What Social Impacts of Foreclosed Housing Redevelopment are Important to Local Actors? How Can We Measure Them?

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Overview of Presentation

Acquisition and redevelopment of foreclosed properties by community organizations helps to mitigate the social impacts of foreclosures on neighborhoods and residents

Social impacts can be measured in a variety of ways
- Lost value to proximate properties
- Strategic value of foreclosed property locations

Models can estimate magnitudes of such effects to identify potential acquisition candidates and social impacts of alternative development strategies

Application of models to a local case study demonstrates how these measures can be used in practice
Funding Support

- **Joseph P. Healey Grant Program**, “Decision Modeling for Foreclosed Housing Acquisition in a Large Urban Area” (with Felicia Sullivan; David Turcotte, University of Massachusetts Lowell), July 2009 – July 2010

- **National Science Foundation**, “Collaborative Proposal: Decision Models for Foreclosed Housing Acquisition and Redevelopment” (with Jeffrey Keisler; Senay Solak and Armagan Bayram, University of Massachusetts Amherst; David Turcotte and Emily Vidrine, University of Massachusetts Lowell), August 1, 2010 – July 30, 2012
Motivation

Foreclosure crisis has had severe impacts on individuals and housing markets:

- As of the end of 2010, over 4 million homeowners were severely delinquent on their mortgage payments or in the foreclosure process.
- Real equity declined by 60 percent from 2006-2010, and 11 million homeowners were underwater on their mortgages (Joint Center for Housing Studies, 2011)

Federal government has spent over $11 billion in foreclosure-related programs:

- Neighborhood Stabilization Program
- American Recovery and Reinvestment Act
- Dodd-Frank Wall Street Reform and Consumer Protection Act of 2010

But progress, measured by number of homeowners with modified loans, or number of foreclosed properties acquired and redeveloped, has fallen short of expectations
Role of Community-Based Organizations

CBOs lead local responses to foreclosure crisis and are essential to neighborhood stabilization and revitalization:

- Homebuyer education
- Foreclosure counseling
- Renter advocacy
- Family support
- Housing and economic development
- Community planning

Mission-driven CBOs have significant experience and expertise, but often lack commensurate technical resources to generate maximum impact (Mallach, 2008)
Objectives of Research Projects

- **Healey Grant Project:**
  - Field research to understand current practice
  - Identify CBO partner(s) to extend decision models
  - Use GIS to support strategy design

- **NSF Grant Project:**
  - Incorporate uncertainty and multiple periods
  - Mixed-methods for decision modeling
  - Multi-site case study of decision modeling implementation
Focus on Social Impacts

Through Healey grant, identified social impacts of foreclosures as a driving force behind CBO interventions

- How do foreclosures impair neighborhood stability?
- How do CBOs conceive of social impacts, and how are they measured?

Research questions

- What characteristics of foreclosed housing are salient to the problem of community-based foreclosed housing acquisition and redevelopment?
- How can such characteristics be quantified?
- How can they be used in decision models?
Social Impacts of Foreclosed Housing

Families:
- Financial insecurity and economic hardship
- Personal and family stress, disruption and ill health
- Increased school mobility for children (ULI, 2012)

Communities:
- Property values, vacancies, prices and rents
- Disorder, crime and violence
- Public sector costs and fiscal health

Data to estimate many of these impacts are limited or not easily quantifiable (Kingsley, Smith and Price, 2009)
What Attributes Are Relevant for Acquisition and Redevelopment?

Social value
- Impacts upon community distress measures associated with foreclosed housing
  - Criminal offending
  - Blight
  - Property values

Strategic value
- Ability of redevelopment projects to further CDC goals
  - Proximity to neighborhood amenities and disamenities
  - Support for economic redevelopment

Development value
- Probability of project success
  - Acquisition and redevelopment costs
  - Likelihood of successful acquisition
One CBO’s Perspective on Social Impacts

We identify and measure attributes of candidate foreclosed properties known to be important to a particular CDC:

- **Property values**
  - What is the expected foregone loss in property values associated with successful acquisition and redevelopment of certain foreclosed housing units?

