

Advancement of Performance-Based Scenario Planning for Regional Planning and Decision-Making

A Synthesis Report

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16. Abstract This report synthesizes key content and outcomes identified as the result of a two-day scenario planning convening held in January 2016; interviews with regional planning organizations held in December 2015; and subsequent research. This document explores how regional planning organizations utilize scenario planning in their work, what tools they are using, and how scenario planning can become more widespread by considering barriers to use and entry of current processes and tools.			
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Executive Summary

For decades, scenario planning has improved how decisions are made about land use, infrastructure and transportation systems, planning and development policies, and more. From its origins as an approach to urban planning decision-making in the 1980s and a corporate and military planning process before that, the field of scenario planning has grown to include dozens of tools and hundreds of specific models and applications. While many planning organizations use scenario planning in some part of their regular operations, the rate and extent of its adoption could be faster and wider, particularly given its documented advantages.

In May 2016, the Federal Highway Administration (FHWA) and Federal Transit Administration (FTA) finalized a new rule, *Statewide and Nonmetropolitan Transportation Planning; Metropolitan Transportation Planning*,¹ which mandates changes to how state departments of transportation and metropolitan planning organizations (MPOs) perform transportation planning, programming, oversight, and environmental review. This rule updates federal regulations to reflect changes contained in the *Moving Ahead for Progress in the 21st Century Act (MAP-21)*² and the *Fixing America's Surface Transportation (FAST) Act*,³ making them consistent with other statutory requirements. A key feature of these new regulations is a framework for the voluntary use of scenario planning by MPOs in the development of metropolitan transportation plans.⁴

To increase the rate of adoption – and capacity for use – of scenario planning across the United States, the FHWA sought to investigate how regional planning organizations (a general term used throughout this document, which includes metropolitan planning organizations (MPOs), regional planning commissions, councils of governments, and other similar regional entities) use scenario planning processes and tools, what encourages them to adopt scenario planning or increase its use, and how barriers to entry might be reduced to encourage more widespread use of scenario planning. A combination of research, interviews with practitioners, and a convening were used to produce this report. This effort explores the state of the practice regarding regional scenario planning and considers a range of possible improvements, from new technologies and tools to funding, policy, and collaboration strategies.

In December 2015, 24 regional planning agencies were interviewed to understand how they use scenario planning in their decision making, the challenges the current set of scenario planning tools present, and how adoption of scenario planning can be increased. Regional planning organizations are an important set of users of scenario planning, so understanding the opportunities and impediments among these organizations is an important first step that should prove helpful to the regional planning organizations themselves, as well as federal agencies, scenario planning tool developers, and others. A key ingredient of scenario planning is the process and how it supports the practice of planning. The interviews summarized in this report illustrate how various tools (not all of them specifically designed for scenario planning) can help support the planning process and ultimately improve decision making. Further innovations in development and deployment of new tools and techniques were also considered. In January 2016, a dozen of these regional planning organizations, in addition to federal partners and academic experts in scenario planning, met in Washington, D.C. to discuss the findings of the interviews and develop an action plan for collaboration. Since then, parallel activities have helped inform the conclusions of this document, which provides recommendations how NARC, FHWA, and scenario planning practitioners can improve the quality of scenario planning processes and what tools can be used to support scenario planning. Together, these efforts can help bolster the ability of regional planning organizations and local jurisdictions to incorporate scenario planning approaches and techniques into more effective decision-making. This document outlines opportunities to reduce the demands on organizations currently using scenario planning or increase the use of scenario planning, in particular at the regional level.

¹ 23 C.F.R. 450.324 (2016).

² MAP-21, Pub. L. 112-241, 126 Stat. 405 (2012).

³ FAST Act, Pub. L. 114-94.

⁴ 23 C.F.R. 450.324 (2016).

Relevant findings:

- Four platforms are most commonly used by agencies for GIS-based scenario planning, three of which fall under the category of sketch planning tools (CommunityViz, Envision Tomorrow, and Urban Footprint) and a fourth which is seen as a predictive econometric model looking at land use and transportation, UrbanSim.⁵
- Adoption of scenario planning follows a typical “diffusion of innovation” curve: a few agencies are leading the way and conducting robust processes; many are exploring or lightly using scenario planning; and a few have yet to try or even consider scenario planning.
- A limited number of the regional agencies using GIS-based scenario planning tools could be considered “Power Users,” with in-house expertise applied to a range of issues. Most agencies have very limited capacity for scenario planning tools, and rely heavily on assistance from consultants or other agencies.
- Users report a high level of frustration with the cost of setup, maintenance, and use of scenario planning tools; and the lack of commonality in the modeling methodologies, utilization of data (inputs and outputs), and processes in applying these tools to decision-making.

Key Conclusion

When considering the state of practice of scenario planning, several important issues arise: improving usability of scenario planning tools for current users, reducing the barriers to entry to encourage new users, and doing these while considering the broad range of needs and varying capacity of users. Taking these factors into account, one primary conclusion has emerged that would have the greatest impact:

The formation of a consortium of planning organizations and other stakeholders, hosted by an outside, independent entity, to promote innovation and collaboration among users and generally advance the field of scenario planning.

A consortium would offer a flexible vehicle for collaboration; support activities to address challenges faced by organizations currently using these tools; and help reduce the barriers to entry to attract new organizations to scenario planning. As envisioned, a consortium could welcome as members an array of scenario planning users, tool developers, funders, elected officials, and institutions that support scenario planning. Members themselves would direct the consortium’s work. Various options exist to operate and support a consortium of this type. Possible financial support for this effort could come from philanthropic organizations, federal grant sources, and a dues structure, or some combination thereof.

Based on the interviews and discussions conducted for this project, the consortium could consider the following activities:

- Working groups for peer exchange and collaboration
- Research on tool needs and gaps
- Collaboration on tool improvements
- Sharing of best practices, examples, and techniques
- Development of educational and marketing resources
- Advocacy for funding and policy incentives
- Technical assistance provided by consortium members to those implementing scenario planning

Similar efforts currently exist (VisionEval, General Transit Feed Specification/GTFS, Scenario Planning Applications Network/SPAN), but a more comprehensive effort is envisioned across various levels of government and including an array of scenario planning tools. It is in the collective interest of users, developers, and communities to accelerate adoption of scenario planning. Doing so will enhance current efforts, speed improvement of existing tools (and possibly spur creation of new tools), increase political support for scenario planning, and better help regions (and others) address our rapidly changing world.

⁵ Nothing in this document implies an endorsement by the U.S. Department of Transportation, Federal Highway Administration, the papers authors, or any regional planning organization of any of the scenario planning tools discussed herein.

Overview: Scenario Planning Tools & Techniques

Though it has a long history in military and corporate planning and decision-making, variations of scenario planning as it applies to transportation planning has been in use for nearly three decades. Early applications, however, mainly focused on testing different land use alternatives rather than an iterative process of scenario development and analysis. And though its benefits are well known and clearly documented, scenario planning has not been adopted on a broad scale among the nation's planning agencies. Recognizing the important role scenario planning can play in the planning process – in particular to implement requirements related to performance based planning and programming – Congress created a framework for the voluntary use of scenario planning by MPOs in the development of metropolitan transportation plans in the *Moving Ahead for Progress in the 21st Century Act* (MAP-21)⁶ transportation authorizing legislation. Recent changes to federal regulations now reflect these changes.⁷

Though Congress did not mandate the use of scenario planning, the explicit inclusion of this approach to planning creates an opportunity to increase its use. This will be further facilitated by exploring ways to overcome the reluctance or resistance of some organizations to incorporate scenario planning in the planning process. Scenario planning tools are often costly and time-consuming to implement; new tools are constantly under development, raising fears that something better will be released in the future; quality data can be difficult and expensive to obtain; and leaders and decision-makers do not always understand the benefits or uses of scenario planning tools incorporated into planning and decision-making processes.

Given both the significant benefits of scenario planning tools and approaches and the barriers to their adoption, practitioners and tool developers are interested in increasing usability and encouraging more widespread adoption by reducing barriers to entry. Conversations among current users have focused on resource pooling or other forms of collaboration to improve outcomes, but additional work in this area would help target resources more effectively and generally advance the field as a whole.

This paper predominantly focuses on performance-based scenario planning tools integrated with scenario planning processes. There is periodic mention of qualitative approaches to scenario planning (Exploratory Scenario Planning), which can provide an affordable mechanism for communities to think about alternative futures and how to deal with uncertainties. Overall, this paper seeks to understand the state of the field, identify barriers and limitations, and develop strategies to improve the quality and quantity of scenario planning work nationwide.

Defining Scenario Planning

A variety of definitions exist to explain what is meant by scenario planning. One definition applicable to regional planning describes scenario planning as the “process of long-term strategic planning that involves the development and use of future scenarios of the problem or system at hand. A scenario is simply a vision of a possible future state of the world and the relevant environment. Scenarios are methodically constructed stories about alternative futures in which today's decisions might play out. A good scenario must be plausible, internally consistent, and challenging for strategic purposes. It should make the decision makers see the future in new ways and question their unspoken assumptions. A scenario planning engagement should involve the use of multiple, mutually exclusive scenarios.”⁸

Performance-based scenario planning approaches involve at least two components:

- A number of distinct scenarios that portray ways the future could unfold in the region, which typically include both narratives and data, and often include a series of approaches that range from no action or “business as usual” to far-reaching changes⁹
- A set of indicators that can be tracked across scenarios to compare the tradeoffs of each scenario and measure performance over time

⁶ MAP-21, Pub. L. 112-241, 126 Stat. 405 (2012).

⁷ 23 C.F.R. 450.324 (2016).

⁸ Caplice, Chris and Shardul Phadnis. 2013. *Strategic Issues Facing Transportation, Volume 1: Scenario Planning for Freight Transportation Infrastructure Investment*. National Academy of Sciences: Transportation Research Board.

⁹ Holway, J., C.J. Gabbe, F. Hebbert, J. Lally, R. Matthews, and R. Quay. 2012. *Opening Access to Scenario Planning Tools*. Policy Focus Report. Cambridge, MA: Lincoln Institute of Land Policy.

Producing these components requires the following:

- Data on current conditions or future conditions
- Assumptions about future trends and changes
- Tools, algorithms or analysis methods that, when applied to data and assumptions, result in predicted future conditions for each scenario
- A process that leads to the creation of scenarios and mechanisms to evaluate different scenarios relative to desired outcomes and opportunities

In addition, performance-based scenario planning tools linked to regional planning generally includes a series of engagement strategies that involve stakeholders in the development and evaluation of scenarios; visualization techniques that allow people to compare scenarios through maps, charts, and projections; and the integration of core issues, showing how changes to one variable impact other variables and goals. Desired outcomes can vary among agencies and regions deploying scenario planning tools and practices, but commonly look to gain political and stakeholder support behind planning and development decisions, which maximize identified and prioritized social, economic, and environmental benefits for the community. In addition, exploratory scenario planning techniques can be used to prepare for uncertainty and improve community resiliency.

Types of Scenario Planning and Tools

Scenario planning tools vary widely, from sophisticated and high-tech digital models to low-tech discussion and critical thinking processes. Some tools attempt to “do it all,” offering a wide range of functionality and applicability; others are specialized to meet narrow needs and combine with other tools. The tools evaluated for this effort were primarily computer-based, require inputs of data and assumptions, and result in outputs demonstrating impacts and likely future conditions. The tools examined offered one or more of the following features:

- Indicator development, analysis and modeling
- Visualization (3-D or 2-D) of scenarios or options
- Real-time adjustments to scenarios based on user inputs
- Modeling of fiscal, environmental, demographic, housing, health, or other variables
- Allow comparisons of alternative futures or proposals
- Modeling and scenario development integrating disciplines (land use, transportation, climate, etc.)

Benefits of Scenario Planning

Scenario planning has been widely studied, and its benefits are well documented in white papers and peer-reviewed literature, and by users and proponents. Benefits are less understood by public officials, the public, or by planners and agencies that do not use scenario planning. A quick literature review, including FHWA’s guide, *Supporting Performance-Based Planning and Programming through Scenario Planning* (2016),¹⁰ provides examples of the benefits of scenario planning. Scenario planning helps regions and jurisdictions:

- Predict and analyze future conditions, and understand how policies or decisions impact them
- Understand the consequences of decisions on a wide range of social, economic, demographic, environmental, and land use conditions
- Compare alternative paths and understand the tradeoffs and likely impacts of possible choices
- Make it easier to visually understand the impacts of decisions and choices
- Connect specific policies and choices with large visions or goals for the future
- Involve the public in dynamic planning processes and communicating with them about choices

FHWA summarizes the benefits of scenario planning: “In short, scenario planning can formalize the consideration of uncertainty in the planning process.”¹¹

¹⁰ Federal Highway Administration. 2016. *Supporting Performance-Based Planning and Programming through Scenario Planning*.

¹¹ Zmud, J. 2014. *Applying Scenario Methods to Transportation Planning and Policy*. [webinar] Retrieved from Transportation Research Board website, <http://onlinepubs.trb.org/onlinepubs/webinars/141023.pdf>

State of Scenario Planning

Through literature reviews and interviews, the state of the practice of scenario planning – in particular its use by regional planning organizations – was analyzed to determine how widely it is used, how it is used, how well it is working, and what can be improved. This research consisted of three primary steps: 1) review of current literature; 2) in-depth interviews with selected scenario planning practitioners; and 3) recommendations and discussion of improvements to encourage more widespread use.

