to the multiple 2010 census tracts. This has issues with accuracy, but it is impossible to see, for example, the mortgage approval rate in different sub-sections of the 2000 census tract. (HMDA data is not available at geographies smaller than tract.) Therefore, when the 2000 tract is divided into smaller 2010 tracts, no data is available about those smaller tracts.

However, total loan applications can be interpolated by area. For example, if a 4000 acre tract is divided into three tracts of 1000, 1000, and 2000 acres, it could be estimated that 25 percent of the total loan applications were in each of the two smaller tracts, while 50 percent of the loan applications were in the larger tract. (Applications are divided in proportion to the area of the new, smaller tracts).

In the case of multiple 2000 tracts combining to form a larger 2010 tract, the process is simpler. Data in the previous geography can simply be summed to view it in the current census geography. For example, tract 391000 (the west side of downtown Indianapolis) was formerly three census tracts. When calculating the median mortgage amount in the current geography from data collected in the former geography, the median is selected from all mortgages in those three previous tracts.
Conclusions

In order to test the efficacy of the application, it must be put to use. There are numerous ways in which this tool could be used, from the real estate industry (developers, agents, and even homebuyers) to community development and planning. This paper will prove the tool's application to the targeting of community development resources. As described above, community development resources are limited and therefore must be targeted. Even if it were not for scarcity, these resources are simply more effective when well-targeted (see Goldstein 2010). Goldstein finds that community development resources (specifically NSP dollars) are most effective when used in distressed neighborhoods not contiguous to other distressed neighborhoods. Galster (2006) finds that in Richmond, Virginia the concentration and targeting of resources created a critical mass that truly impacted neighborhoods.

Figure 3. Map of Overall Neighborhood Score for Indianapolis

1  Keystone-Monon
2  Mapleton-Fall Creek
3  East Washington St.
Given that the literature urges the targeted use of CDBG funds in areas where such funds could be most effective (not isolated among other distressed neighborhoods, but contiguous to neighborhoods of investment), how can Indianapolis Community Metrics help locate such neighborhoods? The application be used to locate distressed neighborhoods proximal to healthy neighborhoods and to locate declining neighborhoods proximal to growing neighborhoods. In other words, the tool can locate weakness near strength, both in terms of current market situations and the rate of change in neighborhood housing markets.

When the Overall Neighborhood Score is mapped for all of Indianapolis, it is clear that the downtown core is relatively health, and the first ring suburbs range from average (southern Marion County) to healthy (northeast Marion County). However, the neighborhoods surrounding the urban core are largely distressed. (See Figure 3.) Given the vast amount of distressed tracts surrounding downtown, where should revitalization begin? We should begin by investigating distressed tracts (red) adjacent to areas of investment (blue).

Three tracts in particular appear well positioned for revitalization. These are detailed in Figure 3. The tracts very closely align to neighborhood boundaries. These neighborhoods are named in the above figure. For each neighborhood, the reason for investigating each neighborhood will be explained, and then it will be further explored to determine suitability for revitalization.

**Keystone-Monon.** The Keystone-Monon neighborhood falls within the boundaries of Midtown, which is divided into northern and southern portions by 38th Street. Areas north of 38th Street are generally more well-off than those south of 38th Street. However, the Keystone-Monon neighborhood falls...
Monon neighborhood is the exception. Located north of 38th Street and west of Fall Creek, this neighborhood features amenities such as the Indiana State Fairgrounds and the Monon Trail, a popular bike and pedestrian trail connecting to downtown. With these amenities, proximity to healthy markets, and the psychological advantages of being “north of 38th,” Keystone-Monon could offer high impact for CDBG dollars.

The Overall Neighborhood Score for Keystone-Monon is -0.65, while the adjacent neighborhoods to the north and west have scores ranging from 0.71 to 1.37. Consistently, the strongest index in the adjacent neighborhoods in Housing Type and Tenure Index, with scores ranging from 1.21 to 2.71. However, Housing Type and Tenure is the weakest index for the Keystone-Monon neighborhood, at -0.85.

Using the application, we can drill down into the Housing Type and Tenure Index and find what is causing such a low score for the neighborhood. The results are shown in Figure 5. The indicator most important in determining the Housing Type and Tenure score is the number of home purchase loan application records per acre. This is near zero for the Keystone-Monon neighborhood. We can drill down further and see (Figure 5) that there were only three applications for a loan to buy a home in 2013, and there have been
between 8 and 15 in previous years. While the fairgrounds take up a large amount of the tract, there are still dozens of homes that are simply not selling. And with a median mortgage amount of $34,000 in the tract, those that do sell suffer from depressed values.

Our findings indicate that this tract could be a wise place to target CDBG dollars. The complete lack of interest in this tract by the real estate market shows a clear need, while the depressed values offer affordable acquisition of property. Because this tract is so close to areas of investment to the north and west, and because of amenities like the Monon Trail and the fairgrounds, this neighborhood could soon attract private money to leverage the CDBG funds.

