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A Spectrum of Approaches

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ABSTRACT

Problem, research strategy, and findings: Despite growing interest by practitioners in using exploratory scenarios within urban planning practice, there are few detailed guidelines for how to do this. Through the discussion of five case examples, we illustrate different approaches to linking exploratory scenarios to different planning contexts. We conclude by observing that to directly inform a plan, regardless of the specific approach taken, exploratory scenarios in urban planning must incorporate stakeholder values and not only rely on expert judgment and analysis.

Takeaway for practice: Exploratory scenarios are effective for analyzing uncertainty within a planning process. However, exploratory scenarios can be incorporated into planning practice in different ways, ranging from workshops among experts that aim to cultivate general learning to complex projects that result in highly detailed scenarios and recommendations for plans. Practitioners can draw on the cases we present to inspire planning methods for particular projects, taking into account specific contexts and goals.

Keywords: case research, planning methods, reflective practice, scenario planning, uncertainty

Although the broader concept of a scenario as a depiction of a hypothetical future has a long history in planning, in recent years, interest has grown in scenario planning methods among urban planning practitioners engaged in forms of long-range planning (Bartholomew, 2007; Chakraborty & McMillan, 2015; Myers & Kitsuse, 2000). Originally inspired by methods developed for corporate strategic planning, scenario planning specifies that planners should create multiple plausible scenarios through a prescribed sequence of steps, instead of using either a single preferred vision or a forecast as the basis for planning (Avin & Dembner, 2001; Chakraborty & McMillan, 2015; Hopkins & Zapata, 2007; Xiang & Clarke, 2003; Zapata & Kaza, 2015). Most projects conducted using scenario planning methods in urban planning have aimed to define a preferred, or *normative*, scenario. Recently, practitioners have moved beyond normative scenarios toward using scenarios to explore a wider range of uncertain futures, which is known as *exploratory* scenario planning. However, this shift has resulted in a wide array of approaches for where and how to use scenarios. Here we describe a spectrum of approaches for using exploratory scenarios through five case studies from diverse contexts.

The cases show how exploratory scenarios typically do not directly result in plans, except for two cases that

engaged with stakeholder values. Current models of exploratory scenario building from the corporate world do not provide guidance about how to do this. We therefore recommend practitioners adapt exploratory scenario planning methods in ways that tailor them to the needs of planning by anchoring them in specific goals and values.¹ We conclude by recommending planners construct scenarios when there are appropriate empirical conditions and project resources and there is adequate support from key stakeholders. The resulting scenarios, even those that describe current trends, should be based on careful analysis, demonstrate internal consistency, and be clearly organized. Plans can then describe the decisions and actions that head in the direction of a desired exploratory scenario but do not pick a preferred scenario because they are based on unpredictable outside forces.

The remainder of the article is organized as follows. In the Background section we discuss scenario planning practice in greater detail. In the Methods section we describe the case research conducted and broader idea of reflective practice that provides the research approach used. The Results contain brief descriptions of the five cases, highlighting their diverse applications of exploratory scenarios. In the Discussion, we comment on cross-cutting themes from among the cases and provide suggestions for practitioners and scholars on how to advance scenario planning practice.

Background

Normative and Exploratory Scenario Planning

Using scenarios to define a preferred land use transportation plan, often at the regional scale, is well established in the United States (Bartholomew, 2007; Federal Highway Administration [FHWA], 2011; Oregon Department of Transportation, 2013) and in some European countries like The Netherlands (Salewski, 2012). Notable U.S. projects in this tradition include LUTRAQ (1000 Friends of Oregon, 1997), Envision Utah (Matheson, 2011), the Sacramento Region Blueprint Plan (Allred & Chakraborty, 2015), and Cleveland (OH) region's Vibrant NEO (Hexter & Kaufman, 2017). We call this main tradition in scenario planning *normative* because it focuses on creating a scenario that describes a desired future. In addition to the preferred scenario, normative projects typically contain scenarios illustrating competing visions for the future or futures resulting from current trends. Normative approaches to scenario-based planning tend to assume a larger degree of control and influence to realize the desired plan and often do not fully address uncertainties about how the future will unfold (Abbott, 2005; Wiechmann, 2008). For example, such projects typically include a preferred land use pattern and set of transportation investments but do not address what to do if future growth or transportation funding does not meet scenario assumptions.

More recently, however, practitioners have begun experimenting with a different way to use scenarios, which creates scenarios that reflect possible futures separate from whether project stakeholders think they are desirable. The purpose of using scenarios in this way is to explore and prepare for uncertainties such as the amount of economic growth, effects of climate change, and the introduction of new technologies. We acknowledge there is a long tradition in urban modeling of creating alternative urban growth scenarios (e.g., Li & Yeh, 2000). However, our focus here is on professional projects that begin with the creation of qualitative scenarios through group discussion of uncertainties and only then use analytical tools to model various aspects of the scenarios that have been created. For simplicity we call this category of professional projects *exploratory scenario planning*, adopting the term proposed by Marlow et al. (2015). Chakraborty et al. (2011) propose that using scenarios in this way allows practitioners to create plans that identify decisions that are *robust* (meaning they perform well under different scenarios) or *contingent* (only perform well under some scenarios).

Challenges of Exploratory Scenarios in Urban Planning

Executing exploratory scenario planning projects differs from the better-known normative approach because it

requires a different project structure and mindset. The process of creating exploratory scenarios is often more time consuming and complex than normative scenarios and requires integrating factors across a broad range of topics and making decisions about how scenarios are to be defined and then used. Exploratory projects also place greater emphasis on learning (Goodspeed, 2017). This division between exploratory and normative scenarios was explicitly accepted in the recent FHWA report *Next Generation Scenario Planning: A Transportation Practitioner's Guide* (Ange et al., 2017), a sequel to the agency's 2011 report (FHWA, 2011). This report divides scenario planning into *decision support* (normative) and *information* (exploratory) projects and suggests that professionals must make an upfront choice between these two options. We revisit and question this divide in our Discussion and Conclusion.

