Scenario Planning for Future Cities

10/16/19

Robert Goodspeed, PhD, AICP
TAUBMAN COLLEGE OF ARCHITECTURE + URBAN PLANNING IS BUILDING TOMORROW

ENGAGE IN CRITICAL THINKING AND APPLIED DISCOURSE TO BECOME AGENTS OF CHANGE

STATE-OF-THE-ART DIGITAL FABRICATION LAB
EXTENSIVE TRAVEL ABROAD OPTIONS
37,500-SQUARE-FOOT DESIGN STUDIO

ENERGETIC, AWARD-WINNING FACULTY
DEGREE PROGRAMS

ARCHITECTURE:

» BACHELOR OF SCIENCE (B.S.)
» MASTER OF ARCHITECTURE (M.ARCH.)
» POST-PROFESSIONAL DEGREES
  » MASTER OF URBAN DESIGN (M.U.D.)
  » MASTER OF SCIENCE (M.S.) DEGREE WITH CONCENTRATIONS IN DIGITAL AND MATERIAL TECHNOLOGIES, AND DESIGN AND HEALTH
» PH.D. IN ARCHITECTURE

URBAN + REGIONAL PLANNING:

» MASTER OF URBAN AND REGIONAL PLANNING
» GRADUATE CERTIFICATES:
  » REAL ESTATE DEVELOPMENT
  » HEALTHY CITIES
  » URBAN INFORMATICS
» PH.D. IN URBAN AND REGIONAL PLANNING
Contemporary Long-term Planning Challenges

**Transformation**: How can the physical and functional pattern of a city be changed to improve sustainability?

**Resilience**: How can cities be prepared for external forces, such as climate change impacts or new technologies?
Planning Approaches

Visioning
Planning Approaches

- Whose vision?
- Data?
- Plausibility?
Planning Approaches

Visioning

Forecasting
Conventional Wisdom about Trends is Often Wrong

“Heavier-than-air flying machines are impossible.”
   – Lord Kelvin

“With over fifty foreign cars already on sale here, the Japanese auto industry isn’t likely to carve out a big slice of the U.S. market for itself.”
   – Business Week, 1968

“I think there is a world market for about five computers”
   – Thomas Watson, IBM Chairman, 1943

_The Experts Speak_, quoted in Schoemaker 1991
Quantitative Trends Aren’t Easier…

Metro Detroit Average Daily VMT, Actual and Forecast

Note: VMT estimation methodology varies between studies. Data Sources: SEMCOG, Suburbs Alliance.
Planning Approaches

Visioning

Forecasting

Strategic Planning
Planning Approaches

Visioning

Forecasting

Consensus Building

Strategic Planning
Planning Approaches

**Future Focus**
- Single Vision
  - Visioning

**Present Focus**
- Anticipates Plural Viewpoints
  - Consensus Building

**Internal Project Focus**
- Mutual Understanding

**External Focus**
- Trends & Systems
  - Strategic Planning
### Competing Approaches and Scenario Planning Links

<table>
<thead>
<tr>
<th>Approach</th>
<th>Where/how adopted in Scenario Planning Practices</th>
<th>How SP differs?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visioning</td>
<td>Utilized extensively in normative scenario planning; even exploratory projects address competing values</td>
<td>Greater effort to ensure even normative scenarios are plausible, and rigorously developed.</td>
</tr>
<tr>
<td>Forecasting</td>
<td>Similar methods used to create scenarios</td>
<td>No such thing as a most likely future</td>
</tr>
<tr>
<td>Strategic Planning</td>
<td>Similar use of spatially or topically focused; consideration of internal/external issues</td>
<td>Greater emphasis on future</td>
</tr>
<tr>
<td>Consensus Building</td>
<td>Extensive use of participation and stakeholder engagement</td>
<td>May not pursue strong consensus, future orientation</td>
</tr>
</tbody>
</table>
A Forecasting Metaphor

How to anticipate the road ahead?
Curvy or straight? Types of obstacles?