- **Strategic values**
  - What location-based measures of foreclosed properties embody a CDC’s strategic goals and resident preferences?
Focus on Property Values

Real estate theory proposes that changes in housing unit and neighborhood quality are eventually capitalized into property values.

Extensive literature on impacts on foreclosed housing on property values of nearby units (Harding et al, 2009; Campbell et al, 2009; Hartley, 2010; Wassmer, 2010)

In the absence of other documented impacts, focus on avoided property value losses as primary dollar-valued benefit associated with foreclosed housing acquisition and redevelopment.

We develop a model based on discrete-time Markov chains to compute expected total property value losses associated with a specific foreclosed unit.
How do Foreclosures Affect Neighboring Properties?

We measure the aggregate impact of a single foreclosure on all proximate properties:

Assumptions:

- Impacts are linearly additive across proximate properties
- Second-order effects are negligible
- Density and distribution of proximate properties do not influence impacts
What Data are Necessary for a Model of Avoided Property Value Losses?

1. The stage of the foreclosure process of the distressed unit at the time of potential acquisition by a CDC
2. The distance between the distressed property and each proximate property
3. Appraised values of all properties proximate to a distressed property
4. The percent loss in property values associated with a given foreclosure state and distance
5. Possible property foreclosure states
6. The probability that the distressed property will be in a given stage of the foreclosure process in the future

(1) – (4) can be derived from publicly-available property data and findings in the real estate finance literature
(5) is available from current housing research
(6) requires specialized analytic models
The Property Value Impacts (PVI) model

We want to calculate the expected lost value to a property proximate to a foreclosure:

\[
L_{ph}^t(i,d) = v_h \cdot \left( \sum_{k \in S_p} Y_{ph}(k,d) \cdot P_{ik}^t \right)
\]

where:

- \( p \) = a foreclosed candidate property for acquisition;
- \( i, k \) = discrete states for \( p \) at a given point in time;
- \( h \) = a property proximate to \( p \);
- \( P_{ik}^t \) = the probability that \( p \), currently in state \( i \), will be in state \( k \) \( t \)-periods from now;
- \( v_h \) = current value of property \( h \);
- \( d \) = the distance between \( p \) and \( h \);
- \( Y_{ph}(k,d) \) = percent discount on value of \( h \) that is \( d \) from \( p \) known to be in foreclosure state \( k \) currently.
Markov Chain of Foreclosure States

Need to estimate the probability of a property occupying a particular foreclosure state at some time in the future

\[ P_{ik}^n = \text{the probability of property } p \text{ being in state } k \text{ } n \text{ periods into the future given current state } i; \text{ the } i-k\text{th entry of the } n\text{-step transition matrix } P^n \text{ (Ross 2009).} \]

Assume:

- A property can only occupy one state per period, and that the length of the period can vary by state.
- All states communicate with each other and are recurrent
How Can We Adapt Published Results on Property Value Impacts?

We combine the foreclosure stages observed by Harding et al. (2009) into five categories, and develop piece-wise linear functions of the estimates of property value discount, $y_{ph}(k,d)$, by distance and stage of foreclosure:

<table>
<thead>
<tr>
<th>Stage (i)</th>
<th>Current</th>
<th>Delinquent</th>
<th>Default</th>
<th>Foreclosure</th>
<th>REO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distance (d)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>0.00</td>
<td>0.17</td>
<td>0.76</td>
<td>0.82</td>
<td>0.96</td>
</tr>
<tr>
<td>250</td>
<td>0.00</td>
<td>0.17</td>
<td>0.52</td>
<td>0.61</td>
<td>0.77</td>
</tr>
<tr>
<td>500</td>
<td>0.00</td>
<td>0.13</td>
<td>0.18</td>
<td>0.25</td>
<td>0.39</td>
</tr>
<tr>
<td>750</td>
<td>0.00</td>
<td>0.05</td>
<td>0.20</td>
<td>0.17</td>
<td>0.16</td>
</tr>
<tr>
<td>1000</td>
<td>0.00</td>
<td>0.06</td>
<td>0.15</td>
<td>0.12</td>
<td>0.11</td>
</tr>
<tr>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
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<tr>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>3000</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
</tbody>
</table>
Discount Functions by Stage and Distance
Strategic Value Analysis