Much of the existing literature on exploratory scenario methods is drawn from the world of corporate or organizational planning, which differs in important ways from the field of urban planning (Ralston & Wilson, 2006; Ramírez & Wilkinson, 2016; Van der Heijden, 2005). In particular, urban planning practitioners must address two issues not present in corporate settings. First, unlike in business where exploratory scenarios are almost always created to inform the strategy of an individual company with a clear mission, professional planning practice involves diverse societal and professional goals and may use exploratory scenarios to analyze specific decisions, to inform more concrete subsequent planning, or as a method to write a plan. Second, because exploratory scenarios seek to conduct an objective analysis of external trends, values are often considered less important in exploratory versus normative scenario projects.

Methods

Repertoire-Building Research in Reflective Practice

Our perspective here embodies the concept of *reflective practice*, a theory of how practitioners can create new knowledge (Schön, 1983). In contrast to conventional science, reflective practice describes the process of how knowledge can be created by professionals taking action and reflecting on the results, not only by independently conducted research studies. Selecting appropriate professional methods is an example of practitioner knowledge because it is context specific and relies on tacit knowledge. Schön (1983) proposes four types of knowledge-creating research that can enhance practitioners' capacities for reflection-in-action. Among these four, our study is an example of *repertoire-building research*, which "serves the function of accumulating and describing" practice exemplars that broaden practitioners' repertoire of possible actions and approaches (Schön, 1983, p. 315). As

repertoire-building research, our primary purpose here is to illustrate and analyze competing approaches so practitioners can incorporate their ideas into their practice. However, because it is not conventional social science research, we do not conduct a formal evaluation of the success or failure of these cases, use a multivariate analysis, or propose general theories.

Identifying and Documenting Exploratory Scenario Planning Cases

Our decisions about case selection, research, and reporting flow from this particular approach to research, not from the norms of case research established in the social sciences that develop or test generalizable theories. We selected the five cases from a larger list of cases through extensive deliberations because they are well documented and provide useful illustrations of contrasting ways of using exploratory scenarios (Table 1).

We selected cases to serve as illustrations of the method and explore its usefulness in different settings. As relevant, we note aspects of the cases such as the scale and scope of the project, analysis tools used, the time and resources available, and other particular factors such as the history and planning culture of the context. However, our primary focus here is on the logic of the scenario methods used.

The five cases we selected, along with their sponsors, are 1) Winning the Future (Atlanta [GA] Regional Commission), 2) Freight Futures (National Cooperative Highway Research Program), 3) Connections 2045 (Delaware Valley Regional Planning Commission), 4) Gwinnett County Unified Plan (Gwinnett County [GA]) and 5) Central Western Communities Sector Plan (Palm Beach County [FL]). Three of the cases (1, 4, and 5) involved one of us (Uri Avin) as a practitioner and are examples of reflection-in-action because in each case we applied scenario methods in somewhat different ways to different settings and observed their results firsthand. For each case, we carefully reviewed the project final plan and supplementary materials. In addition, we conducted five interviews with each of the projects' leaders using an interview protocol with standard and project-specific questions. To facilitate case comparison, Figure 1 contains flowcharts that summarize each case's use of scenarios.

A Spectrum of Approaches to Exploratory Scenarios in Urban Planning

Before presenting the cases, we briefly explain the general way the professionals involved in all of these projects created exploratory scenarios, allowing the case descriptions to emphasize how the scenarios are integrated into the planning process.

Constructing Exploratory Scenarios

The methodology most frequently used to develop exploratory scenarios in urban planning is based on the process popularized in the 1990s by the founders of the now-defunct consulting firm Global Business Network (GBN; this approach is described in detail in Ralston & Wilson, 2006; Van der Heijden, 2005).² At a very high level of generality, the process includes four key steps: 1) brainstorming and discussing key trends, constraints, and issues; 2) identifying driving forces, categorizing them as assumptions or uncertainties, and rating their degree of uncertainty and impact; 3) selecting the driving forces with the most uncertainty and highest potential impact to serve as the basis of the scenarios; and 4) building the scenarios based on the driving forces.³

Volume 1 of a multipart publication by the National Cooperative Highway Research Program on strategic issues facing transportation, known as Report 750, includes a recent illustration of this methodology (Caplice et al., 2013). This report, authored by two Massachusetts Institute of Technology researchers, contains one of the clearest and most systematic expositions of the GBN methodology applied to an urban planning issue, so we use it here to illustrate the method in greater detail.

The scenarios, which address the future of freight transportation, were created using the "scenario axes" technique, which is a standard method for developing scenarios (Ramirez & Wilkinson, 2014). The scenarios differ along two primary axes—the nature of future trade (global versus regional) and resource availability (scarce versus adequate)—but they incorporate many more factors in their construction, as Table 2 shows. In keeping with the GBN method, once the corresponding level (probability and impact) for each driving force has been selected, a written narrative is developed for each scenario, describing worlds that consistently and persuasively combine these characteristics.

All exploratory scenario-generating processes result in similar summaries of how uncertain driving forces are used to define scenarios. Often the scenarios are further developed through quantitative impact models. Clearly, however, the kind of future narratives represented in this project are still very far removed from detailed, prescriptive, and concrete planning documents used by urban planners and other urban stakeholders involved in long-term decisions.

In earlier work, one of us proposes a methodology for incorporating exploratory scenarios in the process of creating urban plans (Avin & Dembner, 2001). This methodology proposes complementing the exploratory scenario-building steps from the business methods with additional stakeholder input steps concerning values and goals. Although this model has attracted some interest in the planning field and one of us

Table 1. Overview of selected and other considered cases.

