Advanced Scenario Analysis: Tools for Enhancing Social Resiliency

Evaluating Advanced Scenario Analysis in Regional Growth Visioning

by

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ABSTRACT

The uncertainty of change inherent in issues such as climate change and regional growth has created a significant challenge for public decision makers trying to decide what adaptation actions are needed to respond to these possible changes. This challenge threatens the resiliency and thus the long term sustainability of our social-ecological systems. Using an empirical embedded case study approach to explore the application of advanced scenario analysis methods to regional growth visioning projects in two regions, this dissertation provides empirical evidence that for issues with high uncertainty, advanced scenario planning (ASP) methods are effective tools for helping decision makers to anticipate and prepare to adapt to change.

DEDICATION

This work is dedicated to my wife, Nancy Gail Bugner Quay, and to my daughters, Robin Gail Rubenstein, Jennifer Lynn Bunjovac, and Ashley Rose Quay, who with patience and encouragement shared this adventure with me.

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INTRODUCTION

The uncertainty of change inherent in issues such as climate change and regional growth has created a significant challenge for existing public decision makers trying to decide what adaptation actions are needed to respond to these possible changes. This challenge threatens the resiliency and the long term sustainability of our social-ecological systems. This dissertation provides empirical evidence that for issues with high uncertainty, Advanced Scenario Analysis (ASA) methods are effective tools for helping decision makers to anticipate and prepare to adapt to change.

Resiliency, the capacity of a system to absorb change or reorganize and retain essential functions, has emerged in the literature as a key concept for long term sustainability of social-ecological systems (Folke, 2006; Folke et al., 2002; Gunderson & Holling, 2001; Lambin, 2005; Voss, Bauknecht, & Kemp, 2006; B. C. Walker, Holling, Carpenter, & Kinzig, 2004). Adaptability or adaptive capacity, the capacity of the actors in a social system to manage the system to successfully adapt to change, is one of the major components of resiliency (Brooks, 2003; Brooks & Adger, 2004; B. C. Walker, et al., 2004; B. H. Walker et al., 2006). Researchers often cite society's ability to anticipate change and effectuate a response as the key factors of successful adaptation (Diamond, 2005; Easterling, Hurd, & Smith, 2004; Yohe & Tol, 2002). Unfortunately even with the advancements in the science of systems modeling our ability to forecast the future is still significantly limited (Brewer, 1983; Candau, 2000; Landis, 1994; Pielke, Sarewitz, & Jr, 2000; Sarewitz & Pielke, 2000; Stewart, 2000; Taleb, 2007; Waddell et al., 2001) which reduces the effectiveness of planning paradigms that rely on prediction to anticipate the future (Barben, Fisher, Selin, & Guston, 2007; D. Guston, 2010; Milly et al., 2008; Quay, 2010). Thus complex problems of high uncertainty such as global climate change

continue to defy the ability of social institutions to conduct effective problem solving (Farmer, 1999; Popper, Lempert, & Bankes, 2005; Ringquist, Worsham, & Eisner, 2003; Rittel & Webber, 1973; Sarewitz, 2004; van Bueren, Klijn, & Koppenjan, 2003; Wildavsky, 2006; Willson & Brown, 2008). To address this dilemma a new planning paradigm is emerging that relies on foresight rather than prediction to anticipate the future. This paradigm, coined anticipatory governance, suggests using foresight to anticipate a wide range of futures, rather than a best or most likely, and then make plans to respond across this full range of anticipated possible futures (Barben, et al., 2007; Camacho, 2009; Driouchi, Leseure, & Bennett, 2009; Eriksson & Weber, 2008; L. S. Fuerth, 2009; David Guston, 2007; D. Guston, 2010; Quay, 2009, 2010).

Recently some public policy efforts have used a new set of methods, Advanced Scenario Analysis, to help local and regional public decision makers increase their anticipation of the future and simplify the problem solving of complex issues (City of Phoenix Water Services Department, 2005; Dewar, 2002; Frece et al., 2006; Lempert, Popper, & Bankes, 2002, 2003; Quay, 1999; Vision North Texas, 2005).