In the process of pursuing these steps, the following questions were considered:

- How broadly is scenario planning being adopted nationally? Is adoption reaching a tipping point?
- What are the barriers to entry for using scenario planning tools? How might these barriers be overcome?
- What tools are regional planning organizations (both high- and low- capacity) currently using for GIS modeling and scenario planning? What are primary similarities and differences?
- How can we make tools more usable, while maintaining credibility, rigor, and sophistication?
- What data are required? How are agencies acquiring and managing data?
- What steps could increase interoperability and consistency among tools and data?
- What kind of training and peer-to-peer support could encourage adoption of scenario planning?
- Has scenario planning added value to planning processes? How and under what conditions?

Adoption of Scenario Planning by Regional Planning Agencies

In December 2015, directors and staff from 24 regional planning organizations were interviewed. Organizations were chosen to cover a spectrum from large, high-capacity organizations to small, limited-capacity organizations. Within each organization, interviewees self-selected based on their leadership, knowledge, and interest in scenario planning. Interviews averaged 45 minutes and covered a standard but flexible framework of questions (see Appendix E for a list of questions asked during the interviews).

The organizations and staff members were diverse in many regards:

- Organization size ranged from three staff members to well over 100
- Jurisdictions covered a spectrum from rural regions in single counties with tens of thousands of residents to highly populated urban regions covering hundreds of cities, multiple counties, and many millions of residents (and cars)
- Organizational experience of interviewees ranged from none to almost two decades
- Most organizations interviewed have authority for – and a focus on – transportation; many also integrate their work with issues of land use, health, economy, sustainability, and equity and some have primary focuses in other areas like land use or economic development

Overall, the agencies and organizations interviewed fell naturally into a set of categories regarding their level of expertise and capacity for scenario planning. These categories roughly match the traditional “diffusion of innovations” pattern.¹²

- A small number of organizations are more advanced - they adopted scenario planning early, built significant capacity over time, and are using it in robust and sophisticated ways.
- The majority of organizations adopted scenario planning more recently or are just beginning to explore its use, may have limited in-house expertise or capacity, and are using scenario planning in limited ways.
- Another small subset of organizations has yet to adopt or even seriously consider scenario planning in any way. There is a rough correlation between adoption of scenario planning and agency size and capacity, with notable outliers.

¹² Rogers, E. M. 2003. *Diffusion of Innovations*. New York: Free Press.

State and Regional Policies

Across the United States, political pressure and incentives to use scenario planning vary widely among states and have a significant impact on its adoption. States or regions with policies and statutes driving strong regional and local planning - or encouraging scenario planning itself - seem to be driving its adoption. Conversely, a lack of state or regional policies or political will hinders its adoption.

Table 1. Examples of state and regional policies and their affects.

Ohio	Washington	Oregon
<ul style="list-style-type: none"> No statutory mandate that jurisdictions maintain comprehensive plans Locating up-to-date zoning and land use data is complicated, making it even more challenging for organizations to adopt scenario planning 	<ul style="list-style-type: none"> Municipal jurisdictions must align their work with regional planning efforts Stronger impetus to develop regional plans with buy-in from local jurisdictions, and to provide clear planning direction, which leads more regional planning organizations to use scenario planning tools 	<ul style="list-style-type: none"> Jurisdictions are required to demonstrate how future planning will meet mandated greenhouse gas reductions and use scenario planning for regional efforts These statutory forces encourage and enable the adoption of scenario planning, even by small MPOs.

Practitioners in states without strong statutory mandates for regional planning noted an increased demand for scenario planning when they used indicators that show interconnections between transportation, land use, and economic impacts. Even larger organizations that use scenario planning expressed uncertainty regarding the continued use of the tools when regional or state mandates were lacking. A key factor to sustaining scenario planning tools is establishing the regional economic benefit of using these tools. However, many of these organizations did not have adequate resources to acquire the data needed to substantiate the economic impacts of planning choices in the short and long term.

Adoption Profiles

The organizations interviewed can be loosely grouped based on their current use of scenario planning tools, their needs and barriers, and opportunities for assistance. While exceptions and variations exist within these categories, generalized profiles illuminate trends which can be used to increase scenario planning use. Organizations within the identified categories require resources and assistance - not just the highest-capacity agencies that are already successfully using scenario planning. For simplicity sake, diverse types of users - and their diverse needs – are summarized into three categories as outlined below and shown in Table 2 and Figure 1.

“Creators & Power Users” play a particularly important role in advancing scenario planning. They actively incorporate scenario planning into regional decision-making and tackle some of the tougher challenges regarding data collection and model interoperability. They incorporate a variety of issues, such as land use, transportation, economic development, and resource management. They frequently present at planning and transportation conferences and are featured in case studies. A key characteristic of this group is a commitment to data-supported decision-making, which requires staff (anywhere from 3-12 people) dedicated to GIS and data analysis. They likewise have significant resources dedicated to data acquisition, cleanup, and maintenance, and scenario planning applications. Most of the “Creators & Power Users” represent larger metropolitan areas, but several smaller agencies have advanced the scenario planning practice despite funding and staffing constraints. This group uses a diverse set of custom and off-the-shelf tools, often combining and adding tools specifically to meet their needs. Urban Footprint and Envision Tomorrow+ are commonly used tools among this group, which also includes some longtime users of CommunityViz.

Many of these organizations are on their second or third deployment of a new scenario planning tool, and each notes that implementing a new tool is a large effort that strains organizational resources. Sometimes a change is necessary, however, to better address a specific planning issue(s) that a current

tool may lack. These organizations have often found additional and more comprehensive uses for tools, including evaluating short-term planning impacts on long-term goals. Even these often higher-resourced organizations express interest in available tools that have a desired functionality but that are currently too expensive to purchase or use.

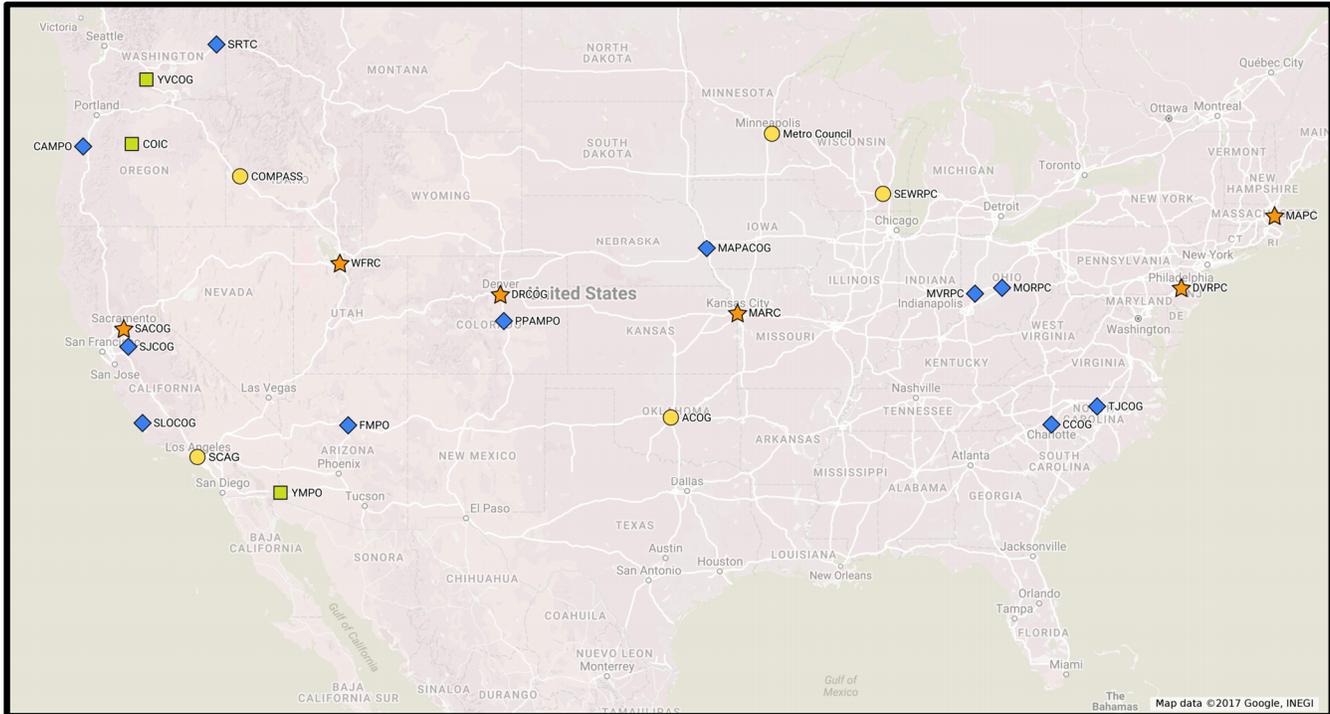
“Intermediate Users” also play a critical role in the adoption of scenario planning tools among regional planning organizations. Peer agencies look to this group for options when in-house capacity is limited and data gaps exist. For “Intermediate Users,” third-party support from the developer of their chosen tool

or from consultants is more commonplace and often essential to launching scenario planning efforts. CommunityViz is one of the more popular choices among “Intermediate Users” and those just starting with scenario planning, and Urban Footprint, Envision Tomorrow+, and Citilabs’ suite of Cube6 applications are also of interest.

Agency Category	Scenario Planning Needs
Creators & Power Users	<ul style="list-style-type: none"> • Tool improvements and tool integration • New ideas and examples • Peer support and exchange • Open source development
Intermediate Users	<ul style="list-style-type: none"> • Tool modularization and interoperability • Peer support and training • Best practices and examples • Partner agencies or support
Beginners & Watchers	<ul style="list-style-type: none"> • Evidence of benefits • Policy and financial incentives • Regional support • Simple and effective tools • Qualitative approaches • Best practices and examples
<p>Table 2. User categories and scenario planning needs distilled from interviews with diverse agencies and users.</p>	

“Beginners & Watchers” are not actively using scenario planning. This includes smaller agencies which have expressed interest in scenario planning and how it could benefit their region. Most did not show a strong understanding of the process or tools and expressed a need for additional training and assistance. Others had some understanding and interest, but lacked funding, time, or other resources.

Figure 1. Map of agencies interviewed.



★ CREATORS

- Metropolitan Area Planning Council - Boston, MA (MAPC)
- Delaware Valley Regional Planning Commission - Philadelphia, PA (DVRPC)
- Mid-America Regional Council - Kansas City, MO (MARC)
- Denver Regional Council of Governments - Denver, CO (DRCOG)
- Sacramento Area Council of Governments - Sacramento, CA (SACOG)
- Wasatch Front Regional Council - Salt Lake City, UT (WFRC)

● POWER USERS

- Association of Central Oklahoma Governments - Oklahoma City, OK (ACOG)
- Community Planning Association of Southwest Idaho - Boise, ID (COMPASS)
- Metropolitan Council - St. Paul, MN (Metro Council)
- Southeastern Wisconsin Regional Planning Commission - Milwaukee, WI (SEWRPC)
- Southern California Association of Governments - Los Angeles, CA (SCAG)

◆ INTERMEDIATE USERS

- Centralina Council of Governments - Charlotte, NC (CCOG)
- Corvallis Area Metropolitan Planning Organization - Corvallis, OR (CAMPO)
- Flagstaff Metropolitan Planning Organization - Flagstaff, AZ (FMPO)
- Miami Valley Regional Planning Commission - Dayton, OH (MVRPC)
- Mid-Ohio Regional Planning Commission - Columbus, OH (MORPC)
- Omaha-Council Bluffs Metropolitan Area Planning Agency - Omaha, NE (MAPA)
- San Joaquin Council of Governments - Stockton, CA (SJCOG)
- San Luis Obispo Council of Governments - San Luis Obispo, CA (SLOCOG)
- Spokane Regional Transportation Council - Spokane, WA (SRTC)
- Triangle J Council of Governments - Raleigh-Durham, NC (TJCOG)

■ BEGINNERS, WATCHERS

- Central Oregon Intergovernmental Council - Bend, OR (COIC)
- Yakima Valley Conference of Governments - Yakima, WA (YVCOG)
- Yuma Metropolitan Planning Organization - Yuma, AZ (YMPO)

Table 3. Range of capacities of agencies interviewed.