| Project sponsor; name (year) | Geographic scope | Purpose | Digital model(s) | Rationale for inclusion/exclusion |
|--|--|--|---|---|
| Selected cases | | | | |
| 1 Atlanta Regional Commission; Winning the Future (2015–2017) | Atlanta (GA) region: 11 counties and Atlanta; 4.5 M pop. | Prepare for regional development plan update with federal grant support | RSPM; REMI; Impacts 2050; Regional Travel Model | True exploratory scenarios well documented and model supported |
| 2 NCHRP Report 750; Freight Futures (2013–2015) | United States | Produce national scenarios for state DOTs to consider | None | Very well-documented, rigorous, qualitative process with strategic insights applied |
| 3 Delaware Valley Regional Planning Commission; Connections 2045 (2014–2016) | Philadelphia region: 9 counties; 5.7 M pop. | Prepare for regional development plan and long-range transportation plan by metropolitan planning organization | Impacts 2050; RPAT; Regional Travel Model | Well-documented process supported by modeling |
| 4 Gwinnett County, GA; Gwinnett County Unified Plan (2006–2008) | Gwinnett County: 430 mi ² , 790,000 pop. | Produce a comprehensive plan, transportation plan, and consolidated housing plan | Land use/environment allocation, transportation, fiscal and sewer models | Well-documented process in implemented plan |
| 5 Palm Beach County, FL; Central Western Communities Sector Plan (2001–2007) | 90 mi ² area in rural transition; 41,000 pop. | Create sector plan to guide development | Land use/environment allocation, transportation and fiscal models | Well-documented process with explicit stakeholder value inclusion |
| Other cases considered | | | | |
| 6 University of Washington, Urban Ecology Research Lab; Puget Sound Future Scenarios (2008) | Portion of region as focused within city of Seattle (WA) | Think tank exercise to inform future policies | Numerous GIS and environmental models | Well-documented, rigorous, extensively modeled scenarios, rather internally focused, weak link to urban planning |
| 7 La Paz, Baja California Sur, Mexico; Carl Steinitz et al.; Alternative Futures (2006) | Tourist–ecological city and its hinterland | Plan for impending policy choices in face of rapid growth | Primarily GIS spatial analysis overlay techniques | Scenarios included normative orientation allowing for plan decision, limited documentation, weak link to urban planning |
| 8 National Center for Smart Growth, University of Maryland; Prospects for a Sustainable Region Tomorrow (2018) | Baltimore–Washington region; 9 counties, 2 core cities; 6 M pop. | Internal think tank exercise with technical experts to influence policies | Suite of land use change, transportation, and environmental impact models | Well-documented, rigorous, extensively modeled scenarios; project not yet complete, primarily academic study |
| 9 City of Denver, Lincoln Institute, and Sonoran Institute; Denveright (2018) | City of Denver (CO) | Foster learning and discussion among staff and consultants before launching comprehensive plan | Some infrastructure testing | Charrette-based process; incomplete documentation, limited stakeholder involvement |
| 10 City of Sahuarita (NM), Lincoln Institute, and Sonoran Institute (2018) | City of Sahuarita (NM) | Test comprehensive plan against uncertain futures | None | Rigorous qualitative process; yielded strategic insights; incomplete documentation, conducted after plan created |

Note: NCHRP = National Cooperative Research Program; DOT = department of transportation; RSPM = Regional Strategic Planning Model; REMI = Regional Economic Models, Inc.; RPAT = Rapid Policy Analysis Tool; GIS = Geographic Information Systems.

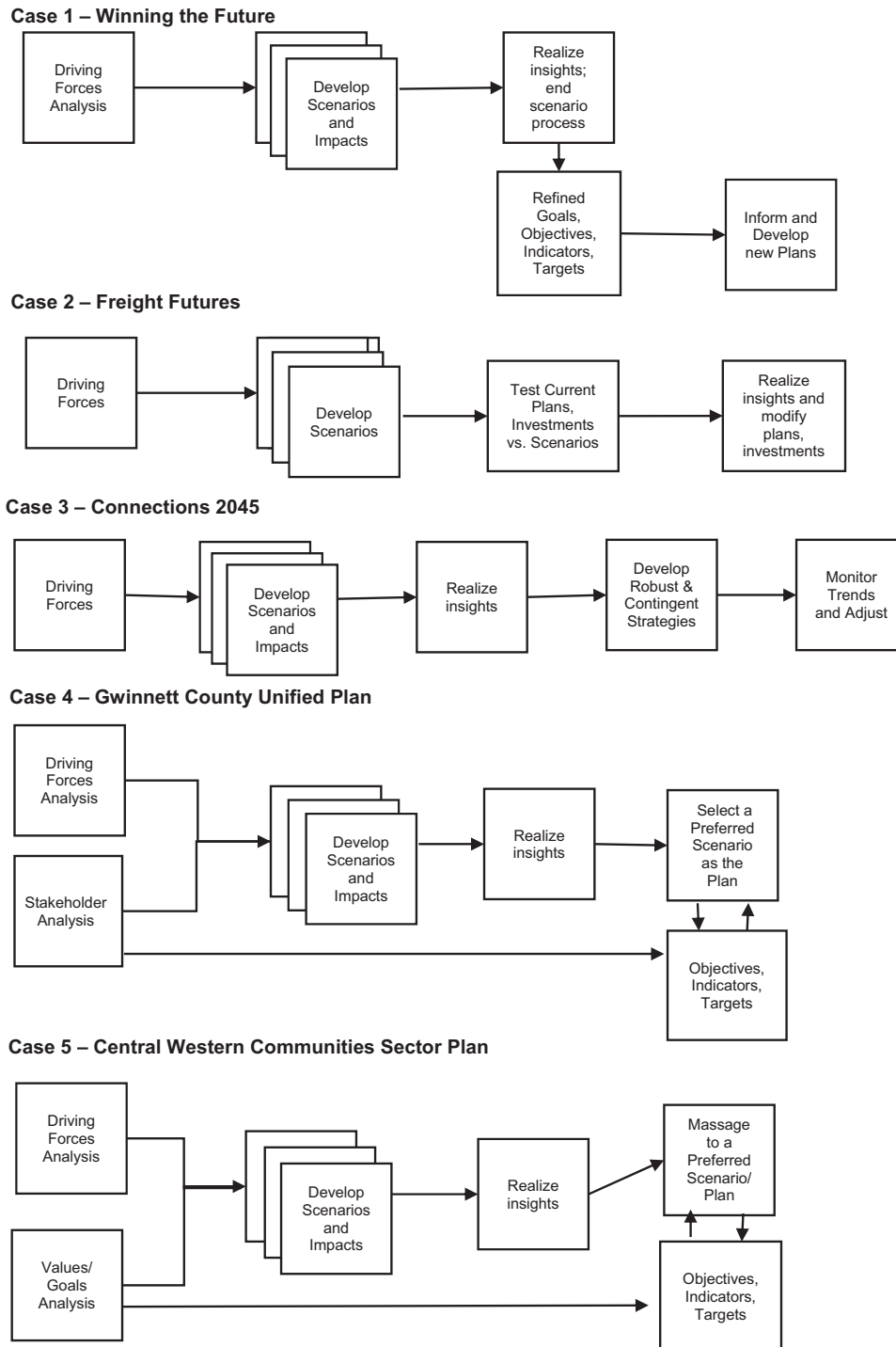


Figure 1. Case study scenario planning approaches.