Forecasting Scenarios Hope

- Uncertainties:
  - E.g., location, type, and density of new development
  - E.g., Population or employment growth

- Predetermined:
  - E.g., Most existing housing and infrastructure
  - E.g., current institutions such as private property markets

**Figure 13.** The balance of predictability and uncertainty in the business environment

Scenario Funnel

Figure 3.1 *The scenario funnel*
Scenario *Content* Typology

Fig. 1. Scenario typology with three categories and six types.


Mahmoud et al (2009)
### Why create scenarios in urban planning?

<table>
<thead>
<tr>
<th>Project Type</th>
<th>Goal</th>
<th>Measures of Success</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vision Projects</td>
<td>• Create a shared vision through creating and comparing several scenarios</td>
<td>• Consensus on vision, implementation strategies, goals, indicators, etc…&lt;br&gt;• Quality of vision(?)</td>
</tr>
<tr>
<td>Decision Projects</td>
<td>• Make better decisions through creation of scenarios</td>
<td>• Plans which allow for better decisions (robust, contingent strategies)&lt;br&gt;• Number, quality, analysis of strategies</td>
</tr>
<tr>
<td>Exploratory Projects</td>
<td>• Improve understanding of uncertainty and future trends</td>
<td>• Foresight?&lt;br&gt;• Enlightenment?</td>
</tr>
</tbody>
</table>

In all cases, the goal is achieved through the comparison of a set of scenarios, designed to be *similar* in some ways and *different* in others.
Example: Vision Project in a Declining Region

Where is Northeast Ohio headed?

“If Northeast Ohio stays on its current course, our communities will face unrelenting fiscal challenges in the years ahead.”

Brad Sellers, Mayor, City of Warrensville Heights

### Financial Outcomes
- Negative fiscal impact across the region
- All counties experience declining revenue compared with costs
- The most fiscally strong county in 2040 is weaker than the weakest county today

### What is driving these changes?
- High Cost of New Infrastructure
- High Rates of Abandonment
- Stagnant Employment

### TREND SCENARIO
If Northeast Ohio follows its current trend of virtually flat population and job growth and maintains its current approach to land use and development, our region will face unprecedented challenges by 2040. Under this “Trend” Scenario, Northeast Ohio will experience:
- "Churn," with Lagging Growth: Northeast Ohio will have minimal growth in population and jobs, but will continue to spread out, abandoning our traditional urban areas for new development and reducing transportation alternatives that require population density to remain viable.
- Abandonment: We are likely to continue experiencing the abandonment of houses, retail centers and industrial properties while we leave behind significant community assets that we have inherited from prior generations.
- Jeopardized Natural Resources: Northeast Ohio will continue to put its natural resources at risk through its land use choices, and infrastructure investments.
- Extreme Fiscal Challenges for Local Governments: The costs of our land use and resource choices will place EVERY county in the region at significant financial risk. As local governments will be forced to spend more than they take in, Northeast Ohioans will have to choose between two bad options: getting used to a diminished quality of life or paying significantly more in taxes.

### THE FOUR SCENARIOS

- **"GROW THE SAME" SCENARIO:** Significant job and population growth with no change in existing development policies.
- **"DO THINGS DIFFERENTLY" SCENARIO:** Growth remains virtually flat and Northeast Ohio adopts a new sustainable policy direction.
- **"GROW DIFFERENTLY" SCENARIO:** Significant job and population growth, and Ohio adopts a new sustainable policy direction.

To answer the question "What course is Northeast Ohio on?" NEOSCC had to determine where Northeast Ohio is today, project how today's trends will shape the future if they continue, and examine alternative futures to a Northeast Ohio that stays "on trend."

NEO 2040: GROW DIFFERENTLY SCENARIO

WHAT MIGHT THE REGION BE LIKE IN 2040 IF THERE ARE SIGNIFICANTLY MORE PEOPLE AND JOBS AND IF CURRENT DEVELOPMENT PATTERNS AND POLICIES CHANGE?

Inputs Summary:
- 4,690,400 residents (+674,000 residents; 0.8% annual growth rate)
- 2,232,700 jobs (+591,000 jobs; 1% annual growth rate)
- 205,000 new acres of parks and conservation land

Output Summary:
- 489,000 new homes built
- 2,400 new abandoned homes
- 487 new miles of Commuter Rail
- 244 new miles of Express Bus

Outcomes:
- Roughly same percentage of suburban housing as the other scenarios, but a smaller number of new rural homes.
- Natural areas conservation is less than Do Things Differently, but more than Trend and Grow the Same.
- Lowest abandonment of all scenarios.
- Roughly the same number of acres developed as Trend even though there are significantly more people and jobs.