How can we represent the value of a foreclosed acquisition opportunity with respect to a CDC’s mission?

- Unit characteristics
- Proximity to local amenities and disamenities

Antecedents:

- Implicit markets for housing attributes (Rosen 1974)
- Hedonic price functions (Bartik and Smith 1987)
- Household utility maximization as a function of housing attributes (Sheppard 1999)
- ‘Push’ and ‘pull’ factors in hedonic models (Li and Brown 1980) and facility location models (Eiselt and Laporte 1995)

Limited research on amenities that influence housing acquisition and redevelopment decisions of CBOs
What are Amenities and Disamenities?

Amenities:
- Schools, parks, cultural venues, full-service grocery stores, other CDC-developed housing, transit stops, ‘strategic corridors’

Disamenities:
- Crime ‘hot spots’, vacant lots, distressed housing, excessively busy intersections

Notions of amenities and disamenities that are believed to influence strategic value of properties may vary widely
A Theory of Strategic Value for Foreclosed Housing Acquisition

Assumptions:

- Proximity to amenities and disamenities within a given neighborhood are the only relevant considerations
- Amenities and disamenities can be grouped into discrete categories (e.g. ‘schools’, ‘crime locations’)
- Decision maker has defined preferences for categories of amenities and disamenities
- Decision maker has defined preferences for amenities (overall) as compared to disamenities

Strategic value of a given property is a function of:

- Aggregate value of property with respect to all local amenities
- Aggregate value of property with respect to all local disamenities
Strategic Value: Functional Forms

**Individual resident frame:** only the closest amenity and disamenity influence locational decisions

\[
A^I_i(r) = \frac{1}{\min \{d^I_{ij}\}}
\]

\[
D^P_i(r) = \min \{d^P_{ik}\}
\]

**CDC frame:** all local amenities and disamenities influence locational decisions

\[
A^I_i(c) = \sum_{j=1}^{J} \frac{1}{(d^I_{ij})^2}
\]

\[
D^P_i(c) = \sum_{k=1}^{K} (d^P_{ik})^2
\]

Standardize strategic value measures for consistency, and aggregate by class and amenity/disamenity
Case Study: Chelsea, MA

About Chelsea

- A small urban and diverse community adjacent to Boston
- Has been especially hard hit by the foreclosure crisis

Between 2009 – 2010 we collaborated with a local CDC to understand foreclosed housing development processes, gather data and refine our decision models

- A recognized leader in foreclosure acquisitions
- A commitment to community stabilization and resident engagement

We apply property value impacts and strategic value models to 35 foreclosed residential properties identified by the CDC as potential acquisition candidates as of October 2009
## Description of Candidate Properties

<table>
<thead>
<tr>
<th>Statistic</th>
<th>Number of properties within 500ft</th>
<th>Average value of proximate properties</th>
<th>Number of other foreclosed properties within 500ft</th>
<th>Assessed value of candidate properties</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum</td>
<td>104</td>
<td>$284,683</td>
<td>0</td>
<td>$263,800</td>
</tr>
<tr>
<td>Maximum</td>
<td>193</td>
<td>$497,653</td>
<td>11</td>
<td>$531,100</td>
</tr>
<tr>
<td>Mean</td>
<td>150.2</td>
<td>$350,386</td>
<td>5.9</td>
<td>$378,031</td>
</tr>
<tr>
<td>25th Percentile</td>
<td>127</td>
<td>$319,669</td>
<td>3</td>
<td>$323,600</td>
</tr>
<tr>
<td>Median</td>
<td>155</td>
<td>$350,592</td>
<td>6</td>
<td>$379,700</td>
</tr>
<tr>
<td>75th Percentile</td>
<td>174.5</td>
<td>$372,878</td>
<td>9</td>
<td>$421,550</td>
</tr>
</tbody>
</table>
## Transition Matrix