(Avin) has used it to organize some projects, most scenario projects are constructed differently around the simpler GBN process, and Avin has not used it for all scenario projects. One drawback of the model is that it is perceived as overly complex and elaborate and therefore difficult to implement unaided. Another drawback is that it tends to result in a set of value-

driven scenarios, one of which may be the basis of a plan, when many practitioners are interested in using exploratory scenarios in different ways. For example, many planners may seek to create scenarios to formulate a set of strategies or actions or understand the performance of strategies across a set of future scenarios. The cases we describe below therefore do not

Table 2. Summary of major driving forces used by the Freight Futures project.

| Driving forces | Scenarios | | | |
|----------------------------------|-------------------------------|-----------------------------|--------------------------|---------------------------|
| | Naftasitique! | One World Order | Global Marketplace | Millions of Markets |
| Global trade | Low | High | High | Low (physical) |
| Resource availability | Low | Low | High | High |
| Energy cost level | High | High | Low | Low |
| Energy cost variability | Low | High | High | Low |
| Level of environmental awareness | Same as today | High | Low | High |
| Population dispersion | Growth in SW | Growth in biggest cities | Growth in biggest cities | Rise in mid-tiered cities |
| Energy sources | Majority NA | Mix of foreign and domestic | Majority foreign | Majority domestic |
| Level of migration | High within bloc, low between | High | High | Low |
| Migration policy | High | High | Low | Low |
| Currency fluctuations | Low within bloc | High | Moderate | Low |

Source: Caplice et al. (2013). Used with permission of the Transportation Research Board, from permission conveyed through Copyright Clearance Center, Inc.
Note: NA = North America, SW = Southwest.

fit neatly within this model. We revisit the model in light of the cases in the Conclusion.

Next, we describe the cases in order of increasing complexity. They range from projects where exploratory scenarios are created as a largely independent learning exercise separate from the development of specific plans and recommendations, to projects where exploratory scenarios are embedded within the structure of a detailed plan. Each case description contains the types of scenarios created, the technical tool(s) used, and how the scenarios were incorporated into the broader planning process.

CASE STUDY 1: WINNING THE FUTURE (ATLANTA REGIONAL COMMISSION)

Well-crafted scenarios can illuminate the future and provide a new level of insight about what may occur and thus open the minds of project participants about current ways of thinking. Especially if the scenario impacts are described and analyzed in credible ways, scenarios can sharpen and inform debates about addressing the future, uncovering the range of community priorities and values. Beyond this, the insights gleaned from the analysis can set the stage for identifying community goals, objectives, and targets in preparation for developing a new or updated plan that responds to these and, ultimately, to the political process. The recent scenario project by the Atlanta Regional Commission (ARC), with some consultant assistance, exemplifies this type of project. Its primary steps are shown in Figure 1.

ARC has a long history of normative scenario planning supported by extensive modeling capacity, illustrated by scenarios analyzed in their recent regional transportation plan (ARC, 2019). Their many regional

visioning efforts have yielded some important local planning projects supported by ARC funding but little in the way of regional change in the direction of their smart growth visions. Rather than repeat this type of project, ARC committed to an exploratory scenario process in 2014 to understand what an uncertain future might mean to their region's economic competitiveness, still feeling the effects from the Great Recession.

Over an 18-month period, supported by a grant from the Strategic Highway Research Program, three to four full-time staff conducted a largely in-house effort to define plausible futures and assess their impacts on the region. This project, called "Winning the Future: Sharpening Our Focus," was rigorously structured and supported by various traditional as well as innovative modeling tools (ARC, 2018). Their primary tool, the Regional Scenario Planning Model, focused on policy options for transportation and related air quality impacts and is part of the new VisionEval suite of tools developed by the Oregon Department of Transportation (Gregor, 2015). The tools had a very generalized set of land use types or categories and reported indicators in aggregate terms for the region. We summarize details about the driving forces considered and resulting scenarios in the [Technical Appendix](#). The scenarios created as part of this project are not intended to be directly incorporated into a more specific planning document, such as ARC's federally mandated regional transportation plan. Instead, it was intended to highlight key trends, issues, and tradeoffs that may shape their next regional development plan.

Although the scenario narratives and assumptions were rich and integrated, the modeling used to test their impacts was limited to only a half dozen transportation-related outputs, illustrating the common

problem of a mismatch between typically broad narratives and narrowly defined modeling capacities. This project is an example of a well-documented, vivid, and graphical exploratory scenario effort that other metropolitan planning organizations may profitably study.

CASE STUDY 2: FREIGHT FUTURES (NATIONAL COOPERATIVE HIGHWAY RESEARCH PROGRAM)

In this example, exploratory scenarios are used to vet current plans, policies, and investments in the hope of realizing insights that suggest modifications to make them more resilient to change, such as by thinking of them as having more or less robust or contingent elements or identifying missing elements needed in the light of the scenarios. This case study describes the use of the Freight Futures scenarios, introduced previously and summarized in the Technical Appendix, to assess specific transportation policies and projects (Figure 1).

The authors (Caplice et al., 2013) test the value of their scenarios by having officials from six state departments of transportation assess their own freight planning policies, strategies, and projects grouped into various categories (i.e., as connectors, corridors, and gateways) against their four scenarios described earlier. Participants reported the scenarios helped them realize significant insights. These resulted in important modifications to the different state transportation plans and investment priorities. Table 3 summarizes the various agency initiatives generated by these workshops in response to the prompt, “What kinds of specific initiatives should they take to prepare for these future scenarios?” Though not presented as such, this list of initiatives suggests, in fact, a set of strategies (varying by agency) that are important components of a national agenda for robust and contingent freight planning in the face of uncertainty.