This dissertation examines the results of two public regional visioning efforts in Dallas and Phoenix that utilized traditional public policy methods as well as Advanced Scenario Analysis (ASA) methods to develop sets of growth principles and concepts, here called strategic heuristics. In both cases there is high uncertainty and complexity regarding the future of these regions and in each case it is hoped that these strategic heuristics will be used by decision makers to guide their decisions related to future growth of the region. One key uncertainty in these efforts is the range of political will that exists to implement these principles and concepts. To assess the existing range of political will a survey was conducted for each region that assesses for each strategic heuristic stakeholder opinions of its usefulness for political action and their agreement

with it. Using the results of this survey the range of political will for growth principles created using ASA methods is empirically compared to the range of political will for growth principles created using other public policy methods and the basis for these differences is explored. Using this empirical analysis a case is made for the use of ASA methods as a tool of foresight for in planning for issues of high uncertainty.

This chapter provides a brief overview of resiliency in terms of anticipation and adaptation, an overview of Advanced Scenario Analysis methods and their relationship to anticipation and adaptation action, and a summary of this research's approach and goals. Chapter 2 – Literature Review provides a review of decision theory as it relates to public decision making under uncertainty, the history of scenario planning and the emergence of Advanced Scenario Analysis (ASA) methods. Chapter 3 – Research Design provides details of the embedded cases study research approach used to test the effectiveness of ASA methods. Chapter 4 – Case Study Results presents the results of the case studies and empirical tests. Chapter 5 – Conclusion summarizes the case study results and provides conclusions about the effectiveness and use of ASA methods and suggestions for further research.

The Challenge of Resiliency – Anticipating and Responding to Change

Late in 2006 the news media reported that after many years of growing awareness about environmental issues the public had reached a "green tipping point", wherein the majority of people supported efforts to make human society more green (Cavendish, 2006; Makower, 2007; NAHB, 2007; Walsh, 2007). The basic sustainability concept of "being green" is that if humans can reduce the stress on unstable natural systems, then these systems would self repair themselves and return to a stable state. But from the viewpoint of long term sustainability these natural systems are not stable, rather they are complex adaptive systems whose state varies over time in response to changes in

external and internal factors (Holling, 1973). Over the last thirty years a new complimentary view of sustainability has emerged that is based on the resilience of social-ecological systems to adapt to external and internal stress and remain functionally intact (Lambin, 2005). "The resilience perspective shifts policies from those that aspire to control change in systems assumed to be stable, to managing the capacity of social–ecological systems to cope with, adapt to, and shape change" (Folke, 2006, p. 254). The capacity of adaptation within social-ecological systems is a key element within the concept of resilience (Folke, 2006; Folke, et al., 2002) and "because human actions dominate in Social-Ecological Systems, adaptability of the system is mainly a function of the social component—the individuals and groups acting to manage the system. Their actions influence resilience, either intentionally or unintentionally. Their collective capacity to manage resilience, intentionally, determines whether they can successfully avoid crossing into an undesirable system regime, or succeed in crossing back into a desirable one" (B. C. Walker, et al., 2004, p. 7). Society's ability to anticipate change and effectuate a response are often cited as the key factors of successful adaptation (Diamond, 2005; Easterling, et al., 2004; Yohe & Tol, 2002). Thus, society's ability to anticipate and respond to change is critical to the resiliency of social-ecological systems.

Time is a critical element in the discussion about the sustainability of any social-ecological system because it is inversely related to our ability to anticipate the future, the longer the time frame the less likely we are to anticipate future change. (Gupta, 2006; R. White, 2005). Researchers have documented many examples of human and natural societies that proved to be sustainable for hundreds even thousands of years that eventually faced some internal or external change for which they could not adapt to and eventually collapsed (Diamond, 1997, 2005). What is the time scale of the sustainability of our society? Most sustainability efforts consider their goal to be "long

term sustainability" though rarely is the term "long term" defined. If history is our guide long term means at least multiple centuries and generations (Tonn, 2003). Thus the concept of time related to sustainability is different than the 10 to 20 year time frame common for most public planning processes ("Arizona Revised Statutes," 2007; California Water Code," 2002; E. D. Kelly & Becker, 2000; Schofer & Stopher, 1979; Tonn, 2003, p. 1112). Some capital intensive planning may extend to as long as 50 years. One factor for this longer time frame is our ability, or lack thereof, to understand the future. The shorter the time frame the greater the understanding of the factors that may affect future events and thus the better future events can be anticipated. The longer the time frame the more uncertainty there is about not only the future state of these factors, but also the uncertainty of what factors are important. Long time frames of 50 to 100 years are realms of deep uncertainty, for which traditional short range planning processes are ill equipped (Lempert, et al., 2002, 2003).