Example Agencies	Scenario Planning Work	Barriers to Advancement	Strategies for Advancement
CREATORS			
MAPC DVRPC MARC DRCOG SACOG WFRC (see Figure 1 for full agency names)	Agencies that are leading and advancing the field of scenario planning. They: <ul style="list-style-type: none"> • Infuse scenario planning into most of their work • Innovate in the application of scenario planning • Have significant in-house capacity to run GIS-based scenario planning tools to support regional planning and decision making • Create, set up, and customize their own tools • Have significant political support and resources to use scenario planning 	<ul style="list-style-type: none"> • Funding • Staff time • Data sources or quality • Limited collaborators • Planning timelines 	<ul style="list-style-type: none"> • Peer support and exchange • Open source development • Incentives (funding or policy) • Tool and data integration • Increased market for fee-for-service work
POWER USERS			
ACOG COMPASS Metro Council SEWRPC SCAG	Agencies that use scenario planning regularly, often robustly. They: <ul style="list-style-type: none"> • Use scenario planning extensively and regularly in their work • Experiment with new applications of scenario planning • Have sufficient in-house capacity to run scenario planning processes and tools • Customize and set-up scenario planning tools in-house or with consultant assistance • Have sufficient political support and resources to use scenario planning 	<ul style="list-style-type: none"> • Technical knowledge • Applications and examples • Funding • Staff time • Data sources or quality • Planning timelines 	<ul style="list-style-type: none"> • Peer support and exchange • Open source development • Incentives (funding or policy) • Tool and platform quality and function • Tool and data integration • Increased market for fee-for-service work
INTERMEDIATE USERS			
CCOG CAMPO FMPO MVRPC MORPC MAPA SJCOG SLOCOG SRTC TJCOG	Agencies that use scenario planning in standard ways for some projects. They: <ul style="list-style-type: none"> • Use scenario planning for specific plans or analyses • Use scenario planning in standard or tested ways • Have limited in-house capacity to run scenario planning processes and tools, and rely on partners or consultants for assistance and training • Use off-the-shelf tools and limited features or rely on others to set-up and customize • Have some political support and resources to use scenario planning 	<ul style="list-style-type: none"> • Technical knowledge • Applications and examples • Funding • Staff capacity and skills • Staff time • Data sources or quality • Planning timelines • Partners and consultants • Political will or support • Risk aversion 	<ul style="list-style-type: none"> • Partner agencies or regional hubs • Peer support and exchange • Training and capacity building • Incentives (funding or policy) • Simple and cheap introductory tools • Tool and platform quality and function • Tool and data integration

Table 3. Range of capacities of agencies interviewed (cont.).

Example Agencies	Scenario Planning Work	Barriers to Advancement	Strategies for Advancement
BEGINNING USERS			
COIC YVCOG YMPO	<p>Agencies starting to use scenario planning, or using it in isolated circumstances. They:</p> <ul style="list-style-type: none"> • Use scenario planning infrequently or for limited purposes • Have little or no in-house capacity to run scenario planning processes and tools • Rely on consultants, partners and tool providers to set up and offer tools • Have little political support or resources to obtain and use scenario planning tools in advanced ways 	<ul style="list-style-type: none"> • Applications and examples • Funding • Staff capacity and skills • Staff time • Data sources or quality • Planning timelines • Partners and consultants • Political will or support • Risk and investment to adopt 	<ul style="list-style-type: none"> • Partner agencies or regional hubs • Training and capacity building • Incentives (funding or policy) • Simple and cheap introductory tools and qualitative approaches • Tool and platform quality and function • Demonstrations and marketing
WATCHERS			
Metro Council COIC YVCOG YMPO	<p>Agencies considering or exploring the use of scenario planning and/or new tools and scenario planning techniques. They may have:</p> <ul style="list-style-type: none"> • Tried scenario planning tools or processes in isolated circumstances • Received demonstrations or information • Limited in-house capacity or insufficient data for scenario planning • Exploratory relationships with tool providers, partners or consultants • Little political support or resources to use scenario planning • Incomplete understanding of benefits and applications 	<ul style="list-style-type: none"> • Awareness and understanding • Funding • Staff capacity and skills • Staff time • Data sources or quality • Planning timelines • Partners and consultants • Political will or support • Risk and investment to adopt 	<ul style="list-style-type: none"> • Regional hubs or service providers • Incentives (funding or policy) • Simple and cheap introductory tools • Demonstrations and marketing
NON-USERS			
	<p>Agencies not considering or exploring scenario planning. They may have:</p> <ul style="list-style-type: none"> • Planning processes, mandates, or timelines incompatible with scenario planning • Tried scenario planning with limited success • Little in-house capacity or insufficient data for scenario planning • Political barriers to using scenario planning • Little to no understanding of scenario planning, benefits, and applications 	<ul style="list-style-type: none"> • Awareness and understanding • Funding • Staff capacity and skills • Staff time • Data sources or quality • Planning timelines • Partners and consultants • Political will or support • Risk and investment to adopt 	<ul style="list-style-type: none"> • Regional hubs or service providers • Incentives (funding or policy) • Simple and cheap introductory tools • Demonstrations and marketing

Scenario Planning Application and Uses

Based on the survey conducted for this project, scenario planning is used for a wide range of planning efforts and applications, including:

- **Transportation and land use.** The most common uses of scenario planning involve transportation and land-use scenarios. Most organizations using scenario planning run models that involve or integrate transportation and land use. The models also frequently integrate geographic, economic, financial, and demographic data.
- **Growth and build-out projections.** Another traditional use of scenario planning is to model growth and build-out projections, including demographic, housing, geographic, and land-use data. A number of organizations noted that their regions are either experiencing slow growth or are mostly built-out already, making these scenarios less useful than in regions with significant growth potential or rapidly changing demographics.
- **Future forecasting and global trends.** The most advanced scenario planning users are often looking far beyond current local or regional conditions and modeling future trends on the mega-regional, national, and even global scales. These organizations recognize that major forces including climate change, oil markets, and international trade will increasingly influence their jurisdictions. Scenario planning is an opportunity to strategically engage citizens in these major trends, understand their potential impacts, and prepare for uncertainty.
- **Air quality, energy, and emissions.** An increasing number of regions are working to meet specific emissions, energy efficiency, or air quality targets (e.g. California). Scenario planning is a critical approach for them to evaluate the impacts of land use, transportation, and other policy decisions on environmental and health targets.
- **Equity and quality of life.** None of the organizations that were interviewed are creating modeling tools specifically focused on equity or quality of life, but a growing number are incorporating indicators and scenarios to consider these issues. The HUD/EPA Sustainable Communities Initiative (SCI) program accelerated this trend. A lack of data around equity and quality of life requires most organizations to use surrogate datasets (such as access to housing or transportation), but the trend reflects a growing interest in these topics despite the challenges of projecting these indicators, even if current data exists.

In addition to topic-based applications, organizations also use scenario planning for different process-based purposes. These include:

- **Engagement.** Engaging stakeholder groups or the general public in making decisions about the future of their communities, or community leaders in identifying data and strategies to address challenges posed by scenarios.
- **Public education.** Helping the public understand the connections between topics like land use, transportation and sustainability, and to understand how policy decisions impact their lives.
- **Fiscal and economic impact and land-use modeling.** Analyzing extensive datasets to identify future trends in land-use and where there will likely be greater investments in infrastructure.
- **Measuring progress.** Establishing and tracking data-driven indicators or performance metrics for regional plans and visions, and investigating the impact of policy decisions on indicators, sometimes in the service of achieving established targets.

Organizations also use scenario planning for a variety of long- and short-term planning efforts. In long-range efforts, organizations use scenario planning for isolated topics (like transportation indicators) or for developing comprehensive regional scenarios and visions with many indicators, including health, economics, transportation, land-use, resiliency, environmental impacts and equity. Many organizations also have specific indicators and data relevant to their region or planning process, such as construction permit data, bike and pedestrian infrastructure, mode share, health data, and socioeconomic impact indicators. A few organizations with the greatest capacity are investigating global forces and trends, and considering their impact on local, regional, and even megaregional indicators.

Some organizations are also using scenario planning to understand how individual projects will impact communities and regions, incorporating the analysis capabilities of scenario planning tools into day-to-day decision making. Organizations often described these efforts as routine exercises to understand how infrastructure, transportation, environment, economy, housing and commercial demand, and health would be impacted by a given development. Other short-term efforts include identifying the impacts of proposed policies, conducting build-out analyses, or preparing transportation studies.

Most importantly, various types of scenario planning often overlap and are interwoven. Organizations frequently mix or combine tools and scenario planning processes to match their capacity and address the specific planning issues at hand.

Scenario Planning Tools

A number of scenario planning tools are currently available, with a diverse set of vendors and tool providers supporting them. Organizations that were interviewed referenced more than 25 distinct scenario planning tools and models that they have used or are currently using, including several custom-designed tools. Most organizations mentioned some degree of customization of models or inputs. A surprising number also bypassed the marketplace altogether, using tools that were developed in-house or by cooperating agencies, consultants, or partners.

Organizations typically acquire tools in one of the following three ways:

- **Off the shelf.** Some organizations purchased a scenario planning tool or license off the shelf, or hired a consultant to use a tool for scenario planning analyses. Among the organizations surveyed, the most commonly used tools were CommunityViz, Envision Tomorrow, Urban Footprint, and Criterion's Index.
- **Customized.** Some organizations started with an existing tool and heavily customized it for their own purposes, or used a customized version developed by a consultant or partner organization. Criterion's Index, RPAT, and Urban Footprint were most commonly customized tools.
- **Custom-Built.** The last method of acquisition - smaller in number – involved organizations that created their own tools. Custom-built tools were most often developed by consultants, very large agencies or those with long and sophisticated histories of using scenario planning tools. There are also cases where a state or major agency built a tool, and are making it available to smaller organizations. Examples include the Delaware Valley Regional Planning Commission's "Choices & Voices" tool, and a custom tool designed in Portland, Oregon.

Common Platforms and Tools

More than 25 distinct platforms are used by the interviewed organizations, with countless customizations and variations. Each has different strengths and applications, scopes and scales, requirements, and limitations.

The most commonly used platforms are: CommunityViz (City Explained (formerly Placeways)), Envision Tomorrow/Envision Tomorrow+ (Fregonese, via HUD Sustainable Communities Initiative in many cases), Urban Footprint (Calthorpe), RPAT, and custom-built tools. Many organizations also use a wide variety of transportation or travel, economic, land use, and other models - often integrated with scenario planning tools.

Tool Selection Factors

The 2011 FHWA Guidebook for scenario planning suggests that tool selection and the scenario planning process should be guided by considerations for applicability of the tool to address the planning issues at hand, the cost of the tool and return on investment, and the level of complexity needed in data and analysis to effectively address the planning issue.

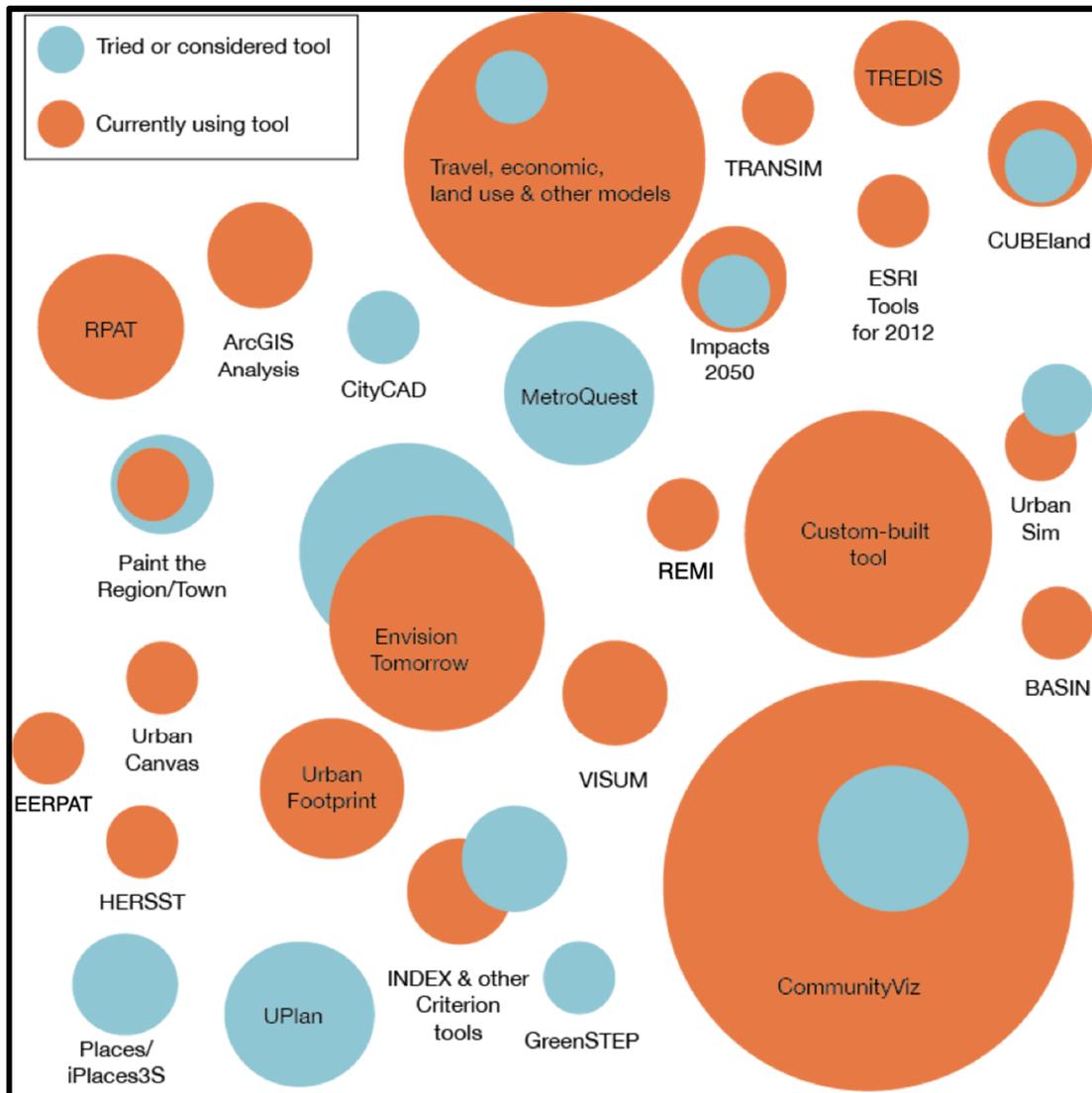
These considerations are still relevant to most organizations; applicability, cost, and complexity were identified as the most important factors. As a result of these factors and tool limitations, organizations often use a blend of several tools. This allows organizations to keep more work in-house by using

established and familiar GIS platforms. Outside tools, which are unfamiliar to staff, were used for the final modeling in many cases. In other cases organizations customized tools to solve a specific planning issue. For example, one organization rewrote a sustainability tool to conduct fiscal impact analysis, which was more compelling to local jurisdictions than understanding sustainability itself.