Note that although very rigorous procedurally, this exercise is essentially qualitative and expert driven. The scope of the project is also limited to freight futures planning, and the stakeholders were knowledgeable professionals well aware of their agency missions and goals. In these ways, the process used is a top-down, technocratic one.

CASE STUDY 3: CONNECTIONS 2045 (DELAWARE VALLEY REGIONAL PLANNING COMMISSION)

Despite the strong theoretical argument for using exploratory scenarios to generate robust and contingent plans, we were hard pressed to find any bona fide examples that adequately demonstrated this approach. Many efforts seem to struggle to link the scenarios to concrete decisions. We identified one well-documented case that moves in this direction. The Delaware Valley Regional Planning Commission (DVRPC) Connections 2045 plan was conducted over about 18 months by 1.5

to 2 full-time staff, and it included a scenario analysis the agency called Future Forces (DVRPC, 2016).

This project was conducted as part of a 2-year, in-house, modeling-intensive effort to lay the groundwork for a new regional transportation plan for the greater Philadelphia (PA) region. It was led by a group convened by a sponsoring agency called the Greater Philadelphia Futures Group, including experts in economics, land use, the environment, public health, transportation, and technology. This group identified a number of critical driving forces for their region whose impacts they wanted to test. They treated these individual driving forces as scenarios, even though they did not constitute integrated narratives of the future and therefore do not resemble the scenarios created by the GBN method described above (see Figure 1). A summary of the five scenarios produced is in the Technical Appendix.

These scenarios were quantified and tested for selected impacts (primarily transportation related) via a systems dynamics-type model called Impacts 2050, also a product of one of the National Cooperative Highway Research Program Report 750 series that focused on demographic changes affecting travel behavior (Bradley & Fox, 2014).⁴ The driving force/scenario impacts and the robust (third column in Table 4) and contingent actions (second column in Table 4, which selects just one important contingent action) illustrate the outcomes from this process.

The robust strategies, identified here as “universal actions,” read as a rather general set of guidelines. It is clear that only some of them were inspired by the impact modeling, whereas most are really general observations arising from the process. The DVRPC views the insights from Future Forces as a resource for their next long-range plan, now underway, in which they anticipate developing more complete scenarios for testing and insight. They are contemplating using UrbanSim as their land use model, upgrading Impacts 2050 and adopting VisionEval’s regional scenario planning model (previously called RSPM) to enhance their next effort. Other projects we are aware of that sought to use exploratory scenarios to derive robust and contingent actions also resulted in only very general prescriptions.

CASE STUDY 4: GWINNETT COUNTY UNIFIED PLAN (GWINNETT COUNTY)

This example moves closer than the previous ones to the development of a plan based on scenario testing, insights, and the definition of robust and contingent strategies. As a result, the plan’s body fully documents the scenarios that were created, rather than relegating them to appendices as is usually done, and it retains two contrasting scenarios as worthy of serious consideration. In the end the plan is based on the scenario

Table 3. Summary of initiatives proposed at visioning workshops corresponding to different scenarios.

| | | MNDOT | WSDOT | POLB | GDOT | No. |
|---|-----|-------|-------|------|------|-----|
| Develop or improve intermodal connections: Improve capacity of intermodal exchanges, improve interoperability via policy changes and technology, create regional logistics hubs, etc. | GM | X | X | X | | 11 |
| | MM | | X | | | |
| | N! | X | X | X | X | |
| | OWO | X | X | | X | |
| Create freight-only lanes: Create dedicated truck lanes on highways, separate passenger and freight transportation infrastructure, initiatives to take passenger traffic off highways, etc. | GM | X | | X | | 8 |
| | MM | X | X | | | |
| | N! | X | | | X | |
| | OWO | X | | X | | |
| Make regulations and standards to facilitate freight: Notional freight policy, repeal/revise Jones Act, improve goods flow across U.S.–Mexico border, fast-track environmental impact review process, standardize truck weights and sizes, etc. | GM | X | | X | | 8 |
| | MM | | | | X | |
| | N! | X | | X | X | |
| | OWO | X | | X | | |
| Increase highway capacity: Increase highway capacity, improve road conditions, streamline interchanges for commercial traffic, improve last-mile infrastructure, etc. | GM | | | | | 7 |
| | MM | X | X | | X | |
| | N! | X | X | | | |
| | OWO | | X | | X | |
| Expand rail capacity: Increase capacity, double-track, separate freight from passenger traffic, improve operations (increase speed, reduce variability), etc. | GM | | X | | | 6 |
| | MM | | X | | | |
| | N! | | X | | X | |
| | OWO | | X | X | | |
| Reduce environmental impact of transportation: Incentivize use of greener modes of transportation, identify environmental initiatives, etc. | GM | X | | X | | 6 |
| | MM | X | | | | |
| | N! | X | | | | |
| | OWO | X | | X | | |
| Improve capacity of waterways: Dredge waterways, build new locks along waterways, build new barge facilities, etc. | GM | X | | | | 5 |
| | MM | | | | | |
| | N! | X | | | | |
| | OWO | X | X | | X | |
| Land use: Reserve industrial land for industrial use, create multimodal zones for industrial use and long-haul distribution, simplify zoning process, etc. | GM | X | X | | | 5 |
| | MM | X | | | | |
| | N! | X | | | | |
| | OWO | X | | | | |
| Use information technology to improve freight flows: Implement demand management, implement technology to track and monitor cargo, use technology to charge for port usage, etc. | GM | | X | | | 3 |
| | MM | | | | X | |
| | N! | | | | | |
| | OWO | | | | X | |

Notes: MNDOT = Minnesota Department of Transportation; WSDOT = Washington State Department of Transportation; POLB = Port of Long Beach; GDOT = Georgia Department of Transportation; GM = Global Marketplace; MM = Millions of Markets; N! = Naftastique!; OWO = One World Order. The agencies involved in this exercise were MNDOT, WSDOT, POLB, and GDOT.

