Overview of Scenario Approaches, Tools and Applications

AMPO 2015
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Scenario Types and Examples
Some Terminology

- Baseline Scenario = Trends, Probable
- End State Scenario = Normative, Prescriptive
- Exploratory Scenario = Contingent, Plausible
Two ways of Conceiving TLU Scenario-Building

1. End state planning: Testing the effects of TLU Alternatives vs. Trends on Selected Outcomes....in order to choose an optimal future TLU plan

2. Exploratory planning: Testing the effects of Multiple Trends on Many Outcomes including TLU....in order to adopt the most resilient strategies
### What Approach When?

<table>
<thead>
<tr>
<th>Policy Influence over the Future</th>
<th>Predictability of the Future</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>Exploratory</td>
<td>Exploratory/End State</td>
</tr>
<tr>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Baseline/Exploratory</td>
<td>Exploratory/End State</td>
</tr>
</tbody>
</table>

- **Exploratory** indicates a lower level of predictability or higher level of influence.
- **Baseline/Exploratory** indicates a higher level of predictability or lower level of influence.
- **Exploratory/End State** indicates a very low level of predictability or very high level of influence.
- **Exploratory/End State** indicates a very high level of predictability or very low level of influence.
**Basic End State Scenario Process with PSS**

- **Uncertainty**
  - Project Baseline Trends
  - Assess Impacts
  - Target Desired outcome
  - Execute Actions, Plans

<table>
<thead>
<tr>
<th>Methods</th>
<th>Tools</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extrapolation of trends, markets, public engagement, planning visions</td>
<td>INDEX, Place3S, CViz, ET+, UF,</td>
</tr>
<tr>
<td>Create/tweak indicators, algorithms</td>
<td>Charrettes, task forces, Delphi etc.</td>
</tr>
<tr>
<td>Public engagement, Planning visions</td>
<td>Capital, operating budgets, incentives etc.</td>
</tr>
<tr>
<td>Adopt Plans, ordinances etc.</td>
<td></td>
</tr>
</tbody>
</table>
The standard paradigm

“How Shall We Grow?” Approach

- Community engagement
- Leadership engagement
- Scenario modeling
The Standard Outcomes

Preferred Vision

2050 Trend

2050 Vision
# The Standard Metrics

## A More Sustainable Region

<table>
<thead>
<tr>
<th>Metric</th>
<th>Today</th>
<th>2050 Trend</th>
<th>2050 Vision</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population (millions)</td>
<td>3.5</td>
<td>7.1</td>
<td>7.1</td>
</tr>
<tr>
<td>Developed land (square miles)</td>
<td>2,618</td>
<td>5,195</td>
<td>3,278</td>
</tr>
<tr>
<td>Conserved land (square miles)</td>
<td>2,144</td>
<td>2,144</td>
<td>4,627</td>
</tr>
<tr>
<td>Average commute (minutes)</td>
<td>20</td>
<td>90</td>
<td>66</td>
</tr>
<tr>
<td>Water demand (billion gallons)</td>
<td>1.02</td>
<td>1.70</td>
<td>1.72</td>
</tr>
<tr>
<td>Air quality (mkg CO)</td>
<td>1.045</td>
<td>3.419</td>
<td>2.824</td>
</tr>
<tr>
<td>GDP ($ billion)</td>
<td>$118</td>
<td>$421</td>
<td>$513</td>
</tr>
</tbody>
</table>

Source: myregion.org
Best Practices in *Exploratory Scenario Planning*

<table>
<thead>
<tr>
<th><strong>Methods</strong></th>
<th><strong>Tools</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Analysis of Driving Forces, likelihood &amp; impact</td>
<td>STEEP framework</td>
</tr>
<tr>
<td>Literature, Experts, Stakeholders</td>
<td>None often; SHAPING TOMORROW, Factr, Sensemaker, Futurescaper, Co-tunity, SHARPCLOUD</td>
</tr>
<tr>
<td>Public engagement, Planning visions</td>
<td>Task forces, Delphi etc.</td>
</tr>
<tr>
<td>Revisit indicators, targets etc.</td>
<td>Revisit investments, incentives etc.</td>
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**Project Baseline Trends**