Several smaller organizations noted that scenario planning should be scalable to allow lower-capacity organizations to engage in scenario planning at decreased cost and lower level of complexity. Many organizations noted that they used only a limited number of the features in their tools, which could suggest a market for tools with customizable menus of options rather than complete packages.

Many organizations expressed frustration with the functionality of their current tools, or with the lack of a specific desired functionality in the available tools. Interviewees mentioned many functionalities they found lacking, ranging from public engagement features to the geographic scale of modeling. The organizations that developed their own tools often cited those functionality gaps as driving factors in their decision to create a new tool, though at least one organization cited a “DIY culture” as the primary reason to proceed on their own.

Figure 2. Diagram of common scenario planning tools.



Common scenario planning tools are represented by circles, proportional in size to the number of agencies interviewed that are currently using the tool or that have tried or considered it in the past. The most commonly used tools are CommunityViz; travel, economic, land use or other models; custom-built tools, and Envision Tomorrow (+).

Benefits of Scenario Planning

All agencies indicated that acquiring and using scenario planning tools adds value and are worthwhile investments, even if they experienced complications making the tools operational. Some agencies use scenario planning tools only episodically, such as for scenario development during a long-range planning process, or linked to a specific grant project like the HUD Sustainable Communities Initiative. The process and impact analysis involved in scenario planning helped build support and political will for new development policies, when combined with meaningful stakeholder engagement and policy work.

Several agencies offered powerful testimonials on the ways scenario planning tools increased their capacity to deal with interrelated issues. For example, modeling and analysis tools helped agencies integrate their thinking and decision-making for transportation and land use, fiscal analysis, and environmental (air quality and climate) regulatory requirements. In addition, some agencies clarified that the real power of scenario planning is in the process and how it can be used as an approach for making effective decisions under uncertainty (especially in areas where for either technical or political reasons, there is little consensus about what will happen, but a lot of hope and fear about possible consequences).

Incorporating scenario planning into how their organizations approach planning and stakeholder engagement can result in a paradigm shift in how they approach problems, stakeholder engagement, and decision-making. For GIS-based scenario planning tools, the act of setting up the data infrastructure required for scenario planning analysis and the development of a stakeholder engagement plan are two examples of how scenario planning tools and techniques have led to more informed and transparent decision-making beyond the scenario planning process itself. In essence, these changes have led to the democratization of planning and decision-making in communities.

Elements of Success

Within individual organizations, a number of key process elements have been identified that are important considerations when adopting and using scenario planning to effect change. Roberts (2014)¹³ noted a number of factors practitioners identified as essential to the scenario planning process:

- Support from leadership in terms of political will and funding
- Capacity to gather and manage necessary data and ensure clean, quality data sets
- Staff capacity in knowledge and time
- Funding for adequate public engagement to explain the process and facilitate adoption
- Strong leadership that is consistent throughout the process
- Stakeholders understanding of the process, goals, and technical tools

Interviews conducted for the current project confirmed these critical elements for a successful scenario planning process, but some emerged as more important than others and several other elements were also identified.

Regularity of Use

Some of the regional agencies interviewed have chosen to use scenario planning tools episodically, limiting their use to the development of a long range plan or tied to a grant like the HUD Sustainable Communities Initiative. This approach can have its advantages, potentially keeping costs down by waiting to acquire/upgrade tools until the next cycle of long range planning begins. At the same time, this occasional utilization of scenario planning tools can have the downside of needing to collect new data and reeducate staff and stakeholders with each effort.

Agencies using scenario planning on a more regular, recurrent basis benefit from building capacity for using their chosen tool, having an incentive for active data set maintenance, and applying tools to the monitoring and evaluation of projects. Large COGs/MPOs that build this long-term capacity are being asked to provide services for local governments both inside and outside their service area. There are also “hot spots” of use - organizations that are robustly utilizing and developing scenario planning tools for

¹³ Roberts, E. J. 2014. *Exploratory Scenario Planning: Lessons Learned in the Field*. Working Paper. Cambridge, MA: Lincoln Institute of Land Policy.

projects, data management, and informed decision-making are often grouped together geographically, benefiting from regional policies and collaboration.

Data

Many organizations mentioned data as a key ingredient, or conversely a barrier to scenario planning. The availability of data varies widely from organization to organization. Many interviewees noted that local data is not well maintained and data across jurisdictions is often incompatible. Additionally, the cost of acquiring, cleaning, and maintaining data can be burdensome. Once an initial set of data has achieved acceptable standards to run scenario planning, organizations report that the effort around data for future scenario planning efforts is not reduced based on this initial work. For many organizations that do not have the capacity to consistently maintain datasets for scenario planning between large updates. Each effort then requires the same amount of work for data acquisition and cleaning. Organizations that use scenario planning on a more consistent basis reported that they maintain their data sets for pro forma analysis uses, but that this is a large burden on organizational time and staff.

Organizations that are able to tap into shared datasets, or that have created shared datasets for their region, tended to report that the data collection and maintenance burdens were reduced. While organizations were interested in data sharing and many have data sharing programs, no established program was identified that provides data at a cost to local jurisdictions or provides scenario planning services.

Flexible Approach

Quay (2010)¹⁴ notes that incremental and modular efforts for scenario planning contribute to success. Given the uncertainty that is inherent to future scenarios an incremental approach to scenario planning can minimize the resources needed and reduce the investment into a single future scenario. Quay also recommends that organizations create flexible adaptation strategies that can be implemented as needed over time to address several possible scenarios.

Training and Assistance

Most organizations using scenario planning have benefitted from some form of assistance to start or expand their programs - financial, technical, or educational. The Sustainable Communities Initiative (SCI) – a former U.S. Housing and Urban Development (HUD) program – was particularly helpful for numerous agencies to start or expand their scenario planning work. HUD supported a capacity building team to help grantees work through technical issues and help them integrate GIS tools into regional planning.

- **Financial assistance.** Many organizations relied upon grants, such as HUD's SCI, or other financial incentives to start their scenario planning programs, purchase tools or licenses, and train or hire staff or consultants. Others noted applying for grants and dropping plans for scenario planning when grants did not come through or ran out.
- **Tool and platform assistance.** A number of organizations did not have the expertise or resources to choose, set up, and begin using scenario planning on their own, but were able to begin using it with the help of partner or peer agencies. Higher capacity agencies may develop tools or datasets that they then share with smaller agencies in the same region. That model has numerous benefits, including reducing the capacity burden on smaller agencies, reducing the risk in trying new tools, and standardizing results and inputs across a region. In other cases, multiple organizations have partnered on contracts with a single consultant, again maximizing efficiency and ensuring the ability to collaborate and exchange data and results.
- **Capacity building and training.** While high-capacity agencies often have staff in-house who can dedicate time and learn to operate and build scenario planning platforms, smaller organizations often rely on consultants, tool providers, or technical assistance providers. Many have eventually built capacity in-house, relying on consultants or tool providers to train staff members after setting up the initial models and tools. Most organizations expressed an interest in additional peer support - either through informal networks and events, or more formal programs that improved collaboration and partnership among agencies and organizations.

¹⁴ Quay, R. 2010. Anticipatory Governance -- A Tool for Climate Change Adaptation. *Journal of the American Planning Association*, 76 (4), 496-511

Scenario planning tools provide added value. In particular, when combined with meaningful community engagement and policy work, they have significantly helped build support and political will for new development policies more in line with smart growth development, per respondents. The capacity of tools to do more sophisticated analysis for transportation/land use, for fiscal analysis, for environmental (AQ/climate) regulatory requirements, has increased dramatically in recent years.

Barriers and Limitations

A variety of barriers to and limitations of scenario planning were identified by the planning organizations interviewed for this project.

Staff Capacity (Time and Training)

Significant time is often required to set up and run scenario planning models and analyze outputs. Scenario planning also requires significant staff expertise and technical capacity. Many agencies felt that staff capacity was a barrier, either because of time and availability or lack of training and expertise. Smaller agencies in particular noted that scenario planning platforms were risky ventures because of the upfront investment of staff time and resources; some agencies were afraid they would later need to switch or abandon platforms and effectively lose that initial investment. However, qualitative approaches like Exploratory Scenario Planning do not require high tech tools and using a rigorous methodology with limited teaching can obviate this risk.

Duration and Time Commitment

Setting up, running, analyzing, and communicating results of scenario planning are time consuming. Organizations are often faced with tight timelines, and several noted that scenario planning would have pushed (or did push) the timeline beyond critical deadlines. Others noted that their tight timelines do not always leave enough time to scope out and experiment with new tools for adoption, or that long-range plans already exist so far into the future that there is little room to make changes based on scenario planning exercises.

Funding

Funding is a major barrier to adoption for most organizations, in one way or another. Smaller agencies rarely have the budget to purchase tools or hire consultants. Larger agencies with robust scenario planning programs even noted financial barriers to using additional tools and platforms that they would like to adopt. The availability of grants and other financial incentives, such as HUD's SCI, were frequently mentioned as reasons why organizations adopted or tried a particular tool; smaller organizations frequently noted relationships with peer or partner agencies that provided them with tools or expertise.

Data

Data is expensive and time-consuming to acquire and maintain, and must be constantly updated and improved. Poor quality data can derail a scenario planning exercise and drastically reduce the utility of the results. Despite those problems, few agencies mentioned data as a major barrier to the adoption of scenario planning. Most noted that they already support ongoing data programs, and otherwise utilize creative work-arounds (such as sharing or using surrogate data sets) when the data they want or need is not available.

Tools and Platforms

Most organizations have highly customized needs and specific available assets for scenario planning: policy mandates, goals, datasets, planning processes and scales, topics of interest, capacity, budgets, community types, and more. Taken together, these factors can often point toward very different tools, and frequently lead organizations to conclude that available tools did not quite meet their needs. Better resourced organizations often create or customize their own tools to do exactly what they need, but this can be an expensive proposition which often prevents smaller agencies from using scenario planning at all, or limits them to fairly simple uses.

Awareness and Education

Organizations not heavily involved with scenario planning often noted several distinct education and awareness barriers - among their own staff members, supervising agencies, political bodies, and the general public. Scenario planning is evolving rapidly, and staff members can quickly lose touch with the best tools and practices. Leaders and directors may be unaware how scenario planning works or its benefits, making it hard to approve the investment of time and resources that would be required. The general public may also be unaware of scenario planning and how it can help shape the future of their communities. Exploratory scenario planning can be additionally unsettling for elected officials and agency staff who may struggle with an approach that involves planning for negative futures.

Authority

Organizations that were interviewed were diverse in their scope, authority, and interactions with other agencies. Agencies with combined authority over land use and transportation policy were expectedly better positioned to conduct integrated scenario planning exercises. Those with authority over one area (transportation or land use) but not others or that faced issues such as different planning timelines were sometimes hindered in the effective use of scenario planning. Some agencies were set up with little authority at all, so their use of scenario planning was heavily dependent on the will of decision-making agencies. Other organizations specifically noted that scenario planning helped them collaborate with outside agencies in cases where decision-making authority was split among them, providing a shared framework for evaluating policies and decisions. Finally, good data and solid analysis can be particularly important for organizations with less decision-making authority to convince others to make more informed decisions linked to scenario planning exercises.

Political Will

Numerous agencies cited lack of political will as a significant barrier to adopting or using scenario planning. Some noted opposition or lack of interest from municipalities, while others felt opposing political pressures more strongly at the regional or even statewide level. Some organizations noted direct and specific opposition to scenario planning, while others identified a more general lack of interest in investing in planning. Others felt that existing political agreements leave little room for the changes and adjustments that the scenario planning process might suggest. On the flip side, organizations with the strongest scenario planning programs often credit positive political pressure - statewide policies or mandates, encouragement from local officials, or market demand from clients and municipalities – as elements of their success. Also, those organizations that begin with robust collaboration and engagement reported finding less opposition to their efforts.

Looking Across the Field

A 2012 policy paper by Holway et al. and the Lincoln Institute of Land Policy¹⁵ examined the state of the field of scenario planning, and what it would take to increase adoption and improve the use of these tools and methods. Resulting from a collaborative convening of tool users, developers and planners, the paper identified several strategies and barriers that echo findings from current interviews and research.

Holway et al. identified three critical elements to growing and improving scenario planning across the field:

1. Collaboration, or joint problem-solving among organizations using scenario planning, allowing them to solve problems that no single organization can solve by itself
2. Capacity building, or training and skill building that allows organizations and individuals to effectively use the tools and learn how to apply them to their particular planning challenges
3. An open environment, or a culture of sharing information and education and an open source approach to tool development and refinement¹⁶

¹⁵ Holway, J., C.J. Gabbe, F. Hebbert, J. Lally, R. Matthews, and R. Quay. 2012. *Opening Access to Scenario Planning Tools*. PolicyFocus Report. Cambridge, MA: Lincoln Institute of Land Policy.

¹⁶ Ibid.