<table>
<thead>
<tr>
<th>Status at time t</th>
<th>Status at time t+1</th>
<th>Current</th>
<th>Delinquent</th>
<th>Default</th>
<th>Foreclosure</th>
<th>REO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current</td>
<td>0.870</td>
<td>0.130</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>Delinquent</td>
<td>0.047</td>
<td>0.105</td>
<td>0.762</td>
<td>0.084</td>
<td>0.003</td>
<td></td>
</tr>
<tr>
<td>Default</td>
<td>0.042</td>
<td>0.028</td>
<td>0.828</td>
<td>0.101</td>
<td>0.002</td>
<td></td>
</tr>
<tr>
<td>Foreclosure</td>
<td>0.040</td>
<td>0.000</td>
<td>0.048</td>
<td>0.869</td>
<td>0.043</td>
<td></td>
</tr>
<tr>
<td>REO</td>
<td>0.070</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.930</td>
<td></td>
</tr>
</tbody>
</table>

Source: Federal Reserve Bank of Boston; all residential loans in Chelsea that were active in 2010

- Monthly transition rates between stages are low
  - Foreclosure process can be slow
  - CDCs may not act right away
- Markov chain multiplies matrix over multiple time periods to estimate future transition rates
### Property Value Impacts: Computational Results

<table>
<thead>
<tr>
<th>Distributions</th>
<th>Frequency</th>
<th>Average Proximate Property Value Impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>By Property Type</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1-Fam</td>
<td>3</td>
<td>$150,808</td>
</tr>
<tr>
<td>2-Fam</td>
<td>12</td>
<td>$186,146</td>
</tr>
<tr>
<td>3-Fam</td>
<td>20</td>
<td>$183,178</td>
</tr>
<tr>
<td>By Foreclosure Status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Petition</td>
<td>21</td>
<td>$180,707</td>
</tr>
<tr>
<td>Auction</td>
<td>8</td>
<td>$173,787</td>
</tr>
<tr>
<td>REO</td>
<td>6</td>
<td>$194,099</td>
</tr>
</tbody>
</table>

Annual interest rate = 3.5%; time period for analysis = 8 months
Spatial Distribution of Estimated PVI

Estimated property value impacts show variation over space, property type and foreclosure status.
What Property Value Impact Model Results Mean for Practice?

- Of 35 available foreclosed properties, the CDC eventually purchased three of them, ranked 4th, 6th, and 32nd in terms of expected proximate PVI in our model, resulting in a total of $580,000 in estimated averted proximate property value losses.

- Had the CDC purchased the top three properties by expected proximate PVI, the total estimated proximate PVI would have been $705,500 → estimated social loss of 21.6% in foregone property value impacts.
Strategic Value: Distribution of Amenities and Disamenities
Researchers’ and CDC’s Views of Amenities and Disamenities Differ