**Assess Impacts**

**Revise Policies, Actions**

**Monitor and Adjust**
Scenario Development For Freight – NCHRP Guidance

- NCHRP 20-83(1)
  - "Critical analysis of driving forces… may effect the US freight transportation system"

- Driving forces
  - Resource availability
  - Global trade
  - Energy cost (level, variability)
  - Energy sources
  - Environmental awareness
  - Population dispersion
  - Level of migration; policy
  - Currency fluctuations

http://ctl.mit.edu/research/futurefreightflows
Scenarios: Brochures, Videos
Process: Planner & facilitator guides, templates
Contingent Process: Analysis of Driving Forces (Trends and Factors)

Organize analysis of trends by Societal, Technological, Economic, Political, Environmental (STEPE)

Decide which are Givens vs. Indeterminate

Organize Indeterminates by Likelihood and Impact

Use highest likelihood and biggest impact Indeterminates and biggest impact Givens to structure the Driving Forces parts of the Scenarios
2. Strategy Development

<table>
<thead>
<tr>
<th>Key</th>
<th>Scenario A</th>
<th>Scenario B</th>
<th>Scenario C</th>
</tr>
</thead>
<tbody>
<tr>
<td>NR - No Regret</td>
<td>NR</td>
<td>NR</td>
<td></td>
</tr>
<tr>
<td>NB - No-Brainer</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NG - No-Gainer</td>
<td>NG</td>
<td>NG</td>
<td></td>
</tr>
<tr>
<td>C? - Contingent</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Use ***** delivery channel for ***** and ***** products
- Directly control the supply chain in ****** markets
- Utilize ********* for small and medium markets
- Purchase ********* in small and medium markets
- Purchase a ***** with ***** capabilities
- Directly control ***** in selective markets
- Discontinue use of ***** for product *****
- Utilize ***** for the large number of ***** items
- Utilize ***** network including *****
- Utilize ***** processes/tools
- Promote ***** distribution network to *****
Testing Investments

Investments evaluated

- I-5 North/South Highway
- I-15 North/South Highway
- I-80 East/West Highway
- ...
- Rail Connector Los Angeles to Barstow
- North/South Rail
- Northwest/Southeast Rail
- ...
- Sea Ports
- Port to Rail Connections
- Port to Road Connections
- Southern California Airports

Investment decision, confidence

- Yes
  - Certain (100%)
  - Almost totally certain (90-100%)
  - Very likely (80-90%)
  - Likely (70-80%)
  - Fairly likely (60-70%)
  - Slightly likely (50-60%)
  - As likely as is unlikely (50-50 chance)

- No
• Monitor environment to notice shifts and respond sooner
• Active research area
• Two generic ways
  • Sensemaking using scenarios
  • Predetermined sensors-in-the-ground
• Example: Sensemaking using FFF scenarios

News: USA Today reports that in 2010, General Motors sold more cars and trucks in China (2.35 million) than it did in the U.S (2.22 million)...
Best Practices in Exploratory and End State Scenario Planning – Middleweight PSS Tools

<table>
<thead>
<tr>
<th>Methods</th>
<th>Tools</th>
<th>Revisit indicators, targets etc.</th>
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<tbody>
<tr>
<td>Inputs on regional context, community design, marketing and incentives, vehicles and fuels, pricing</td>
<td>RSPM, CViz, Future Builder online tool, Allocation wizard</td>
<td></td>
</tr>
<tr>
<td>Outputs on Mobility, Land use, Economy, Equity, Environment Stakeholder workshops, Telephone survey, Targeted equity outreach</td>
<td>Revisit investments, incentives etc.</td>
<td></td>
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1. Analyze Context
2. Build Scenarios
3. Project Baseline Trends
   3A. Create Other Alts
   3B. Target Desired outcome
4. Assess Impacts
5. Revise Policies, Actions
   5A. Execute Actions, Plans
6. Monitor and Adjust