What does the future look like? Based on interviews and observations of current trends, several key changes lie ahead for the field of scenario planning:

- More, smaller groups using these tools
- Larger regional groups providing services to their membership communities (for a fee or not)
- More widespread use of scenario planning tools that connect a variety of planning issues and integrate information
- More widespread, comparable metrics and standards for the use of tools and interoperability (assumes major investment from the top)
- Continued democratization of data
- Improved community engagement strategies to complement technical tools as well as low tech, qualitative approaches to scenario planning
- Better integration of data and collaboration throughout planning regions, as seen in California

Review of Tools

Initially, some participants in this collaborative effort (led by NARC and leading regional agencies using sketch planning scenario tools) were interested in an evaluation of the primary tools used today, to identify key strengths and gaps. Recently, several other researchers have done this review. Most notably, Uri Avin (2016) of the University of Maryland and the National Center for Smart Growth evaluated three leading scenario planning tools (Envision Tomorrow+, CommunityViz, and Urban Footprint) and other strategic planning and modeling tools as part of a National Cooperative Highway Research Program (NCHRP) report on Scenario/Sketch Planning Tools for Regional Sustainability.¹⁷ Avin's evaluation matrix is included in Appendix D.

Critical findings from Avin on these three leading tools include:

- All three tools are relatively strong in supporting a variety of scenario types and approaches, parameters, and modes
- All three tools link closely to other models, and all except Urban Footprint excel at transparency of assumptions and algorithms
- The three tools are mixed in their use of data, with some challenges around quality, amount, type or source of data required
- The tools also vary in their ability to create baseline and alternative scenarios, evaluate scenarios and make decisions, with CommunityViz rated most highly
- All of these tools lack an easy way for users to record the logical thinking and discussions of participants at a charrette table as decisions are being made
- All three tools are relatively strong on access, ability to use with standard computer platforms, open source nature, or ease of implementation

Regarding the last bullet, CommunityViz and Envision Tomorrow require ArcGIS, which is a proprietary platform. Envision Tomorrow is offered as an open source application but requires ArcGIS to run the spatial analysis. The cloud-based version of Envision Tomorrow runs on ArcGIS for Server. Urban Footprint is built completely with an open source stack of applications but is complicated enough that most users rely on the developer for at least some services to get the tool up and running for their regions. Calthorpe Analytics, the developers of Urban Footprint, is looking to provide proprietary versions of its platform to architecture and engineering firms. It feels this strategy is critical for advancing development and innovation. Calthorpe is committed to keeping its core program open source and available to regional agencies and universities.

¹⁷ Avin, U. 2016. Scenario/Sketch Planning Tools for Regional Sustainability. (NCHRP08-36, Task 117). College Park, MD: University of Maryland.

Recommendations

Several of the leading regional agencies that met in January have been working with the Lincoln Institute of Land Policy since that convening to survey users of the leading tools – CommunityViz, Envision Tomorrow, Urban Footprint, and UrbanSim – for additional details on functionality and gaps.

After significant consideration of how to best support organizations currently using scenario planning, and encourage its wider adoption among regional planning organizations and other relevant constituencies, one clear recommendation has emerged that planners, tool developers, advisors, and others all supported:

The formation of a consortium of organizations and other stakeholders, hosted by an outside, independent entity, to promote innovation and collaboration among users and generally advance the field of scenario planning.

The earlier convening in Washington, D.C. resulted in an early version of a “Call to Action” document (see Appendix A), outlining the need for coordinated action by practitioners to address barriers and limitations to progress in the field and strategies for addressing them. The conversation and conclusions from the convening match the conclusions from this research, and the primary recommendation is also to form a consortium led by an outside, independent entity to collaboratively advance the field.

Based on research findings and the discussion at the convening, a consortium should:

- Establish working groups and learning networks for users of specific scenario planning tools, creating effective mechanisms for peer exchange and technical support and helping lower capacity organizations select and implement scenario planning tools and processes.
- Share best practices and examples of successful scenario planning uses and innovations, showcasing the benefits of scenario planning, encouraging adoption, and improving the level of practice.
- Consider creating a framework to improve scenario planning tools, including identifying service gaps and inefficiencies, increasing interoperability, and standardization.
- Build collective power for users to address needs and opportunities, such as building collective purchasing power, cost-sharing solutions and product improvements, identifying grant funding and regional collaboration opportunities, and creating a more unified voice shaping state and federal programs and policies.
- Help implement the new FHWA and FTA Metropolitan Transportation Planning regulations that allow for optional scenario planning in transportation plans.

A roadmap (Appendix B) outlines the path forward and next steps, some of which have shifted and others already underway as of the publication of this paper.

In addition, recommendations are offered for ensuring the consortium meets the needs of a wide range of users and agencies and offers an effective path to advancing both the field and the localized practice of scenario planning. The following recommendations, many of which emerged from the convening and are included in the roadmap, address both activities that the consortium should consider and higher-level approaches to forming the consortium in a strategic way.

Recommendations for Consortium Activities

Many consortium activities could benefit scenario planning practitioners. The following recommendations – derived from the interviews and convenings conducted for this project – would serve practitioners from organizations with a wide range of available capacity and identified needs. Advanced users tend to be very active in discussions and collaborations, but strategic growth of the field requires a concerted effort to serve organizations that are considering the use of or just beginning to use scenario planning, and have more limited capacity to do so.

Working Groups for Peer Exchanges and Collaboration

The single most common need identified is additional collaboration and interaction with other scenario planning users. This request spanned all regions and types of users, from the most experienced to those just starting out. Various reasons were identified – improving scenario planning processes and

engagement techniques, sharing data, asking questions of more experienced users, or comparing results, to name a few - but nearly all felt they would benefit from more regular and established connections with other users. Communication channels (for example, online forums, in-person events, webinars, conference calls) supported by a consortium would enable scenario planning practitioners to connect with each other and share ideas. Working groups for each of the most commonly used scenario planning tools would also provide vehicles that allow users to interact with peers using the same platform. Working groups could also facilitate more formal technical assistance or fee-for-service work between agencies. This would allow organizations new to scenario planning the opportunity to explore the process without immediately building their own in-house capacity or taking a major financial risk. More experienced organizations could also find efficiencies through such exchanges, and may also find that providing technical assistance can provide a funding stream to make their work more viable.

Research on Tool Needs and Gaps

Gaps and deficiencies exist in the broader practice of scenario planning and in the specific scenario planning tools. A consortium would provide a forum where broader trends and improvements could be considered, and working groups would allow organizations to jointly identify gaps and explore solutions.

Collaboration on Tool Improvements

The consortium could facilitate collaboration to improve the tools. The form of that collaboration might vary depending on the needed improvements. For example, if proposed changes must be made by the original developer, the consortium could bring users together to better leverage their influence as customers. Changes requiring new coding or other adjustments could be accomplished by helping users coordinate efforts and share open-source solutions, reducing duplication and wasted time.

Sharing of Best Practices and Techniques

A consortium can advance the overall field by providing a forum for sharing case studies, techniques, and best practices, demonstrating how others are using scenario planning tools. More advanced users can benefit from examples of complex analyses, ways of combining tools or platforms, or strategies for improving public engagement and processes. Beginner and intermediate users - or agencies just starting to consider scenario planning - can benefit by hearing about a range of applications and ways that agencies or regions like theirs are putting the tools to use. Concerted sharing can improve the practice of scenario planning for professionals at any stage, but can also be an instrumental tool for helping agencies see the potential of scenario planning and decide to take the risk of experimenting with it for the first time.

Development of Education and Marketing Resources

More formal resources developed collaboratively can help with marketing and training. Many beginning and intermediate users cited a lack of training as a barrier to adoption or more sophisticated use. Staff members would benefit from workshops or manuals that help them gain the skills needed to make sophisticated use of scenario planning tools. Agencies just starting to consider scenario planning often noted the need for materials to help make the case for scenario planning to decision-makers. A consortium could develop resources that outline the benefits and applications of scenario planning for diverse agencies and regions.

Advocacy for Funding and Policy Initiatives

Finally, funding and policies serve as important barriers (or incentives), depending on the state or region. Creating funding opportunities or policy requirements would be one of the fastest ways to encourage adoption of scenario. A consortium could help advance policy and incentives at a variety of levels.

Recommendations for Strategic Approaches

Scenario planning occurs in a complex and evolving context, including a variety of political and technical factors. This report offers several recommendations for strategic approaches to forming a consortium, which would capitalize on momentum in the field and look to successful models in similar areas.

Capitalize on Changing Policies and Planning Requirements

States and regions with statutory requirements or incentives to use scenario planning are farther ahead in its adoption. These jurisdictions give planning agencies an important reason to risk trying a new tool; they legitimize the approach, help alleviate concerns among decision-makers, and often provide financial or

technical assistance to remove barriers. The consortium should, in time, work toward the adoption of new policies and incentives that encourage scenario planning, but that can take time and significant effort. In the meantime, the consortium can capitalize on new and existing policies.

In May 2016, the Federal Highway Administration (FHWA) and Federal Transit Administration finalized a new rule, *Statewide and Nonmetropolitan Transportation Planning; Metropolitan Transportation Planning*,¹⁸ which mandates changes to how state departments of transportation and metropolitan planning organizations (MPOs) perform transportation planning, programming, oversight, and environmental review. This rule updates federal regulations to reflect changes contained in the Moving Ahead for Progress in the 21st Century Act (MAP-21)¹⁹ and the Fixing America's Surface Transportation (FAST) Act²⁰, making them consistent with other statutory requirements.

Specific components of the new rule include:

- A requirement that states and MPOs use a performance-based approach to transportation planning and programming, to increase transparency and accountability, improve decision-making, and allow for more effective investments
- Increased emphasis on transportation planning in non-metropolitan areas, by:
 - requiring more involvement and cooperation with local officials (as opposed to limited consultation)
 - providing a process for creating regional transportation planning organizations (RTPOs) to serve non-metropolitan areas
- A change in the membership structure of larger MPOs, requiring certain board representatives and policy structures
- Established as an option that MPOs may use scenario planning in developing their metropolitan transportation plans, and created a framework for the voluntary use of scenario planning
- Increased authority to integrate planning and environmental review processes, including the allowance of funding for environmental review within transportation planning
- A process for developing an optional framework for programmatic mitigation plans in areas such as archaeological resources, critical habitat, or threatened and endangered species

A key feature of these new regulations is a framework for the voluntary use of scenario planning by MPOs in the development of metropolitan transportation plans.²¹ This is likely to increase interest in the use of scenario planning, and presents an opportunity to increase its use nationwide.

Embrace Diversity in Working Groups

A key aspect of the consortium would be establishing flexible and diverse working groups for each of the most popular scenario planning tools. Participation would be voluntary, but the activities of a particular working group would be structured by participants, with coordination by the organization or individual serving the broader consortium. These working groups would include practitioners, developers and academics, and would serve the following purposes:

- Meeting a diverse range of needs and serving practitioners with diverse capacity levels
- Providing a forum for peer support, allowing participants to increase their skills and capacity with existing tools
- Streamlining communications between users and developers around needs, improvements and innovation
- Giving users collective purchasing and negotiating power

Approach

Working groups would coalesce around each of the four scenario planning tools that are currently in widespread use among planning agencies: CommunityViz, Envision Tomorrow +, Urban Footprint, and UrbanSim. Groups would include users with diverse levels of experience and needs, but would focus on

¹⁸ 23 C.F.R. 450.324 (2016).

¹⁹ MAP-21, Pub. L. 112-241, 126 Stat. 405 (2012).

²⁰ FAST Act, Pub. L. 114-94.

²¹ 23 C.F.R. 450.324 (2016).

application for public agencies. Groups would also include the tool developers as well as relevant academics, and consultants. Group membership would likely be informal and fluid, with individuals participating as it makes sense for them.

Working groups would be led by one or more experienced members, who would identify and engage potential members and help the group identify procedures and agendas, such as meeting arrangements, educational activities, and process for raising and addressing challenges. Groups might choose to meet via conference call or video, or to gather at conferences or popular events. They might focus on a single project, such as identifying improvements or developing best practices for a tool, or might operate more flexibly with opportunities for open conversations, webinars or presentations, or 1-1 connections. Groups may even shift their agendas and activities over time to meet changing needs.

Working groups (or subsets) would also systematically evaluate their tools using a single methodology, which will lead to a framework for improvements across platforms. Moving forward, groups might continue to work together or communicate with each other about needs, opportunities, or best practices relevant to multiple scenario planning platforms. A single backbone organization would ideally provide support to all (through a common online platform, coordinated support, or communications) to ensure the groups stay connected and are aware of each other's activities and needs.

Rationale

This working group model is designed as a flexible approach that will meet current needs related to scenario planning identified by a range of agencies, as well as future needs that may emerge. Several components of this model are critical to ensuring that groups will be effective, appealing to members, and enduring.