<table>
<thead>
<tr>
<th>Feature Type</th>
<th># of Proximate Locations</th>
<th>Source of Data</th>
<th>Relevant to CDC?</th>
<th>Criteria for Inclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Amenities</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Schools</td>
<td>5</td>
<td>Mass GIS</td>
<td>No</td>
<td>Any school in or within 500 meters of the CDC service area</td>
</tr>
<tr>
<td>Bus stops</td>
<td>27</td>
<td>Mass GIS</td>
<td>No</td>
<td>Any bus stop in or within 500 meters of the CDC service area</td>
</tr>
<tr>
<td>Parks &amp; open space</td>
<td>3</td>
<td>Mass GIS</td>
<td>No</td>
<td>Any recreational space in or within 500 meters of the CDC service area</td>
</tr>
<tr>
<td>CDC-owned properties</td>
<td>28</td>
<td>CDC</td>
<td>Yes</td>
<td>Properties owned as of 2011 EXCEPT foreclosure acquisitions after October 2009</td>
</tr>
<tr>
<td>Police Stations</td>
<td>1</td>
<td>Mass GIS</td>
<td>No</td>
<td>Police stations in or within 500 meters of the CDC service area</td>
</tr>
<tr>
<td>City Hall</td>
<td>1</td>
<td>Mass GIS</td>
<td>No</td>
<td>City hall</td>
</tr>
<tr>
<td>CDC-identified strategic corridors</td>
<td>4</td>
<td>CDC</td>
<td>Yes</td>
<td>Identified by the CDC in 2009</td>
</tr>
<tr>
<td>Libraries</td>
<td>1</td>
<td>Mass GIS</td>
<td>No</td>
<td>Public library branches in or within 500 meters of the CDC service area</td>
</tr>
<tr>
<td><strong>Disamenities</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other foreclosed properties</td>
<td>33</td>
<td>CDC</td>
<td>Yes</td>
<td>Properties in the CDC service area in foreclosure as of October 2009</td>
</tr>
<tr>
<td>Crime locations</td>
<td>7</td>
<td>CDC</td>
<td>Yes</td>
<td>Identified by CDC in May 2010</td>
</tr>
</tbody>
</table>
Strategic Value Estimates Vary by Frame, Feature set, and Weights

<table>
<thead>
<tr>
<th>Average [Std. Deviation]</th>
<th>Weights</th>
<th>Resident Frame</th>
<th>CDC Frame</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full set of amenities/</td>
<td>Base</td>
<td>0.254 [0.086]</td>
<td>0.199 [0.082]</td>
</tr>
<tr>
<td>disamenities</td>
<td>Alternative</td>
<td>0.286 [0.168]</td>
<td>0.242 [0.164]</td>
</tr>
<tr>
<td>CDC-specified features</td>
<td>Base</td>
<td>0.249 [0.139]</td>
<td>0.185 [0.133]</td>
</tr>
<tr>
<td>only</td>
<td>Alternative</td>
<td>0.252 [0.163]</td>
<td>0.208 [0.170]</td>
</tr>
</tbody>
</table>

Individual resident frame, full feature set, alternative weights

CDC frame, CDC-specified features, base weights
What are the Relationships between Different Strategic Value Estimates?

<table>
<thead>
<tr>
<th>Weights</th>
<th>Base Weights</th>
<th>Alternative Weights</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Base Weights</td>
<td></td>
</tr>
<tr>
<td>Features</td>
<td>Full</td>
<td>CDC</td>
</tr>
<tr>
<td>Frame</td>
<td>Res</td>
<td>CDC</td>
</tr>
<tr>
<td>Base</td>
<td>Full</td>
<td>Res</td>
</tr>
<tr>
<td></td>
<td>CDC</td>
<td></td>
</tr>
<tr>
<td>CDC</td>
<td>Res</td>
<td>-0.63</td>
</tr>
<tr>
<td></td>
<td>CDC</td>
<td>-0.55</td>
</tr>
<tr>
<td>Alt</td>
<td>Full</td>
<td>Res</td>
</tr>
<tr>
<td></td>
<td>CDC</td>
<td></td>
</tr>
<tr>
<td>CDC</td>
<td>Res</td>
<td>-0.40</td>
</tr>
<tr>
<td></td>
<td>CDC</td>
<td>-0.29</td>
</tr>
</tbody>
</table>

- The base and alternative weights, and the resident and CDC frames, are **positively** associated with each other.
- The full and **CDC-specific** feature sets are **negatively** associated with each other, especially within resident frames—how features are identified and viewed matters more than weights and frames.
What Strategic Value Analysis Results Mean for Practice?