Some policy analysts have attempted to simplify policy issues by developing definitive technical analysis using models of natural or man-made systems to forecast future conditions. Application of such models has had a mixed history and typically do not reflect the range of external events that can impact on these systems nor examine the interaction of one system with another (Leao, Bishop, & Evans, 2004). Model builders attempted to make these models reflect the complexity of the real urban systems but such efforts face issues of uncertainty resulting from incomplete knowledge of the modeled system and trends (Stewart, 2000). After several decades of experience in applying these models to policy development, there is growing criticism of the flaws and inadequacies in the use of these models directly for development of public policy (Brewer, 1983; Candau, 2000; Landis, 1994; Waddell, et al., 2001).

Foresight has recently emerged as an alternative approach to prediction for anticipating the future. This approach embraces the fact that some aspects of the future are not knowable and a prediction represents only one of many possible futures. This limitation was recognized in the early scenario planning which suggested the use of scenarios to explore future uncertainty (Berger, 1964; Kahn, 1965; Kahn & Wiener, 1967; Ringland, 1998, 2002, 2006; Schwartz, 1991; Wack, 1985a, 1985b) and the more recent literature suggests that with high uncertainty analysis should cover a broad range of possible futures (Bartholomew, 2007; Lempert, et al., 2003; Lempert & Schlesinger, 2000a; O'Toole, 2008; Quay, 2010). But even the use of scenarios can add complexity to an issue. For complex issues the relevant factors are often interrelated and as one explores a range of possible futures for each factor the number of resulting scenarios can become exponentially large. Unfortunately the human ability to comprehend such a large number of factors is limited by human cognition (Klein, 1998).

Most policymaking comes about when people perceive that "too much or too little of something has occurred or is expected to occur." (Lucy, 1988) When considered through this perspective, the goal of policy making is to effect a change in an anticipated or existing undesired condition to a desired condition. Yet one person's solution may be another person's problem. Thus public policy processes in order to select and implement solutions often must balance differing viewpoints and competing interests for the same problem (Allison & Zelikow, 1999; Conde & Lonsdale, 2004; Forester, 2001; Helco, 1978; Kingdon, 2003; Lucy, 1988; McClendon & Quay, 1988; Sabatier, 1988). Such processes can suffer from poorly defined problems, incomplete information, and a lack of resources and time. (Forester, 1989) Unfortunately today's public policy environment is a highly dynamic endeavor with a variety of trends that make urban issues more complex and uncertain. These trends include: a shift from growth based on local economies to

regional economies; increases in the complexity of water, wastewater, and transportation systems; an increase in variety and complexity of urban forms such as suburban and exurban cores, edge cities, and merging regions; smart growth practices that try to manage the complex economic, environmental, social, political, and physical systems; growing public commitment to meaningful public open space; economic development in times of public austerity using innovative techniques to restructure regional economies; the changing demographics of baby boomers and Hispanics; changes in governance practices that engage diverse populations in complex and time consuming consensus building; and special interests groups using referendums when existing planning process does not meet their needs (Quay, 2004). In such environments policy-makers need methods to wade through enormous amounts of information and conflicting and confusing viewpoints of multiple stake holders so that they can understand the context of the problem and apply an appropriate strategy (Lindblom, 1959, 1979). "Thrown into situations of great complexity, decision makers need theories to simplify their worlds, to suggest what is important to attend to and what can be safely and decently be neglected" (Forester, 1989).

Thus the challenge of social resiliency is society's limited ability to comprehend complexity, whether it is the complexity of a system, the complexity of trying to anticipate a large number of possible futures, or the complexity of the political process. As Forester suggests, decision makers need tools that can assist them in simplifying complex and highly uncertain issues. This dissertation asserts that ASA methods are one such tool.