- **Cross-disciplinary membership.** Working groups should include developers, consultants, researchers, and tool users. Including different disciplines from the scenario planning field will enrich the groups by bringing different perspectives to the table. These different perspectives can help groups troubleshoot and solve problems more effectively. This approach will also help facilitate direct communication between working groups and the most appropriate people or entities. For example, users can speak directly with developers about their challenges or needs, and developers can likewise directly keep users informed about progress and plans.
- **Backbone support.** The concept of backbone support comes from the Collective Impact movement, one of the leading models for creating action-based networks. Collective Impact practitioners recognize that successful networks need dedicated support from a neutral organization or leader to move forward and stay connected. That support includes coordination time, a platform, fundraising, and other activities that help the network achieve its goals. Without a dedicated backbone organization, networks are likely to fail when interest subsides or members get too busy.
- **Peer support and capacity building.** Capacity to do scenario planning varies significantly among agencies, and nearly all reported that capacity can be a barrier to getting started or advancing their practice. Nearly all also expressed an interest in (or appreciation for) peer support, or having other experienced users they can contact with questions or help. Providing a structured forum for peer support within working groups will be a significant draw for participants, providing a reason to get involved and stay involved. It will also help increase the use of scenario planning by providing the resources that help break down barriers to adoption.
- **Group crossover.** One major barrier to scenario planning is the siloed nature of tools currently on the market, each one operating with different platforms, technical requirements, data requirements, and workflows. Encouraging interoperability is an interest of the group that convened in January, and working groups can help accomplish that. If they are connected and structured in a similar way, groups could easily share information, combine or work together on specific challenges, and encourage tool developers to pursue interoperability.

Similar Models and Efforts

A structure for collaboration is needed that unifies users and tool providers around strategies for adoption, encourages innovation, and eliminates barriers to use. The challenge of advancing scenario planning is not unique; users of other technologies and tools have likewise considered the question of how to increase

collaboration and reduce barriers. Rather than reinventing the wheel, we can learn from these efforts to better understand what could make this effort succeed.

Several examples of parallel efforts can provide guidance on how to structure coordination and encourage working together for innovation, standardization, and the development of new tools and functionality. VisionEval is an open source common framework headed up by the Oregon Department of Transportation (OregonDOT) and the FHWA. It is an example of an effort that may be worth emulating, or perhaps even joining. Another model for collaboration is the General Transit Feed Specification (GTFS) and how it has led to data standardization and applications for data sharing for transit. The Open Planning Tools Group (OPTG) provides a third example of a collaboration that has helped share examples and resources and advance the field of scenario planning.

VisionEval

VisionEval²² is an important example of a common framework that enables sharing and interoperability between varieties of related tools for greenhouse gas reduction, energy, and related planning issues. The family of VisionEval tools began with a tool designed to measure greenhouse gas emission outcomes in Oregon (GreenSTEP). It was rebranded the Regional Strategic Planning Model (RSPM) when broader measures such as health, household costs, and other outcomes were added. The tool was adapted nationally in modified form as RPAT (Rapid Policy Assessment Tool) and EERPAT (Energy and Emissions Reduction Policy Analysis Tool). Different agencies using these models have developed web-based interactive visualization tools (dashboards) showing the outputs generated by these models to explore policy/investment trade-offs with stakeholders and the public. One example is the Corvallis Metropolitan Area Scenario Viewer.²³

The core of VisionEval is a common programming framework that enables models to be built by connecting modules in standard R language packages. The impetus for developing the VisionEval framework was to make the code for several related strategic planning models easier to maintain, modify, extend, and interchange. The framework establishes interface standards for modules and manages the data flow between modules and a common datastore. The VisionEval project repository on GitHub²⁴ is the source for project documentation and code. Several partners and technical contributors have participated in the development of the VisionEval framework to date. Partners include the FHWA. Technical contributors include Oregon Systems Analytics (OSA), Resource Systems Group (RSG), Portland State University (PSU), University of British Columbia (UBC), Lane Council of Governments (LCOG), and Volpe. New users, like the Atlanta Regional Commission (ARC) have also contributed to the development of new modules (e.g. for CAVs).

The work to date by the founding FHWA-OregonDOT partnership has focused on the technical components of putting the various tools on a common programming framework. With the next phase of VisionEval collaboration, the goal is to support a broad array of potential tool uses and enable pooled enhancements, expanding the types of outcomes measured or refining the specificity of transportation and land use solutions considered.

The platform and coordination structure of VisionEval may provide an approach to modularization and interoperability that is worth considering for the scenario planning tools consortium focusing on CommunityViz, Envision Tomorrow, Urban Footprint, and UrbanSim. Whether or not these tools can be adapted to have their outputs distributed in standard R language packages, is a question best answered by the tool developers. Both VisionEval and the Scenario Planning Consortium efforts are still figuring out their governance structure and how to coordinate efforts amongst regional agencies, tool developers, and federal and philanthropic partners. There is an opportunity to merge efforts worth considering.

The General Transit Feed Specification

The General Transit Feed Specifications (GTFS)²⁵ defines a common format for public transportation schedules and associated geographic information. GTFS “feeds” allow public transit agencies to publish their transit data and developers to write applications that consume that data in an interoperable way.

²² See <https://gregorbj.github.io/VisionEval/>

²³ See <http://www.oregon.gov/ODOT/TD/TP/Pages/ORScenView.aspx?sv=CAMPO>

²⁴ See <https://gregorbj.github.io/VisionEval/>

²⁵ See <https://developers.google.com/transit/gtfs/>

A GTFS feed is composed of a series of text files collected in a ZIP file. Each file models a particular aspect of transit information: stops, routes, trips, and other schedule data. The details of each file are defined in the GTFS reference. A transit agency can produce a GTFS feed to share their public transit information with developers, who write tools that consume GTFS feeds to incorporate public transit information into their applications. GTFS can be used to power a wide diversity of applications from trip planners, to time tables, and highly customized mapping applications. GTFS represents a collaborative effort made possible through the standardization of how data is shared and accessed and therefore provides a model for how scenario planning and modeling tools could also become more interoperable through standardization and an agreed upon API for sharing.

This would also encourage the development of new applications that are compatible with data in a format designed for scenario planning for land use and transportation planning. The simplest way to make a feed public is to host it on a web server and publish an announcement that makes it available for use. A list of regional agencies providing public feeds can be made available on a common project site, allowing developers to subscribe to announcements about new and updated feeds.

In conversations with “Power Users” and tool developers, several felt the GTFS model held great promise for encouraging interoperability and innovation. If tool providers and users can team together to agree on a process and collaborative structure for creating a similar set of specifications for land use, this could have a catalytic effect on the adoption and improvement of scenario planning tools. Specifications should focus on identifying data standards for scenario planning and an API for applications to talk to each other.

Scenario Planning Applications Network (SPAN)

For ten years, SPAN (formerly the Open Planning Tools Group) has been a network of researchers, tool developers, and practitioners working to share innovative practices, solutions, and discuss challenges in the field. The group has worked to raise the profile of scenario planning by showcasing successful projects and sharing case studies that can inform planners about the potential of this field. SPAN has found a variety of activities to be successful in encouraging collaboration, from conference calls and webinars to an annual convening. With the recommendation of the creation of a consortium that reaches out to a similar network of researchers, tools developers, and practitioners, the role of SPAN would become one of the working groups to focus on high end users and tools developers of the consortium network.

Conclusions

One universal conclusion among agencies and practitioners interviewed is that scenario planning is advancing quickly and may be at a turning point in terms of adoption. No longer a new frontier in planning, scenario planning is now widely accepted as an important and valuable tool. Most organizations are using it in some form, and nearly all are aware that it has the potential to improve their practice. Recent policy developments at the state and national level - most importantly the new planning regulations issued by FHWA and FTA - provide further legitimacy.

While scenario planning will undoubtedly continue to spread and advance on its own, the rapid pace of change in our culture, communities, and climate demand the best tools and techniques we have available, and scenario planning is currently not deployed as effectively or as widely as it might be. As planners and colleagues, it is in our collective best interest to work together to spread and improve the field as quickly as possible.

Because the different families of tools have different strengths and shortcomings, there are unexplored opportunities to integrate their use. Different agencies have widely diverse needs and capacity levels, so there are also untapped opportunities to build connections and encourage collaboration that will help users help themselves and help each other. A flexible structure for collaboration - technical, educational, political and more - can help address all of these challenges and capitalize on current opportunities.

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Appendix A: Call to Action

From Regional Scenario Planning Tool Consortium

This document synthesized next steps and recommendations resulting from a convening of scenario planning tool users and leaders in Washington, DC, January 2016. The Call to Action was drafted and released in the spring of 2016.

Version: February 5, 2016

Problem Statement

Scenario planning is a data-driven process with proven success in helping regional planners engage stakeholders, address emerging challenges, and align public investment decisions with policy, regional needs and local character. Throughout nearly two decades of robust use, practitioners have been developing, ground testing, and fine-tuning scenario planning processes and tools. Today, planners can choose from many different tools and options with varying levels of complexity and sophistication. Agencies that have incorporated scenario planning tools and techniques into their operations have provided many testimonials on the power of scenario planning to improve the quality of decisions, meaningfully engage stakeholders, and increase political support for outcomes.

Despite many advancements and documented benefits, organizations face substantial barriers when adopting and using scenario planning tools and processes. They include political pressure; lack of funding, time or staff capacity; technological challenges and tool customization. Together, these barriers are substantial enough to create uncertainty around the continued use and advancement of scenario planning incorporated into regional decision-making. Practitioners, developers and proponents of scenario planning recognize that the field is hindered and even threatened.

To increase the viability and use of valuable scenario planning tools and techniques, and continue to prove their value, users must work together. This includes collectively leveraging programs and resources to decrease barriers to use, normalizing metrics and data needs, improving user support resources, and encouraging the adoption of scenario planning tools in local and regional planning and decision-making.

Mission

Our mission is to accelerate the development and adoption of scenario planning tools and techniques that help regional and local agencies improve planning and decision-making. We will do this by creating a consortium to:

- Via collaborative efforts, identify pathways to improve functionality, interoperability, scalability, cost, user-friendliness, and other critical aspects of scenario planning tools; and
- Build a peer network to support advancements and best practices in the field of scenario planning.

Approach

We will form a consortium (including public agencies, nonprofits, tool developers and universities) to accelerate the advancement and adoption of scenario planning for regional and municipal planning. The consortium will provide the framework to improve available tools, techniques, awareness and support, generate market demand market demand. It will also serve as a common communication and learning space for key partners to advance scenario planning tools and techniques and provide peer support.

The consortium will:

- Identify service gaps and inefficiencies and create a methodology for improving the functionality, interoperability and availability of scenario planning tools;
- Establish user groups and learning networks for users of specific scenario planning tools;
- Collectively address the needs and common challenges of users through a range of activities (such as cost-sharing solutions and product improvements, identifying grant funding, or conducting research);
- Build a unified voice and bargaining group to help shape state and Federal programs, collaborate with developers, and secure support and improvements for the field;
- Create effective mechanisms for peer exchange and technical support, allowing users to share best practices, examples, and innovations.

The potential benefits of a unified effort are unprecedented and exciting, including:

- Increasing market response and improving tools relative to users' needs;
- Developing data and analytical standards that allow for comparisons between tools and organizations;
- Identifying opportunities to for bridging scenario planning platforms and tools including the integration of decision-making across transportation, housing, land use, air quality and many other critical public policy issues; and
- Broadening the pool of people who can constructively and effectively utilize scenario planning tools.

Call to Action

We call on your organization to join the effort and contribute to the improvement of the scenario planning field. We seek your active participation in forming this consortium, and ask you to make a financial, intellectual and/or time commitment.

We are confident the benefits will far outweigh the costs of participation. Together, we can create better processes, improved tools and increased efficiency - leading in turn to cost reductions, more widespread use of tools, and more informed planning. Together, we can ensure that we all have tools and techniques to meet local needs and respond to a changing future.

Get Involved

For more information or to get involved contact David Warm at warm@marc.org.

Appendix B: Technical Concept Document

Technical Concept for a Collaborative Effort to Improve Regional Scenario Planning Tools

by Frank Lenk, Director of Research Services, Mid-America Regional Council

Adapted from a January 8, 2016 presentation

The current set of scenario planning tools mostly take an “all-in-one” approach. That is each has its own data requirements, data definitions, database and database structure, its own technology for developing, managing and comparing scenarios, its own algorithms and applications for calculating indicators and metrics to be compared, its own way of visualizing those metrics and its own user interface. This “all-in-one” nature is part of what keeps users locked into one tool or another – the cost of changing tools is high if one has to get new data or configure it in a different way or learn a new user interface simply to get access to a needed metric that one tool has but another does not. The all-in-one nature also makes for an increasingly complex tool that is difficult to master and costly to maintain.

Drawing on successful collaborative open-source software development projects elsewhere, one can imagine a different way to structure scenario planning tools, one that is more modular or plug-and-play than all-in-one, and that relies on standards to ensure the pieces all work together. A consortium like the one proposed could have a role in helping to develop such standards, as well as provide the market demand to for them to be implemented. Far from hindering innovation, standards increase interoperability among the tools, thereby increasing the potential number of both developers and users. This creates greater competition by developers for users, increasing the innovation as a result. Moreover, modularization allows for that innovation to proceed in parallel, decreasing bottlenecks and increasing the speed at which improvements can be made.

If one were to map out the scenario production process, one would see data from a variety of sources flowing into a database that the scenario platform then draws from. That platform then employs an algorithm or algorithms to make certain calculations, which in turn the platform then visualize the results in tables, charts and maps, or perhaps even 3-D buildings. The adoption of standards can help spur interoperability, competition and innovation at each step of the way.