<table>
<thead>
<tr>
<th>Weights</th>
<th>Features</th>
<th>Frame</th>
<th>Average of purchased properties</th>
<th>Average of top three properties</th>
<th>% Lost Strategic Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base case</td>
<td>Full</td>
<td>Resident</td>
<td>0.251</td>
<td>0.414</td>
<td>39.4%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CDC</td>
<td>0.243</td>
<td>0.376</td>
<td>35.5%</td>
</tr>
<tr>
<td>CDC</td>
<td>Resident</td>
<td></td>
<td>0.374</td>
<td>0.520</td>
<td>28.0%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CDC</td>
<td>0.315</td>
<td>0.471</td>
<td>33.2%</td>
</tr>
<tr>
<td>Alternative</td>
<td>Full</td>
<td>Resident</td>
<td>0.230</td>
<td>0.619</td>
<td>62.8%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CDC</td>
<td>0.270</td>
<td>0.635</td>
<td>57.5%</td>
</tr>
<tr>
<td>CDC</td>
<td>Resident</td>
<td></td>
<td>0.425</td>
<td>0.633</td>
<td>32.8%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CDC</td>
<td>0.397</td>
<td>0.669</td>
<td>40.7%</td>
</tr>
</tbody>
</table>

Significant losses, as measured by percent of normalized estimated strategic value associated with actual CDC purchases compared to top three properties within each analysis category.
Application to Decision Models

Decision science models can help CDCs make property acquisition decisions if:

- Objectives (including social impact measures) are conflicting
- Priorities on objectives differ across decisionmakers

Multi-criteria decision models can assist decision-makers by:

- Making explicit the assumptions behind alternative decisions
- Helping estimate the scale of impacts of different decisions

If different measures of foreclosure impacts that are important to CDCs vary across candidate properties and are not highly correlated, then they are candidates for inclusion in decision models.
Can We Apply MCDM to Foreclosed Housing Acquisition Decisions?

Correlations with Strategic Value Estimates:

<table>
<thead>
<tr>
<th>Weights</th>
<th>Feature Sets</th>
<th>Frames</th>
<th>PVI values</th>
<th>Assessed property value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Base weights</strong></td>
<td>Full</td>
<td>Resident</td>
<td>-0.07</td>
<td>-0.02</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CDC</td>
<td>-0.20</td>
<td>-0.04</td>
</tr>
<tr>
<td></td>
<td>CDC</td>
<td>Resident</td>
<td>0.32</td>
<td>0.05</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CDC</td>
<td>0.35</td>
<td>0.00</td>
</tr>
<tr>
<td><strong>Alternate weights</strong></td>
<td>Full</td>
<td>Resident</td>
<td>-0.36</td>
<td>-0.06</td>
</tr>
<tr>
<td></td>
<td></td>
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Absence of large, positive correlations between measures is supportive of MCDM for foreclosed housing decisions.
Discussion

Property value impacts:

- First known instance known of modeling foreclosure impacts using Markov models
- Recent field research indicates that other CDCs may not place great importance on property value impacts
- Sensitivity analyses show 12% increase when planning horizon decreased from eight to four periods, negligible impact of changes in interest rate

Strategic value computations:

- First known instance of quantifying ‘strategic value’ of candidate foreclosed housing acquisitions
- Field research with community partners is essential to identifying salient amenities and disamenities

PVI, SVA and assessed value (proxy for market value) are candidates for inclusion in multi-criteria decision models for foreclosed housing acquisition and redevelopment
Expanding Our Work

Assess impacts of findings:

- To what extent do SVA and PVI reflect actual concerns, data for Chelsea? Are they significant for policy and practice? Can they be replicated?
- Is Chelsea atypical?

Additional case studies with two more CDCs

To answer our title question requires new methods:

- Problem structuring methods
- Value-focused thinking
For updates and more information:
http://umb.libguides.com/foreclosed_housing
References and Related Literature