Middleweight PSS Tools:
- RSPM
- CViz
- Future Builder online tool
- Allocation wizard
Regional Strategic Planning Model

**Inputs**
- Regional Context
- Community Design
- Marketing & Incentives
- Fleet & Technology
- Pricing

**Outputs**
- Mobility
  - Vehicle miles traveled
- Land Use
  - Mixed Use
  - Housing Type
- Economy
  - Travel delay
- Equity
  - Household travel costs
- Environment
  - Air Quality
  - Greenhouse gas emissions

1. Create MPO Households
2. Estimate Daily VMT
3. Add Vehicles & Estimate Greenhouse Gas Emissions

Re-calculate to balance VMT & travel costs
Best Practices in Exploratory Scenario and End State Planning – Heavyweight PSS Tools

**Methods**
Inputs into the transportation, urban development, land cover change, climate, hydrology, air quality, fish models etc.

Watershed resilience metrics
Technical committees
Stakeholder workshops

Revisit indicators, targets etc

**Tools**
STEEP framework
UrbanSim, TDM, SILO, WRF, LCCM, MEM, BEM etc. etc.

Delphi etc.

Rerun model suite

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1. **Analyze Context**
2. **Build Scenarios**
3A. **Project Baseline Trends**
3B. **Create Other Alts**
4. **Assess Impacts**
5A. **Revise Policies, Actions**
5B. **Target Desired outcome**
6. **Execute Actions, Plans**
7. **Monitor and Adjust**

---

**Project Baseline Trends**
Heavyweight PSS Tools

**Create Other Alts**

**Assess Impacts**

**Revise Policies, Actions**

**Target Desired outcome**

**Execute Actions, Plans**

**Monitor and Adjust**

---

**Watershed resilience metrics**

**Technical committees**

**Stakeholder workshops**

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**UrbanSim, TDM, SILO, WRF, LCCM, MEM, BEM etc. etc.**

**Delphi etc.**

**Rerun model suite**
Puget Sound – Scenario Structure

- Climate change
  - Minor
- Economic growth
  - Slow & steady
- Boom & bust
  - Major
Puget Sound Indicator Rollups

- Climate Change
- Habitat
- Biodiversity
- Estuaries
- Human Health

Axes:
- Climate Change
- Economic Growth
- Boom & Bust
- Slow & Steady

Categories:
- Minor
- Major
How the Models Interact
When to Use which Tools
When to use which scenario approach?

- **Pace of Growth**
  - Slow
  - Fast

- **Economic Stability**
  - Stable
  - Volatile

- **Pop. Makeup**
  - Homogeneous
  - Heterogeneous

- **Consensus on Problems**
  - Strong
  - None

- **Urbanization**
  - Urban
  - Undeveloped

- **Time Horizon**
  - 5 years
  - 30 years

Colors:
- Green: Baseline, Probable
- Red: End state, Normative
- Blue: Exploratory, Contingent
<table>
<thead>
<tr>
<th>Span of the Seven Process Steps</th>
<th>Ease of Use</th>
<th>Resources to Develop and Apply Tools</th>
</tr>
</thead>
<tbody>
<tr>
<td>Few</td>
<td>Simple</td>
<td>Simple sketch tools 1-2 years</td>
</tr>
<tr>
<td></td>
<td>Complex</td>
<td>Complex models 3-5 years</td>
</tr>
<tr>
<td>Many</td>
<td>Simple</td>
<td>Middleweight models 2-3 years</td>
</tr>
<tr>
<td></td>
<td>Complex</td>
<td>Integrated heavyweight modeling suites 5-10 years</td>
</tr>
</tbody>
</table>
Attributes of Some Familiar Models & Tools

Ease of Use

Simple

Few

IND
ET
UF

Complex

Many

CV

RS
PM

Span of the Seven Process Steps

Few

Many

PRE STO
SEAT TLE

MEP LAN
TRANUS
PEC IAS
URB SIM
Overview of Approaches, Tools and Applications

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