For example, common data definitions, database structures and, ultimately, common databases themselves would allow the data developed by users to readily flow into any of the scenario planning tools, keeping data issues from determining which tool a user is able to employ. Standards for algorithms ensure that they are peer reviewed and produce the same results regardless of which tool does the calculations. Promoting standard ways for applications employing those algorithms to plug into the scenario platforms would allow developers of applications to calculate specific indicators to “write once, deploy many” so that their applications work on any platform, increasing the size of their potential market. Scenario platforms will begin to be judged on the size and quality of their “app store,” increasing the competition among the platforms to open up their application interfaces and make it as easy as possible for others to contribute (plug in) new functionality. Such functionality could even include alternative user interfaces – so that the same platform could be configured for use by a variety of people, from professional planners to city managers and elected officials to the general public – or alternative data visualization engines, which would give users greater choices concerning their look and feel.

In each case, greater modularization produces greater competition, greater choices for users, and makes users less dependent upon a single developer or single tool. But modularization requires adoption of the standards necessary to make the components truly plug and play. Figuring out the right process and governance to develop and manage such standards could be an early role of a collaborative effort amongst regional agencies and tool providers.

If a standards-driven, modular approach is desirable, the following questions become relevant for evaluating existing tools:

- What are the quintessential questions users MUST be able to answer using scenario planning tools? These become the basis for determining the data and processes ripe for opening up to standardization.
- How well does each tool platform perform on the core functions/indicators/apps required to answer those questions?
- A key core function is database development and management. What database is used to manage the scenario data? What data is required, and how easy is it to import the data into it, keep it updated?
- What is each tool’s underlying technology, and how open is it? To what degree is it already designed to be modular and accept contributions from others?
- How big is each tool’s current “app store” – applications developed by those not associated directly with the developer? How easy is it to get such applications incorporated into the tool?
- What does each tool do exceptionally well? What might we want to ensure works well across all tool platforms?

Appendix C: Summary Assessment Matrix of Tools

Legend:

Poor 	Fair 	Good 	Very Good 	Excellent 
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ET+ = Envision Tomorrow Plus

CV = CommunityViz

UT = UrbanFootprint

The following table is reprinted by permission from: Avin, Uri. NCHRP 08-36, Task 117 Scenario/Sketch Planning Tools for Regional Sustainability. February 2016. (Table 4.1)

Category/Subcategory	ET+	CV	UF	Comments
Conceptual Attributes				
Types of scenarios supported				
Predictive/Exploratory/Normative?				Only CV, through its Allocation and Suitability Tools, begins to accommodate exploratory approaches.
Approach to scenario creation				
Place Types: e.g., Predefined, User-defined?				All have predefined types that allow expansion and customization. Some have more Types "out-of-the-box" (UF) and other have more flexible customization (CV).
Method of Place Type/land use distribution: e.g., "Painting," Rules, Models?				Painting mode common to all though geographic flexibility varies currently. Only CV has a rule-based allocation option.
Sustainability Framework Environmental				
Economic				Currently ET+ has the most extensive capabilities here, including ROI, Fiscal and employment resilience indicators and calculators. UF has a fiscal model.as does CV.
Equity				ET+ and UF have Public health indicators.
Inclusion of nonspatial parameters, policies				
Converted to spatial effects; Maintained in parallel form in tool?				UF, because of its California origins, has particularly extensive energy and GHG indicators.
Regional adjustments				
Designed for region or subarea or scalable with different attributes by scale? Does software allow combining values and averaging them?				UF's modules have been California-specific, though it is now being used outside of CA.
Educational Aspects				
Opportunities for feedback and double loop learning: e.g., real- time updates?				For UF user must manually input new datasets currently. New GUI in 2016 allows users to adjust key assumptions.
Entertainment/Engagement Quotient: e.g., Presentation Tools? Charrette tools?				Runtimes constrain instant comprehensive feedback; UF functionality for visualization still under development.
Expert Aspects				
Transparency of assumptions, algorithms				UF is "translucent." There is some documentation, but it is not easy to look at actual relationships embedded in the tool.
Linkages to econometric, travel and other models				Open-source tools (like UF and ET+) only a net benefit if agency staff are used to working with them. For less equipped staff, ArcGIS-based tools can be easier to use out of the box. UF automates input of census, land use, and transportation network data.

Category/Subcategory	ET+	CV	UF	Comments
Functional Attributes				
Getting started – Data requirements, management, and organization				
Minimum amount of data required to create and run scenarios: e.g., existing land use and future land use				UF requires parcel and TAZ-level land use and socio-demographic data; census data; transportation networks. The extent and specificity of initial data requirements means it is a more robust model, however.
Format: e.g., Native (Most data can stay in original format and tool can be adapted to match); Specified (Most data can stay in original format but must have specific fields); Imported (Data must be imported into a new file/format)				
Data Quality required: e.g., moderate				Only CV has built in checks on formula syntax.
Ability to organize and convert data and mapping inputs: e.g., Land use classifications; Infrastructure mapping/data				UF has a Translation Engine to interpret parcel and land use data and Place Type inputs from other formats and convert them into a base raster grid CV probably has the lowest requirements in terms of inputs, whereas ET and UF have better organization and optimization routines.
Ability to link to/import other data sources				For UF, many California-specific datasets already loaded, but not set up to automate linking to comparable datasets outside of California.
Linkages to econometric, travel and other models				UF working toward out-of-the-box functionality.
Nonplace type approaches (e.g., allocation routines)				CV has an allocation model built-in; UF has a query tool that allows for rule-based painting.
Creating Scenarios				
e.g., Via a Set range of Place Types; “Core” Place Types with basic attributes; “Core” with detailed attributes; Large range of Place Types; Large range of Place Types with basic attributes; Large range of Place Types with detailed attributes				UF has largest number of Place Types (over 35 currently); these are calibrated from CA and other western state environments. For ET+ Placetypes are created by defining the mix of prototype buildings.
Ability to add customize land use/place type				
Soundness of allocation method				Only CV has an allocation methodology.
Creating a baseline				
Existing conditions e.g., Can use LU/LC data “as is”; Must convert/match existing LU/LC to Place Types				ET+ must convert existing LU/LC to Placetypes; UF has “existing plan translation” tools.
Assumptions: preloaded/template; customizable; from scratch				For CV, assumptions for each core Placetype are already loaded but can be easily be customized. Interface also allows easy creation of assumptions from scratch.
Trend scenario generation: Methodology e.g., manual, assisted, defaults built in etc.				
Creating alternative scenarios				
Number of scenarios supported/Limitations on numbers and scales of scenarios compared simultaneously and number of features				While ET and CV technically have no limits to number of features and scenarios, they both are frequently constrained by the performance limitations of ArcGIS running on desktop hardware. UF plans to support processing on multiple CPUs over “the cloud,” which could make the number of features virtually irrelevant.
Are scenarios end-state only or can user create incremental snapshots?				CV’s TimeScope Wizard allows basic snapshots/slices and the new Allocation Tool allows multiple iterations where output of one becomes input to next. The other tools are end-state. UF scenarios present end-date results only.

Category/Subcategory	ET+	CV	UF	Comments
Functional Attributes (continued)				
Creating alternative scenarios (continued)				
Types of feedback: "real-time" indicators, alerts and/or warnings, error checking, others				CV currently has the broadest options here.
Changing assumptions: Easy to do/on the fly; Hard to do/separate process				For ET+, changes made in excel templates, which then propagate through the scenario; For CV, easy to do/on the fly; for UF, real-time feedback functionality still under development, including ability to change assumptions.
Evaluating scenarios and making decisions				
Range of indicators produced: Default/natively; With additional inputs (To get more types indicators additional types of data would be required); Customized				CV has particularly extensive formula capabilities with over 90 built-in functions that be used to create a wide variety of custom indicators.
Ability to add stakeholder "values" to indicators e.g., Weighting; Rating; Prioritization routines				For CV, can add weighting as a multiplier assumption to an indicator or performance measure.
Ability to normalize indicators/create a performance "Dashboard" – method (e.g., better than/worse than today, normalized versus benchmarks, normalized for range (worst = 0; best = 100)				For CV this can be done and normalized by range.
Technical quality of indicator calculations: General overview (algorithms are simple rule-of-thumb with coarse "ballpark" figures or they are highly complex and precise etc.)				For UF, generally reports using high-quality/state of practice methods, but cannot be verified, as methods are not yet well documented or transparent.
Presenting Scenarios and Indicators				
Map outputs e.g., One at a time/single; Side-by-side				For CV, map outputs can be displayed one at a time or two side-by-side on monitor or using the report generation tool. For UF, outputs currently delivered by tool developer since end-user functionality still in development.
Indicator formats e.g., Table, Charts, Export to other apps supported, Thematic maps				For UF, tables, charts, thematic maps output in open-source database tools, can be queried into standard Excel and ESRI formats. ET's charting is Excel-based, and it has flexibility in terms of graphic quality. CV defaults require some manual work for quality graphics but can be exported to Excel for presentation purposes.
3D Visualization: Regional scale (e.g., Thematic 3D maps, 3D maps with charts); Local scale (e.g., Parametric-generated building massing models; Parametric-generated building textured models				
Reporting tools e.g., Summary of inputs, assumptions, algorithms, Summary of results, Static or dynamic, Story-boarding/saved views, Web-based, Printer-friendly				
Public comments captured				Noteworthy limitation of all three tools.

Category/Subcategory	ET+	CV	UF	Comments
Implementation Attributes				
Access				
Platform e.g., Freestanding app, GIS extension, GIS extension and spreadsheet, Self-hosted cloud-based, Vendor-hosted cloud-based				ET+ and CV are desktop GIS extensions. UF delivered as "Software as a Service" (SaaS) via "thin" web-based client, but in still in development.
Distribution e.g., Shrink wrapped (license, installer) – Fixed seats/Floating Seats; Software as service; Open-access (free software, installer, closed code); Open-source (free software, components, open code)				Both ET+ and UF are open-source, though UF is still under development for end-user full functionality; CV is distributed as a one-step installer with fixed or floating seat licenses. UF involves setting up multiple software server-stacks, which, although "free" – have a high overhead of expertise required.
Prerequisites				
Hardware				Need a lot of hardware/software to serve UF but not if using Software as a Service (SaaS). No server needed for ET+ & CV.
Software, including any open-source stack components				An agency trying to implement UF itself would need a very large software stack it is built-on. However SaaS would be virtually none for the client.
Staff expertise required				ET+ and CV require ArcGIS skills. CV is scalable. UF requires data/GIS skills, along with IT skills to set up servers.
Costs				
Hardware				For ET+ and CV, minimal if already own computer; for UF, minimal if already own servers, otherwise possibly significant.
Software – Initial and Ongoing/updates				
Amount of support (e.g., consultants) needed				For ET+ and CV, consultant support helpful, but not required; For UF, consultant support currently required.
Training				For ET+ and CV, training by vendor or authorized consultants: available; for UF training by tool developer currently required.
Performance/Robustness				
Speed				For UF, the server/client setup is that the server processing could be done in the cloud and be very fast.
Stability				
Methods and assumptions clearly documented				
Quality of graphic output				CV has far more reporting tools than the others, various web reports, output to AGOL (ArcGIS On Line), Google Earth.
Ease of Use				
Skill level to set up application and to create/evaluate scenarios				For ET+, users familiar with Google Maps should be capable of creating scenarios; for CV, takes staff training (e.g., 12 hours) and time to become familiar with basics; for UF, takes staff training and time to become familiar with basics.
Support				
Help files: Context accessible, Manual-based, Wiki-based, Updates				
Tutorials e.g., Free/web-based, Vendor-supplied, Workshops available?				
One-on-one support e.g., Dedicated support staff, Vendor consulting-based, Email/form-based, discussion boards				
Maintenance e.g., Manual, Automatic, Done by vendor, Self-hosted–must update stack				

Appendix D: Interview List and Questions

24 regional agencies were interviewed:

1. Association of Central Oklahoma Governments (ACOG)
2. Boston's Metropolitan Area Planning Council (MAPC)
3. Central Oregon Intergovernmental Council (COIC)
4. Centralina Council of Governments (CCOG)
5. Community Planning Association of Southwest Idaho (COMPASS)
6. Corvallis Area Metropolitan Planning Organization (CAMPO)
7. Delaware Valley Regional Planning Commission (DVRPC)
8. Denver Regional Council of Governments (DRCOG)
9. Flagstaff Metropolitan Planning Organization (FMPO)
10. Metropolitan Council
11. Miami Valley Regional Planning Commission (MVRPC)
12. Mid-America Regional Council (MARC)
13. Mid-Ohio Regional Planning Commission (MORPC)
14. Omaha-Council Bluffs Metropolitan Area Planning Agency (MAPA)
15. Sacramento Area Council of Governments (SACOG)
16. San Joaquin Council of Governments (SJCOG)
17. San Luis Obispo Council of Governments (SLOCOG)
18. Southeastern Wisconsin Regional Planning Commission (SEWRPC)
19. Southern California Association of Governments (SCAG)
20. Spokane Regional Transportation Council (SRTC)
21. Triangle J Council of Governments (TJCOG)
22. Wasatch Front Regional Council (WFRC)
23. Yakima Valley Conference of Governments (YVCOG)
24. Yuma Metropolitan Planning Organization (YMPO)

INTERVIEW QUESTIONS FOR AGENCIES ALREADY USING SCENARIO PLANNING TOOLS:²⁶

Scenario Planning Activities

1. What is the mission and geographic scope of your organization?
2. How did your organization begin using scenario planning tools?
3. Are there cases where scenario planning tools have helped your region look at issues in a more integrated and comprehensive fashion? (I.e. transportation and land use)? How about at different scales? What are some examples?
4. Describe the range of planning activities in your agency that include the use of scenario planning tools?
 - What scenario planning tool(s) are you using for this project?
 - How long did it take to set up the tool(s), excluding time spent collecting and cleaning up data?
 - Were the tool(s) developed in-house or acquired from a tool provider?
 - To what level is staff trained for using this tool (i.e. operators, high level analysts, or expert design level architects for next generation tools)
 - If tool providers have been involved, are there components of the tool that function differently than described by the provider? To what extent did they help with training and applying the tools to on the ground projects?
 - What advice would you like to pass along to other regional agencies interested in utilizing the same set of tools for similar planning activities (i.e. system requirements, cost, interoperability, etc.)?
 - Overall, how useful have the scenario planning tools and metrics applied to this planning project been to your agency for improving decision-making?
 - What are the most powerful and least compelling features of the tool(s)?
 - Are there tools that you considered and decided not to use? Are there tools that you used to use, but no

²⁶ Interviews were flexible conversations and did not necessarily include direct answers to all of these questions. Interviews may also have included questions or follow-up inquiries not included on this list. We did not ask questions when they were not applicable to the agency's experience.

longer do? If so, why?