**Mapleton-Fall Creek.** Just south of the Mapleton-Fall Creek neighborhood (across Fall Creek) is the Fall Creek Place neighborhood. In 15 years Fall Creek Place has transformed from an area of extreme disinvestment to what is now one of downtown's strongest housing markets. (Its Overall Neighborhood Score has risen from 0.33 in 2009 to 1.4 in 2013.) However, its neighbor to the north still suffers from disinvestment. (Its neighborhood score is -0.34 and has actually fallen since 2009.)

When we explore the neighborhood score more deeply, we see that Mapleton-Fall Creek is near-average in the Business & Employment and Housing Type & Tenure Indexes (0.43 and -0.42, respectively), but its lowest index is Prestige (-0.70). The Prestige Index is low because the median mortgage amount is only $10,000 and the mortgage approval rate is only 50 percent. The other main component of Prestige, the percent of loans used for home improvement, is strong at 10 percent (more than one standard deviation above the mean). This could
be a sign that home owners are beginning to invest in their homes in hopes that the real estate mar-
ket might grow stronger as it has in Fall Creek Place.

When we look closer at median mortgage amount (see Figure 6), the principle component in
Prestige, we see that it has fallen from $116,000 in 2009 to $10,000 in 2013. The historical data sug-
gests that 2013 might be an outlier. From the small sample we have (2009-2013), $77,000 is the me-
dian. This would be about average for Indianapolis.

It may be wise to monitor Mapleton-Fall Creek to determine if the declining median mort-
gage value continues or if the success of Fall Creek Place begins to creep north. By using Indianapolis
Community Metrics to monitor the neighborhood, intervention can occur earlier if necessary.

**East Washington Street.** In Figure 7, the census tract to the south of East Washington
Street is outline in teal. The map is showing Overall Neighborhood Score, and it is apparent that this
tract scores much lower than its neighbors to the west, north, and south. To the west, downtown is
strong market. To the north is Holy Cross and tracts that include Woodruff Place (historically a sta-
ble area of larger homes) and East St. Clair Place (a significant recent redevelopment area). To the
south is Fountain Square. While these neighborhoods have a median overall score of 0.57, East Washington
Street scores -0.9. It is relatively strong in the Business & Employment Index (Angie’s List is headquartered
here and other businesses have offices near downtown), but weak in all other indexes.

The median mortgage amount in this area is $0 for 2013, which skews several indexes. When we look at
previous data, we see that the area’s mortgage amount has previously ranged from $43,000-$60,000, which is
slightly below average. Because of this, the area’s over-
all score was a little higher between 2009 and 2012, ranging from -0.55 to -0.36. This data suggests that the 2013 score may be an outlier, but on average the neighborhood is still relatively depressed. From 2009-2013 there have been an average of six applications for home loans each year, and the mortgage approval rate has been 40.6 percent on average. In 2013, the approval rate was 44 percent, nearly two standard deviations below the mean.

This information suggests that homeownership should be strongly encouraged in the neighborhood, and CDBG funds could support this goal. Because of the neighborhood’s proximity to healthy neighborhoods, CDBG money could have a high impact in this neighborhood. Because East Washington Street is a national highway and so close to downtown, economic development will be a strong component of revitalization efforts in the area.

Lessons Learned

The application is very helpful in exploring neighborhoods across Indianapolis to locate where community development funds could have the most impact. It is most effective as an initial exploratory tool. For decision-making, this application should be paired with all other data resources available. This application cannot replace more detailed research, but it can make it possible to get a good overview of neighborhood health in only a few minutes of exploring the map and datasets.

In order to make the application more effective, it needs to be easier to spot outliers. It could help to incorporate more historical data, or even calculate indicators as two-year averages rather than annual data. It would also be useful to be able to drill down to see individual loan application records in table format. This level of detail could help explain outlier years when median mortgage amounts are at or near zero, for example.

Finally, the ability to query the data would be an extremely useful feature for the application. One could, for example, search for tracts with low Social Disadvantage scores but high Business & Employment Scores to find areas where policies could encourage the employment of neighborhood
residents in order to revitalize the neighborhood near businesses. Or one could locate and highlight tracts with low overall scores that are within 1/10th of a mile of tracts with high overall scores. This query offers a good starting place to find neighborhoods where CDBG funds could be successfully leveraged with private money and have a high impact.

There is a need to examine the tool’s effectiveness in cities with a more robust rental market. Many of the indicators, and the Housing Type and Tenure Index specifically, reward neighborhoods of predominantly single-family housing and owner-occupied housing. For example, a tract scores better on that index if there are more loan application records per acre. This would hurt a tract where most of the housing is rental housing, even if these units are very desirable. In Indianapolis, the hypothesis that strong owner-occupied markets define strong neighborhoods is not unreasonable. Most of the city’s neighborhoods are principally built of stand-alone, single-family homes. However, in a more urban location, such as Chicago, block after block could be composed of nearly all rental units, which in no way implies a weak housing market.

As a step in the direction of implementing neighborhood indicators, this application provides information and resources to organizations and individuals who did not previously have access to such neighborhood data. It offers the ability to quickly survey the city for neighborhoods in need of intervention or neighborhoods on the rise. And, importantly, it is an application and model that can be very easily replicated for any city or county across the country, because it is built from frequently updated, universal, and accessible data sources.
References