Land Use:
- Current: 2% Residential Urban, 5% Residential Suburban, 13% Commercial, 17% Industrial, 8% Mixed Use, 38% Parks and Conservation
- Grow Differently: 5% Residential Urban, 5% Residential Suburban, 7% Commercial, 12% Industrial, 14% Mixed Use, 58% Parks and Conservation

Transportation Investment:
- More investment in rail and bus rapid transit

Investment in Communities:
- More investment in existing communities

Alternative Scenarios 51
## Scenario Summary

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3,914,600</td>
<td>1,839,800</td>
<td>93,430 new residents</td>
<td>108,100 new jobs</td>
<td>121,500 new acres of parks and conserved land</td>
<td>276,800 new housing units</td>
<td>174,900 new abandoned housing units</td>
<td>23,400 acres consumed by outward migration</td>
<td>3,100 lane miles of new roads</td>
</tr>
<tr>
<td>Grow the Same</td>
<td>4,696,400</td>
<td>2,232,700</td>
<td>875,000</td>
<td>501,000</td>
<td>121,500</td>
<td>546,000</td>
<td>93,100</td>
<td>48,400</td>
<td>6,000</td>
</tr>
<tr>
<td>Do Things Differently</td>
<td>3,914,600</td>
<td>1,839,800</td>
<td>93,430</td>
<td>108,100</td>
<td>288,500</td>
<td>120,000</td>
<td>19,800</td>
<td>4,100</td>
<td>700</td>
</tr>
<tr>
<td>Grow Differently</td>
<td>4,696,400</td>
<td>2,232,700</td>
<td>875,000</td>
<td>501,000</td>
<td>205,600</td>
<td>459,000</td>
<td>2,400</td>
<td>29,800</td>
<td>2,400</td>
</tr>
</tbody>
</table>

Types of Housing:
- Single family home
- Multifamily apartment
- Townhouses
- Mobile homes
Imagine Madison
(2018)
Imagine Madison Scenario Metrics (UrbanFootprint)

<table>
<thead>
<tr>
<th>Citywide UrbanFootprint Scenarios Results Summary</th>
<th>Scenario #1: Edge Growth Focus</th>
<th>Scenario #2: Edge/Redevelopment Balance</th>
<th>Scenario #3: Redevelopment Focus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture/Woodland/Rural Land Consumed (acres)*</td>
<td>2,072</td>
<td>1,702</td>
<td>1,140</td>
</tr>
<tr>
<td>Annual Energy Use – Residential (BTUs/year, in trillions)</td>
<td>19.65</td>
<td>19.61</td>
<td>19.52</td>
</tr>
<tr>
<td>Transportation-Related Greenhouse Gas Emissions for Passenger Vehicles (metric tons/year, in millions)</td>
<td>1.78</td>
<td>1.76</td>
<td>1.73</td>
</tr>
<tr>
<td>Annual Gasoline Costs ($/household/year)</td>
<td>$2,887</td>
<td>$2,852</td>
<td>$2,781</td>
</tr>
<tr>
<td>Vehicle Miles Traveled (miles/year, in billions)</td>
<td>4.85</td>
<td>4.77</td>
<td>4.68</td>
</tr>
<tr>
<td>Additional Vehicle Miles Traveled (difference between base year of 2015 and scenario end year of 2040; miles/year, in millions)</td>
<td>574.8</td>
<td>490.8</td>
<td>405.2</td>
</tr>
<tr>
<td>Transit Trips/day</td>
<td>63,996</td>
<td>88,090</td>
<td>90,394</td>
</tr>
</tbody>
</table>

Note: All numbers assume that the only changes from 2015 are to land use and transportation to isolate the impacts of different styles of development. No assumptions have been made on increased fuel efficiency, inflation, etc. Analysis run for Dane County, but growth of 70,000 population and 37,000 jobs was assigned only to land that is already in the city or planned to become part of the city under existing boundary agreements.