5. Does your organization offer specific programs or services to jurisdictions and/or organizations that support the use of scenario planning?
6. Please describe how your agency manages data access, data sharing, and how to keep data updated when shared amongst agencies and jurisdictions? Are there costs involved for acquiring certain data sets?

Future Plans

1. What new tools or metrics are you hoping to develop or have access to? Please explain how these tools or metrics would better facilitate planning for your organization?

Track 1: Unified Push for Change

Mike McKeever, SACOG (Sacramento) Ted Knowlton, WFRC (Salt Lake City) David Warm, MARC (Kansas City)

- What policies, procedures and technological changes can accelerate adoption of scenario planning?
- How can we collectively improve the caliber of scenario planning tools and practices?
- What might a unified strategy for wide- scale adoption of scenario planning look like, including tools, data standardization practices, common metrics, and tool deployment procedures?

Track 2: Collaboration and Capacity Building

Dan Jerrett, DRCOG (Denver) Tim Reardon & Marc Draisen, MAPC (Boston) Critter Thompson, Open Planning Tools Group

- How have networks and peer support programs improved scenario planning?
- What are the primary needs and barriers for agencies looking to adopt or improve scenario planning?
- How can we grow a more effective network to collaboratively improve scenario planning tools and practices?

2. What additional needs or improvements would you be looking for in a new tool?

Adoption of Scenario Planning Tools and Techniques

1. Do you feel the use of scenario planning tools is finally reaching a tipping point with regional agencies recognizing their benefits and using them?
2. What do you think would be most useful in encouraging more widespread adoption of scenario planning in regional decision-making?
3. What are the most important incentives or biggest barriers to overcome?

INTERVIEW QUESTIONS FOR AGENCIES WITH LIMITED EXPOSURE TO SCENARIO PLANNING

1. What is the mission and geographic scope of your organization?
2. What is the interaction between transportation and land use planning in your region?
3. How familiar are you with scenario planning and tools for performance-based planning?
4. To what extent have you used these tools in your agency?
5. What are some planning activities in your agency, where scenario planning tools would be useful?
6. Overall, how useful do you feel scenario planning tools and metrics would help your agency improve decision-making?
7. What are the most powerful and least compelling features of scenario planning tools?
8. Please describe how your agency manages issues of data access, data sharing, how to keep data updated when shared amongst agencies and jurisdictions, and whether there are costs involved for acquiring certain data sets?
9. What barriers persist and make it difficult to start using scenario planning tools? Do you have thoughts about ways to break through barriers related to policy, politics and/or technology?
10. Potential prompts for types of barriers: social (adequate staff), planning methods (not adopting/ understand/interest in scenario planning), financial (\$), leadership (other priorities), stakeholders (lack of interest among member cities/region), etc.
11. How can peer agencies and key partners help your agency get started with scenario planning?
12. Anything else you want to share?

Appendix E: Convening Agenda

The following document is the agenda and convening list prepared for the January convening.

2016 Convening of Regional Agencies:

Accelerating the adoption of scenario planning tools and techniques in regional planning

January 6-7, 2016

National Highway Institute Training Facility 1310 North Courthouse Road, Suite 300 Arlington, VA

Creating Great Places with Planning & Decision-Making

Great places have a combination of ingredients: committed people, strong infrastructure, and unique assets. But those aren't enough to secure long-term vitality, equity, and resilience. Truly successful places also proactively identify future challenges and opportunities, and use data-driven approaches to engage stakeholders, evaluate alternatives, and make smart decisions.

In a rapidly changing world, quality data and analysis tools are critical to helping cities and regions to identify trends, consider options and improve decision-making. The Federal government, along with many state and regional agencies, are investing in robust data sets and scenario planning tools that can improve planning at all scales. These modeling and analysis tools combine geographic information, visualizations, economic and other variables, and outcome metrics. When used with accurate and detailed regional or local data, they have the potential to improve stakeholder engagement and the transparency and mechanics of planning.

Programs like the HUD/EPA/USDOT Sustainable Communities Initiative (SCI) helped accelerate the development and diffusion of scenario planning tools and techniques. Adoption is increasing and many organizations now routinely use scenario planning tools and processes, but these valuable techniques have not spread as quickly or as efficiently as is needed. Scenario planning still requires significant expertise, as well as significant time and resources to obtain the required data and effectively run and process the applications.

A network of regional agencies -- with the support of the National Association of Regional Councils (NARC), Federal Highway Administration (FHWA), TransitCenter, and Summit Foundation -- has come together to accelerate the adoption and deployment of scenario planning tools. Together, we want to lower the barriers to entry, set strong guidelines for high-quality data and applications, design an effective delivery network for getting planning support systems up and running, and provide technical assistance on adopting and improving the use of scenario planning.

The goals of this convening are to build relationships among agencies and practitioners that currently use scenario planning tools, identify barriers and strategies for improving the field of scenario planning, and develop a road map for increasing adoption.

AGENDA

WEDNESDAY, JANUARY 6, 2016 | DAY 1

- 8:30 AM **Check-in/ Coffee Networking**
- 9:00 AM **Welcoming Remarks**
Welcome: Leslie Wollack, NARC
Purpose of Convening: Erich Zimmermann, NARC
- 9:15 AM **Setting the Stage**
Synthesis Document Key Findings: Ken Snyder, PlaceMatters
- Overview of tools currently in use by COGs and MPOs
 - Greatest barriers to use
 - Top recommendations for increasing adoption and improving performance
- 9:30 AM **Plenary: Making a Game Plan!**
Expert analysis of the state of the field and potential solutions. These conversations will inform track selection.
- 10:25 AM **Developing a Game Plan**
- Structure of tracks and expected roles and responsibilities
 - Key desired outcome: Identify barriers and strategies for improving the field or scenario planning, and develop a road map for increasing adoption
- 10:40 AM **Breakout Working Session 1: Laying the Groundwork**
See attached position statement for preliminary focus and key issues in each track. Tasks:
- Vetting the position statement: Does the group agree with the theory of change statement? Does it identify the key problems that need to be addressed?
 - How do we increase accessibility of scenario planning tools and support proliferation through technological and procedural improvements to the field?
 - Brainstorm all potential solutions/ideas. Please do not critique or discuss solutions - just list all possibilities.
- 12:30 PM **Working Lunch (provided on site)**
We will call on tables to report out on their first track session by 1 PM, followed by remarks from TransitCenter, Summit Foundation & FHWA
- 1:00 PM **Report-Outs and Partnership Welcome**
Report-outs facilitated by PlaceMatters
Partnership Comments
- Dave Harris, Federal Highway Administration
 - David Bragdon, TransitCenter
 - Darryl Young, Summit Foundation
- 1:30 PM **Breakout Working Session 2: Key Strategies**
Goals:
- Organize your list of ideas. You may organize by type of support or resource needed, type of organization that would most benefit, feasibility, or other characteristics.
 - Prioritize top ideas for further vetting.
 - Which ideas would have the biggest payoff?
 - Which ideas should occur first? Which would come later?
 - Identify top 1-3 ideas to share out to group

- 3:00 PM **Full Group Report Out**
Goals:
- Share top 1-3 strategies/ideas to pursue. Explain the strengths, shortcomings and concerns for the topic.
 - Discuss ideas shared and opportunities for collaboration to ensure success.

3:50 PM **Summary of the day and what to expect tomorrow**

4:00 PM **Adjourn Day 1**

THURSDAY, JANUARY 7, 2016 | DAY 2

Building off of conversations and learning in day one, the second day's activities will focus on priority action steps by establishing a blueprint for future activities. By the end of the day, we will seek to have agreement about steps needed to increase the use of scenario planning tools and decrease burdens for users.

8:30 AM **Recap of previous day outcomes and goals for today - NARC and PlaceMatters**

8:45 AM **Breakout Working Session 3: Creation of Draft Action Plan and Next Steps**

Goals:

- Identify the next steps for your ideas/solutions.
- What are the actionable items that should happen next to keep momentum going?
- What resources should be allocated? What funding can we seek?
- What agencies or organizations should be involved?

11:45 AM **Lunch (provided on site)**

- 1:00 PM **Full Group Report Out**
- Discussion of the process to complete identified desired outcomes
 - A definition and understanding of next steps and the various roles regional agencies, Federal Partners, and funders can take on to implement the action plans
 - Identify entities/individuals to complete immediate next steps
 - Over the next 6 months, a report prepared by NARC and PlaceMatters will document the results of the discussion and research on the current landscape of the scenario planning industry; future considerations regarding interoperability; identification of existing data sources that can be used in scenario planning; and recommendations as to how data availability and consistency can be improved.

2:00 PM **Adjourn Day 2**

TRACK ONE: UNIFIED PUSH FOR CHANGE

Theory of change

A handful of regions and high-capacity agencies have made major progress in applying data and scenario planning tools to regional decision-making. Through countless hours of research, experimentation and on-the-ground experience, a number of their staff members have become experts in the field of scenario planning and have developed highly-customized tools and processes to meet their planning needs. Ironically, that customization may also be one of the main barriers to the wider adoption and improvements of scenario planning. As a network of regional agencies and Federal Partners, we need a consolidated approach and a unified game plan to get other regions using tools that are standardized enough to be comparable, functional, and effective in creating more sustainable and vibrant regions.

As we formulate a unified strategy moving forward, we must consider tools, data standardization, common metrics, and deployment. Characteristics of a preferred platform for scenario planning include:

- Usability – for agencies conducting planning and analysis processes; for conformity to regulations, and for policy makers, stakeholders, and advocacy organizations;
- Consistency – data and analytics that make it possible to compare results across the country;
- Scalability – potential for application at different scales, showing the interrelationships between actions at the neighborhood, district, city, and regional scales and how they fit with state and national programs;
- Interdisciplinary connections – ability to show how specific issues (e.g. transportation funding, land use patterns) affect outcomes in other areas (e.g. equity, public health, climate change, water use);
- Open source design and interoperability – tools must be widely available, transparent in methodology and easily combined with other tools and techniques; and
- Common metrics – each of the topic areas should use the best available methodologies while supporting consistency and usability

Components of an action plan

The potential benefits of accomplishing this are unprecedented and exciting, including:

- Moving toward common standards for data and scenario planning platforms;
- Developing data and analytical standards that allow for comparisons among regions and states;
- Enabling Federal, state and regional entities to effectively collaborate on performance-based planning and decision-making;
- Integrating decision-making across transportation, housing, land use, air quality and many other critical public policy issues; and
- Broadening the pool of people who can constructively and effectively influence public policy decisions.

TRACK TWO: CULTIVATING COLLABORATION AND CREATIVITY

Theory of change (Goal statement)

To create a collaborative framework for planning agencies to work together to produce high caliber applications of scenario planning, build regional capacity, and foster innovation around the creation of new tools, data platforms, and techniques for neighborhood, municipal, and regional scale planning.

Feeder questions

1. How can we improve how we support peer agencies in the adoption of best practices?
2. Should we create a more formal technical assistance network to provide services to other regions, helping them achieve full capacity more quickly? If so, how should it be structured?
3. What are the potential advantages and pitfalls of regional agencies incorporating fee-for-service mechanisms into their operations to pay for high tech services offered to member jurisdictions, developers, and/or outside regions/municipalities?
4. Looking at the emergence of quasi-open source scenario planning tools, are Federal efforts to favor open source the solution or the problem?
5. How can Federal agencies support open-source platform user groups and developer groups to accelerate the development of tool improvements and the deployment of tools?

Appendix F: 2016 Convening Attendee List

Regional Agency	Who	Email
Sacramento Area Council of Governments	Gordon Garry	ggarry@sacog.org
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Appendix G: Literature Search

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Appendix H: Acknowledgements

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- Delaware Valley Regional Planning Commission
- Denver Regional Council of Governments
- Flagstaff Metropolitan Planning Organization
- Lincoln Institute of Land Policy
- Metropolitan Council
- Miami Valley Regional Planning Commission
- Mid-America Regional Council
- Mid-Ohio Regional Planning Commission
- Omaha-Council Bluffs Metropolitan Area Planning Agency
- Sacramento Area Council of Governments
- San Joaquin Council of Governments
- San Luis Obispo Council of Governments
- Southeastern Wisconsin Regional Planning Commission
- Southern California Association of Governments
- Spokane Regional Transportation Council
- Triangle J Council of Governments
- Uri Avin
- Wasatch Front Regional Council
- Yakima Valley Conference of Governments
- Yuma Metropolitan Planning Organization