Source: Caplice et al. (2013). Used with permission of the Transportation Research Board, from permission conveyed through Copyright Clearance Center, Inc.

preferred by county officials that had the most positive fiscal outcome for the county, as well as other performance metrics. Figure 1 summarizes the major steps in this 3-year process.

Gwinnett County, northeast of Atlanta, had for decades been one of the fastest growing counties in the United States, fueled in part by White flight from the city of Atlanta. By 2006, when this planning effort

Table 4. Selected DVRPC Future Forces scenario consequences, scenario-specific actions, and universal actions.

| Scenarios | Consequences | Scenario-specific actions | Universal actions for all scenarios (selected) |
|--------------------------|---|--|--|
| Enduring urbanism | More gentrification and rising housing costs, particularly in urban areas, an increase in suburban municipalities with fiscal distress, and a loss of industrial land | Expand and increase service frequency through the transit system to meet increased demand | <ul style="list-style-type: none"> • Update zoning codes to allow for mixed-use infill development • Build lifelong communities that facilitate aging in place • Use green infrastructure and stream buffer ordinances to improve water quality |
| The free agent economy | Low-skilled workers may fall further behind, incomes may be less stable, and an increase in virtual education and telemedicine may weaken the region's two strongest economic sectors | Expand and support business incubators, small businesses, and workforce training programs | <ul style="list-style-type: none"> • Create regional or local big data team(s) to centralize and analyze data sets, guide decision making, and enhance government actions • Expand regional broadband infrastructure and internet access and training for low-income individuals |
| Severe climate | More extreme weather and emergency events, shortened infrastructure lifespans with greater risk of sudden failure, and negative health and wildlife habitat impacts | Reduce emissions and pursue climate adaptation strategies such as protecting vulnerable assets, updating building codes, and preserving agricultural lands | <ul style="list-style-type: none"> • Create an integrated, multimodal transportation network and a regional funding source to help pay for it |
| Transportation on demand | Increased suburban sprawl and congestion, with associated negative impacts to transit service and quality | Ensure that new transportation technologies and services are safe and accessible to all people | <ul style="list-style-type: none"> • Enhance freight and goods movement • Improve infrastructure resiliency |
| U.S. energy boom | Greenhouse gas emissions could increase, more air pollution would harm health, and cheap energy may delay the move to cleaner energy and more efficient vehicles, facilities, and equipment | Work with the goods movement industry to promote safety, clean air and water, and freight as a Good Neighbor initiative | |

Note: Summarizes scenarios described in DVRPC (2016).

began, Gwinnett was also a major magnet for international immigration. Although still thriving economically, the future seemed less assured than the past trajectory of rapid population and job growth and extensive and expensive transportation, utility, and services expansion. This 3-year, staff- and consultant-led project (Parsons Brinkerhoff) entailed a broad scope including a unified comprehensive plan, a comprehensive transportation plan, and a consolidated housing plan.

Rather than be limited to the 2 × 2 matrix of the traditional GBN approach, multiple driving forces were analyzed and consolidated into scenarios. To do this, a process of extensive public and stakeholder outreach resulted in 16 different driving forces. These included the quality of public education, number of jobs and population, and regional economic trends. These were analyzed to create three initial scenarios, which reflected plausible combinations of these uncertainties. The three scenarios were vetted and refined by technical and steering advisory committees. Note that the scenarios incorporate stakeholder values only implicitly, primarily emphasizing economic wellbeing.

The scenarios were tested via an array of impact models including land use, transportation, utilities, and, most important from a decision-making perspective, fiscal models. County leadership chose to discard further refinement of a “regional slowdown” scenario, not wishing to even explore such a negative future let alone present it as part of a planning process. Unfortunately, in 2007, just before the housing bubble burst, this was precisely the most relevant scenario to explore, demonstrating the crucial importance of convincing elected officials of the value of an exploratory approach. Although the “middle of the pack” scenario, based on recent growth trends, was presented as an equally plausible outcome as the more optimistic and interventionist “international gateway” scenario, county leadership elected to build on only the latter as the preferred plan.

Because 10 years have passed since the plan's adoption, we can consider it in a longer historical perspective. According to staff, departments were required to use the 2030 plan to support capital budgets, and it has served well as a guide (Nancy Lovingood, personal communication, August 22, 2018). The reality

economically, however, after weathering the Great Recession, has been a mix of the middle of the pack and the international gateway outcomes, and staff thus felt that the working through of both scenarios proved valuable. However, discarding the regional slowdown scenario robbed the county of potential insights about possible responses to a recession, which would hit the region hard soon after the plan's completion. The county is currently updating this plan, but the new version aims to build on the scenarios created in the 2008 plan described here and more narrowly focus on their updated implications given the impending build-out of the county. The final case study comes even closer to producing a bona fide scenario-based plan, and thus we provide a more detailed description of its evolution.

CASE STUDY 5: CENTRAL WESTERN COMMUNITIES SECTOR PLAN (PALM BEACH COUNTY)

Among the five cases, this project has had the longest and most storied life. Developed as the state's very first sector plan in the growth management era of Florida's planning history, the initial work by the consultant team WilsonMiller Inc. spanned 2000 to 2003. After that, staff took over the plan amendment process through 2005, when the county adopted it. Unable to reconcile the plan with the critique of Florida's Department of Community Affairs, the ultimate arbiter of plan acceptability at the time, the plan was then rescinded in 2007, having been undermined by interim piecemeal rezoning actions in a very turbulent, scandal-ridden political climate.

The roots of this volatile history are planted in the unusual land use patterns and populations of this unincorporated 80 mi² area, crisscrossed by water canals and unpaved roads and trails and adjacent to the Everglades. An eclectic mix of large citrus groves, trailer parks, equestrian properties, and suburban mansions characterize this area. This land use pattern did not really conform to the county's well-known managed growth tier system of 1999, which placed this heterogeneous mix of places and people into the rural and exurban tiers. The sector plan was to work out the tiers' internal contradictions and conflicts.

Given the multiple stakeholders implied by the land use mix and the lack of a clear idea of the area's future, the county and consultants chose to approach the challenge as an exploratory scenario exercise (Figure 1). Note that the process is identical to Gwinnett County's except for the important difference in the last box, which says, "Massage to a Preferred Scenario/Plan" rather than "Select. . . ." Extensive community surveys and meetings expanded the issues at hand and crystallized stakeholder attitudes. This also allowed staff and consultants to posit eight project-guiding principles that remained constant throughout the effort.