Advanced Scenario Analysis (ASA): The Conceptual Framework

Scenario planning as a general method has been widely applied since the 1970s to various businesses including the finance, health care, and energy industries (Brand,

1999; Fahey and Randall, 1998; Godet, 2001; Justison, Harrison, Pullin, & Anderson, 2000; Mintzberg, 1994; Ringland, 2006; Schoemaker, 1995; Schwartz, 1991; Wack, 1985a, 1985b). In the 1980s and 90s as a component of strategic planning it was used as tool for urban and environmental planning issues (Bartholomew, 2005; Elkington & Trisoglio, 1996; Hulse, Gregory, & Baker, 2002; Landis, 1995; Lund et al., 2007; McClendon & Quay, 1988; O'Brien, 2001; Ringland, 2002; Steinitz, 2003; Zegras, Sussman, & Conklin, 2004). Though there are numerous techniques for creating and assessing scenarios, all these methods are based on a common approach. First, for a specific policy scope a small set of scenarios each representing a future state are defined and the implications of each estimated. Second, decision makers review the analysis of each scenario and choose a scenario or combination of scenarios that seem most desirable or best addresses the conflicting concerns for a particularly issue. Lastly, policies are then crafted that will lead to a future that reflects the selected scenario or combinations of scenario. Though this approach has been successful for many planning issues, for long range complex issues with high future uncertainty this approach has several flaws. These flaws include:

1. Policy makers can only comprehend a few scenarios at one time thus traditional scenario planning typically only examines two to five scenarios (Klein, 1998). This limits the range of policy alternatives and implications that can be reviewed and often rare events are not considered. When the range of possible futures is large the possibility of unanticipated future states increases. When an undefined scenario does occur institutions are unprepared (O'Brien, 2001; Taleb, 2007)
2. Often with traditional scenario planning a 2 x 2 matrix will be created to define 4 scenarios based on the min and max value for two variables. This

is useful if the variation between the min and max of values of a factor is linear because the states between min and max of the two factors can be easily estimated. However if the variation in values of a factors is not linear then such scenarios can be deceiving about future possibilities (Lempert, et al., 2003). For example if the function of change for one factor was exponential, then the number of possible states close to the high (or low) could be greater than if the function were linear.

3. Scenarios based on expert opinion are limited by the experience of the experts. Unfortunately complexity and uncertainty create the possibility of futures for which no one has experienced (Schoemaker, 1995; Taleb, 2007) (See 1 above). Expert scenarios because they are "human" generated can also be subject to behavioral bias such as over confidence and causal fallacies (Schoemaker, 1993).
4. Scenarios become misleading when used as a goal for the future. Scenarios are not predictions, rather they are possibilities for the future that help people think strategically about the future (Ringland, 2006; Taleb, 2007). Yet using scenarios as a goal implies that they can be achieved through a series of events or policies, essentially predicting a future state. In reality the future will be affected by a wide range of factors that will dynamically interact with such events and policies which may or may not result in the desired future.
5. Scenarios which are based on a model to forecast future conditions, such as urban growth, depend on the ability of a model to accurately predict the future and thus are subject to the failures of long range uncertainty. (J. Berg, Nelson, & Rietz, 2003)

6. People have a tendency to focus on a single event evoking some future desired result. However given the complexity of today's urban and rural environments and the physical and institutional systems created to support and manage them; future trends are not the result of a single system or policy decision. Rather the growth, stability, or decline of urban and regional places is based on the interaction between multiple systems which are managed based on multiple policy decisions from overlapping political jurisdictions. (Lempert, et al., 2003)

Recently a new type of scenario planning, Advanced Scenario Analysis (ASA), has emerged to address these limitations (Ahmed, Sundaram, & Srinivasan, 2003; S. Bankes, 1993; S. C. Bankes, Lempert, & Popper, 2003; Burke & Ewan, 1999; Chakraborty, Kaza, Knaap, & Deal, 2011; Driouchi, et al., 2009; Lempert & Schlesinger, 2000a; Menke, 1979; Quay, 1999, 2008b, 2011; Roy, 2010). ASA methods utilize scenario generating methods to create large numbers of scenarios (dozens to hundreds) as opposed to a limited number (2 to 6). Rather than focusing on comparing individual scenarios, ASA methods analyze the entire set of scenarios in aggregate. Methods such as decision or factor sensitivity, risk assessment, worst case, and averaging are used to describe future possibilities over a range of uncertainty. This analysis is then used to reduce complexity by distilling from the futures analysis strategic concepts that can serve as a guide to decision making. For example, after examining a range of scenarios based on variations among five factors, one may find that only two factors generate wide differences in future states and all other factors only create minor variations. This reduces the complexity of the issue to two factors allowing decision makers to focus their decision making. Though the specific methodology varies with application, the basic concept of using a large number of scenarios and reducing complexity and uncertainty to

a key set of strategies or insights distinguishes these methods from traditional scenario planning where decision makers develop strategies by directly comparing individual scenarios and choosing or developing a preferred scenario.