* Some of this land is agricultural land that is already within the city boundary.
### Table 1

**Simplified, decision-centered scenarios: Structure and conceptual components for hazard-contingent, decision-centered scenarios and analysis for Great Lakes coastal shoreland management.**

<table>
<thead>
<tr>
<th>Management options</th>
<th>Climate futures</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Lucky</td>
</tr>
<tr>
<td></td>
<td>Historical low standing water level and FEMA 2% storm</td>
</tr>
<tr>
<td><strong>Option 1: Current</strong></td>
<td>Scenario: Current/lucky future</td>
</tr>
<tr>
<td><strong>Option 2: Buildout under current zoning</strong></td>
<td>Scenario: Buildout/lucky future</td>
</tr>
<tr>
<td><strong>Option 3: Buildout under BMP zoning</strong></td>
<td>Scenario: BMP/lucky future</td>
</tr>
</tbody>
</table>

Note: Spatial areas for analyses presented were drawn from FEMA Flood Insurance Rate Maps (FIRMs). FEMA has not prepared final maps of high-energy wave zones (FE) for Great Lakes coasts, so potential high-energy wave zones were estimated using preliminary FEMA estimates where available or long-term lake hydrographic data for standing water levels and lake gauge and other available hydrologic data for wave run-up elevations otherwise. Detailed information for estimating high-risk zones can be found at [http://resilientgreatlakescoast.org](http://resilientgreatlakescoast.org). BMP = best management practices.
Example: Great Lakes Coastal Resilience

Table 2

<table>
<thead>
<tr>
<th>Spatial characteristics/management options</th>
<th>Climate futures</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Lucky</td>
</tr>
<tr>
<td>Land area affected (acres)</td>
<td>336</td>
</tr>
<tr>
<td>Parcels affected (n), out of 5,656 total parcels, by wave action and/or inundation</td>
<td>667 (12% of total)</td>
</tr>
<tr>
<td>Structures damaged (n), by wave action and/or inundation</td>
<td></td>
</tr>
<tr>
<td>Option 1: Current</td>
<td>57</td>
</tr>
<tr>
<td>Option 2: Buildout under current zoning</td>
<td>207 (4.7 + 150)</td>
</tr>
<tr>
<td>Option 3: Buildout under BMP zoning</td>
<td>59 (57 + 2)</td>
</tr>
<tr>
<td>% Structures damaged under zoning with BMPs relative to zoning without BMPs</td>
<td>29</td>
</tr>
</tbody>
</table>

Note: Based on estimates presented to local citizens and officials of Grand Haven City and Township by the research team on October 20, 2015. See also note for Table 1.

DenveRight Internal Scenario Workshop

DenveRight Internal Scenario Workshop

**Ranking the Drivers**

Which of these driving forces WILL MOST IMPACT access to Denver’s opportunities, services, and amenities for existing and future residents in the next 35 years?

- Critical Uncertainties
- Critical Certainties

---

**CRITICAL CERTAINTIES**

1. Aging Population + Net Population Growth; Nearing 4.3M in DRCOG
2. Longer, More Frequent Drought + Extreme Weather Events
3. Water is a Commodity, Continued Water Gap;
4. Access to the Outdoors and Recreational Tourism Remains a Major Value

**CRITICAL UNCERTAINTIES**

1. Development Capacity
2. Political Will
3. Mode Shift
4. Population Change
   - followed closely by the Market and Quantity & Prioritization of Funding
DenveRight Internal Scenario Workshop

CRITICAL CERTAINTIES
1. Aging Population + Net Population Growth; Nearing 4.3M in DRCOG
2. Longer, More Frequent Drought + Extreme Weather Events
3. Water is a Commodity, Continued Water Gap;
4. Access to the Outdoors and Recreational Tourism Remains a Major Value

CRITICAL UNCERTAINTIES
1. Development Capacity
2. Political Will
3. Mode Shift
4. Population Change
   *followed closely by the Market and Quantity & Prioritization of Funding

Denver Today
- Little Mode Shift
- Right Use, Right Place

Boom!
- Right Use, Right Place
- Vibrant Growth
- Mucho Millennials

Brown Cloud
- Little Mode Shift
- Absent Political Will

Deverisco
- Vibrant Growth
- Mucho Millennials
- Absent Political Will

Analyze Blueprint Denver Strategies in light of scenarios
# Project Success Measures