The [Technical Appendix](#) contains narrative thumbnails describing the three initial scenarios developed, each of which reflects distinct stakeholder values that complement selected driving forces. The guiding principles or goals, noted earlier, were operationalized via indicators produced by a series of models and tools: INDEX for land use and infrastructure, a fiscal model, and a transportation model; we include illustrative results in the Technical Appendix. In this case, the indicators are directly organized under different project goals to foster stakeholder consideration of tradeoffs among the scenarios.

A second round of public outreach and surveys reduced the initial set of scenarios (which also included a trends case based on current zoning) to two: "agricultural preservation" and "rural lands stewardship." After airing these, the final plan, called the Concept Plan Overlay, was created. On many of the indicators, the plan split the difference between the two scenarios but leaned more toward increases in commercial land uses and employment.

Despite the failure of the plan to reconcile with the position taken by the Department of Community Affairs and its allies, who supported more agriculture and less growth in this area, the scenario process had explored and analyzed less intense options in line with their preferences. After almost two additional years of pursuing an overlay option, in 2009 the county discontinued the effort altogether. Despite what was a failure in implementation, this exploratory process's success in moving from scenarios toward a specific plan warrants close examination.

Discussion

Our discussion of these cases is organized into three sections. First, we comment on the diverse ways these cases show exploratory scenarios can be incorporated into scenario planning practice. Second, we discuss how exploratory scenarios can be made more relevant for decisions through the careful integration of stakeholder values. Third, we provide a set of general advice for practitioners interested in using scenarios in the urban planning field.

The Diverse Uses of Exploratory Scenarios in Planning

On the strength of these illustrative cases, we discuss common themes among them related to the usefulness of exploratory scenarios. They are clearly very useful to gain insights into complex futures in their educational or informational role (as in the ARC case) for subsequent planning work. The cases also show scenarios can be useful in vetting current plans and investments (as in

the use of the freight futures scenarios). They produce only marginal success in yielding useful robust and contingent strategies (as the DVRPC case and others suggest). The fact that our examples were in regional, multijurisdictional contexts, whose scenarios contain limited spatial specificity and where implementation powers are fragmented, likely contributes to this finding. They evince mixed success in yielding strategies that, taken together, come close to a plan of action: In Gwinnett the most fiscally beneficial scenario won out as the preferred plan over others; in the Central Western Communities plan, a more nuanced process led to the eventual adoption of a sector concept plan containing a synthesis of stakeholder priorities. In both of these efforts, the identification of fiscal impacts was critical to elected officials taking the scenarios seriously. The notion of yielding a preferred plan out of exploratory scenarios, however, remains problematic in principle because by definition exploratory scenarios are typically constructed by explicitly including forces that are out of the hands of local stakeholders.

There is something mechanistic about the GBN scenario construction method that lends itself to a bloodless and technocratic process producing a set of scenarios that analyze and combine driving forces but leave out stakeholder values (or visions) as an inherent element of their construction. Unlike in business contexts, in urban planning there is rarely a clear, given set of shared goals other than at the most general level, among both elected officials and their constituents. Below that level, goals and values are actually revealed in the tradeoffs made when facing hard choices over specific issues. Thus, once specific stakeholder values also inform and shape the particular scenarios, as in Central Western Communities, stakeholders and elected officials have a tangible product that can touch people's hearts as well as minds. In effect, one is carefully splicing into the scenarios an element of visioning. This is the most understandable and direct way to communicate and work through scenarios in the politicized forums that all planning decisions involve. Soliciting and integrating stakeholder values into the urban planning exploratory process is thus an important corrective needed in the exploratory process.

This value-integrating scenario crafting process is a difficult and creative one for which digital planning support systems are of little use because it relies instead on a cycle of brainstorming and critical reflection. A good example of working through this process to create plausible, value-informed scenarios is one Keeler (2014) creates for water resources scenarios, where numerous stakeholder groups were included in several focus groups to vet the scenarios' coherence from their perspectives, resulting in important correctives.

Toward Exploratory Scenarios for Decision Making

Early in this study we raise a core question about the nature of exploratory planning approaches. Should their use for decision support versus information provision be viewed as separate categories, or do they describe a spectrum of approaches? We believe that the illustrative cases—which move from the one end of the spectrum to the other—demonstrate that this divide is artificial. But it also appears to us that a key aspect of successfully bridging this potential divide is constructing scenarios that explicitly include stakeholder values rather than only applying a narrow or mechanical analysis of driving forces using the management methods. This continuum also seems to relate to a hierarchy of effort and outcomes. It seems that pushing toward the identification of robust and contingent actions and the creation of specific actions is greatly facilitated and strengthened by the creation of more concrete and specific scenarios, often done through some form of quantitative modeling. This allows the testing of specific actions within the scenario mix that allow some analysis of impacts and tradeoffs, as the illustrative cases suggest.

There remains a clear need to document such ongoing efforts and to push the limits of the methodology if planners are to sustain the use of what is clearly a more taxing and difficult process than the more typical approaches to planning, which rely on a single forecast or prescribed vision of the future. This broader question of when to use an exploratory approach versus predictive or normative approaches is important, and more guidance is needed here. As a first step to addressing this issue, [Figure 2](#) relates planners' assessments of key factors of the planning context and the types of scenarios that may be most appropriate. Before choosing an approach, checking one's planning context against these factors is a good first step.

There exist, however, only a few sources of guidance for planners on the development of exploratory scenarios for urban planning work specifically (Ange et al., 2017; Avin, 2007). We therefore close our discussion with some recommended best practices implicit in some of the cases we review that draw on our broader experiences and knowledge of the literature.

Advice for Scenario Practitioners

Our advice is roughly organized according to the typical process of moving through a scenario development process.

1. Cultivate a scenario-oriented mindset but engage in the full-blown process selectively. In other words, develop the habit of scanning planning challenges from the perspective of the factors identified in [Figure 2](#). Embarking on a full exploratory process

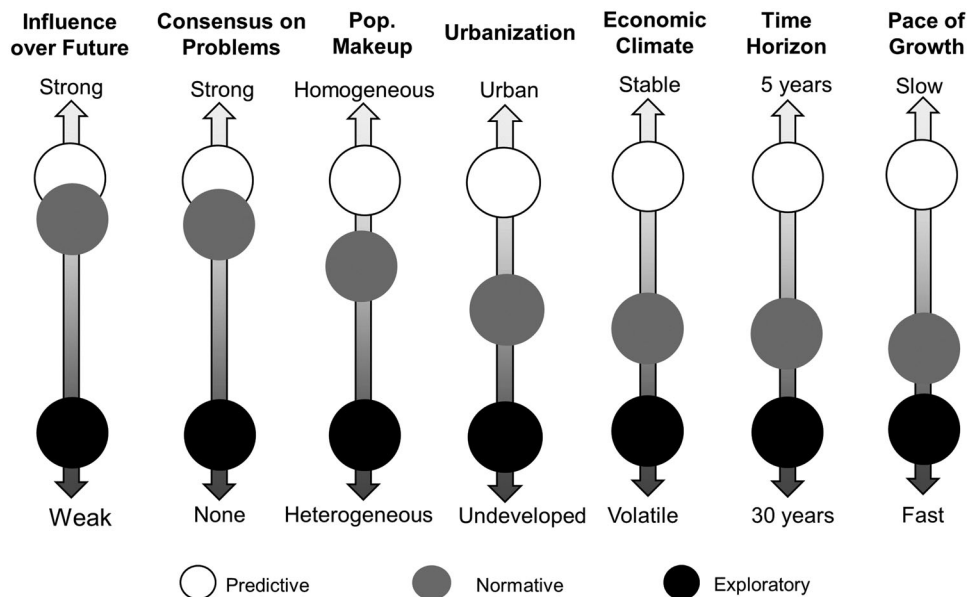


Figure 2. Alignment of scenario typologies with the planning context. Redrawn with permission from Figure 5.11 from Avin et al., 2016 (pp. 5–12). Adapted and reproduced with permission from the National Academy of Sciences. Courtesy of the National Academies Press, Washington, DC.

- will take more time and effort than a more conventional approach, so it should be approached only in certain cases with appropriate empirical conditions, project resources, and stakeholder buy-in.
- Support of top leadership is essential for this kind of process and for eventual multi-agency implementation, as is briefing them throughout the process. Elected officials (and many planners) are initially averse to considering plausible but less desirable futures; they assume plans should only focus on desirable futures. Unless they buy into the value of an exploratory mindset, such an approach will not succeed.
 - Do not simply extrapolate current trends to create a baseline scenario. In your analysis of driving forces, givens (assumptions shared among all scenarios) should also influence the trends scenario. Is such a business-as-usual future merely an extrapolation of current land use patterns? Of current policies? Of current driving forces? Your analysis of givens in your analysis of factors driving change should be incorporated into a trends future, which means, in effect, that the baseline is a constructed scenario rather than a mere extrapolation. It requires the same level of disaggregation and synthesis that the other scenarios do.
 - Thoroughly test the logic and consistency of the scenarios. The more complex the scenarios, the more necessary it is to run them by informed outsiders. The devil is in the details, and many efforts are undermined by internal inconsistencies within the scenarios. The stories should exhibit no arbitrary assumptions, nor should they incorporate too many intermediate events, to yield the final outcomes assumed.
 - Avoid overly complex scenario structures. The standard exploratory scenario design (popularized by the GBN firm) suggests a four-cell matrix along two primary axes representing the key drivers of the scenarios. Although this methodology runs the risk of oversimplification, it has the advantage of being very comprehensible. Extending the structure to three axes or to multiple drivers (as in the freight futures scenarios we describe earlier) can produce richer, more complete stories but can be difficult to explain and make it harder to analyze cause and effect relationships through quantitative analysis.
 - Choose a set of actions that lead you toward a preferred scenario rather than choosing a specific scenario. If exploratory scenarios stress uncertainty, then the very notion of choosing a long-term scenario is a contradiction in terms. If the future is a moving target, the best one can do is to select a set of complementary actions that point in the direction of desired outcomes. Where single jurisdictions sometimes do have significant control over implementation (as in the Gwinnett example described earlier) it becomes more feasible to try to implement a given scenario.

Conclusion

The growing importance of uncertainty in many realms of planning is motivating many practitioners to investigate—and use—scenario methods. However, most available projects aim to create a single preferred scenario, which functions similar to a vision. Although we feel this type of scenario project can be suitable in many cases, in other contexts, exploratory scenarios—which are created

primarily through an analysis of uncertainty—are more appropriate. Our goal with this study is to advance the use of exploratory scenarios in urban planning by encouraging reflective practice through a repertoire-building study that describes five ways they can be used through case studies and a discussion that calls attention to some of the issues practitioners should consider. Although scenario methods can be complex and differ significantly from existing planning approaches, they hold significant promise for practitioners. They provide a method to those seeking to conduct the bold and forward-looking planning necessary to grapple with growing turbulence caused by forces like climate change, disruptive technologies, and socioeconomic conflict that will continue to shape our cities for the foreseeable future.

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DECLARATION OF INTEREST STATEMENT

As described in the text, Uri Avin was personally involved in three of the cases as a practitioner.

SUPPLEMENTAL MATERIAL

Supplemental data for this article can be found on the publisher's website.

NOTES

1. Although beyond the scope of this article, our perspective is consistent with a collaborative view of practice that rejects a neat separation between the technical and normative dimensions of planning (Forester, 1989).
2. GBN included individuals with close involvement in corporate strategic planning where scenario planning was first developed, especially the pioneering scenarios created at the Shell Oil Company by Pierre Wack in the 1970s (Wack, 1985a, 1985b).
3. It should be noted that futurists have created many other ways to create scenarios that have not been adopted within urban planning (Bishop et al., 2007).

4. The modeling was not spatially explicit beyond treating the whole region as a unit of analysis. DVRPC also experimented with using the RPAT model but found it not useful for exploratory scenario analysis (Gregor, 2015).

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