<table>
<thead>
<tr>
<th>Project Type</th>
<th>Goal</th>
<th>Measures of Success</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vision Projects</td>
<td>• Create a shared vision through creating and comparing several scenarios</td>
<td>• Consensus on vision, implementation strategies, goals, indicators, etc…</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Quality of vision(?)</td>
</tr>
<tr>
<td>Decision Projects</td>
<td>• Make better decisions through creation of scenarios</td>
<td>• Plans which allow for better decisions (robust, contingent strategies)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Number, quality, analysis of strategies</td>
</tr>
<tr>
<td>Exploratory Projects</td>
<td>• Improve understanding of uncertainty and future trends</td>
<td>• Foresight</td>
</tr>
</tbody>
</table>
Many Cities Want More Sustainable Built Environments...

**Old Paradigm**
- Separated Land Uses
- Auto-Dependent
- Not Walkable
- Low Density
- Highly Polluted Runoff

**New Paradigm**
- Mixed Land Uses
- Less Driving; More Transit
- Walkable
- Higher Density
- Green Infrastructure
… Which Requires Creating and Comparing Many Options

**Old Paradigm**
- Separated Land Uses
- Auto-Dependent
- Not Walkable
- Low Density
- High Polluted Runoff

**New Paradigm**
- Mixed Land Uses
- Less Driving; Transit
- Walkable
- Higher Density
- Green Infrastructure
… Facilitated by New Scenario Planning Tools

Slide Source: Fregonese Associates (describes Envision Tomorrow Plus tool)

### Development Types

#### Quantitative Representation

**Building: Infill Residential**

<table>
<thead>
<tr>
<th>Lot Coverage (%)</th>
<th>68%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parking Coverage (%)</td>
<td>22%</td>
</tr>
<tr>
<td>Building Size</td>
<td>73,455 SF</td>
</tr>
<tr>
<td>Avg. Rent</td>
<td>$1,225/month</td>
</tr>
<tr>
<td>SF per use</td>
<td>70% residential, 20% retail</td>
</tr>
</tbody>
</table>

**Neighborhood: Mixed Use**

| Block Size | 400 ft |
| Lanes | 4 |
| Lane Width | 11 |
| Bike Lakes | Y |
| Sidewalk Width | 12 |
| % Cul-de-sacs | 0% |
| Intersection Density | \(127 \text{ / mi}^2\) |
| Street Miles / Acre | 0.12 |
| % Land for streets, civic, parks | 27% |

### Evaluation Indicators

- Population Density
- Housing Unit Mix
- Land Use Mix
- Developed Acres
- Energy Use
- Water Use
- CO2 Emissions
- Vehicle Mi. Traveled
- Mode Choice

### Assumptions & Empirical Studies

- Compact and walkable
- Streetfront retail
- Residential, office and service uses
- Community gathering places
- Mostly 2 - 3 floors
- One chip = 1 acre
- Jobs per chip = 32
- Households per chip = 24
Available Analysis “Apps”

Before Sketching

• Location Efficiency Tool: Facilitates a raster suitability analysis
• Redevelopment Candidate App: Estimates which properties are candidates for redevelopment through a financial analysis (requires improvement value, land value, building year built)
• Workforce Housing Model: Identifies areas with an imbalance between housing and jobs, and income and worker wages
• Balanced Housing Model: Analyzing housing supply and identify mismatches

After Sketching

• Green Infrastructure App: Estimates runoff reductions, energy savings, air pollutant reductions, CO2 reductions, open space
• Fiscal Impact Tool: Consider fiscal impacts of growth
• Health Assessment Model: Analyze health outcomes based on demographic and built environment characteristics
• Travel Behavior Tools: Regional, district-level, and site-level models
  – Implement “7D” Household travel analysis, based on extensive empirical research that shows travel activity can be explained by density, diversity of land uses, distance to transit, destination accessibility, urban design, development scale, and demographics.

More info & downloads: http://envisiontomorrow.org/
Discussion

Robert Goodspeed
rgoodspe@umich.edu
@RGoodspeed

April 2020