Research Goals, Theory, Context, Hypothesis, and Questions

Goals

Though the literature of traditional scenario planning is well established, the literature for the ASA methods is not well developed. There is a limited amount of literature describing individual methods and how practitioners have utilized various methods. However, there is only a limited body of academic literature describing the theory of ASA methods and no literature providing a critical assessment. The goal of this dissertation is to provide a theoretical basis and critical assessment of how ASA methods enhance decision makers' ability to anticipate and understand complex issues of high uncertainty.

Theory

The context for this dissertation is the process of public decision making. It was suggested earlier that two key factors in the resiliency of social systems are the ability of social systems to anticipate change and the ability to craft and implement plans for adaptation. Further it was suggested that uncertainty and complexity limit human decision making. The underlying theoretical basis tested with this dissertation is that for issues of high uncertainty and complexity Advanced Scenario Analysis (ASA) methods can create simple heuristics that can be used by public policy decision makers to better anticipate a range of possible futures and simplify the decision making process.

This theory is based on the following propositions related to the uncertainty and complexity of urban and regional issues:

Uncertainty Propositions:

1. Decision makers can only comprehend a limited number of possible futures, in the range of four to seven (D. Kahneman, Slovic, & Tversky, 1982; Klein, 1998; Tonn, 2003).
2. Some issues of high uncertainty cannot be forecast with any degree of accuracy, thus the range of future possibilities is quite broad (Brunner, 1992; Candau, 2000; Landis, 1994; Sarewitz & Pielke, 2000; Taleb, 2007; Waddell, et al., 2001)
3. For issues with a large set of possible futures, methods that reduce this set of futures to a few key concepts (heuristics) about the future will assist decision makers to better understanding the range of future possibilities.(Bazerman, 2006; Forester, 1989 ; Kahneman, et al., 1982)

Complexity Propositions:

4. Decision makers seek simplicity or heuristics that can be applied to a decision making process (Bazerman, 2006; Forester, 1989).
5. Complex problems have many interrelated factors which defy traditional rational problem solving (Rittel & Webber, 1973; Strauch, 1975).
6. Methods that reduce complex issues to a core set of the most critical concepts of the issue can be used by decision makers to create heuristics that then can be applied to decision making (Forester, 1989 ; Lindblom, 1959; Simon et al., 1986; Weiss & Woodhouse, 1992).

Political Will

7. The political will of stakeholders for action to solve a problem is an important factors in the success of a public policy process.

8. Political will is: a factor of a need for achievement and an intrinsic motivation to pursue goals; a factor of understanding of the action and benefits; different for different issues; a factor of the importance of the issue at hand; and a factor of common interests of a group. (Treadway et. al., 2005; Malena, 2009; Ferris, Fedor & King, 1994; Post, Raile, & Raile, 2010)
9. Political will is complex and exists across a continuum that can change over time (Brinkerhaff, 2007,2009).

Hypothesis

To test the research theory the following hypothesis was proposed: Public policy heuristics developed using Advanced Scenario Analysis methods will better articulate the uncertainty of political will inherent within the political process than heuristics developed using other methods of policy analysis and development.

Research Assumptions and Questions

To measure political will it was assumed that a measurement of an individual's opinion of usefulness of a strategic heuristic for decision making and their an indication of disagreement with the heuristic, would serve as a self interest proxy for measuring the political will of the individual for the heuristic.

Two research questions were used to test this hypothesis and explore the validity of the test and the factors associated with accepting or rejecting the hypothesis:

1. Within the context of public policy processes do strategic heuristics derived from Advanced Scenario Analysis methods generate a wider range of opinions of usefulness and agreement than heuristics developed through other planning methods?

2. Do the characteristics that stakeholders believe make heuristics more useful for decision making correspond to the literature's description of the factors that affect political will?

Summary of Research Approach

To assess the viability of ASA methods for facilitating foresight, regional visioning was used as a context to explore a factor of uncertainty in regional planning, political will, or the willingness to support strategies to shape regional growth. For the vast majority of regions, decisions about regional growth are fragmented among many communities, each of which will make dozens of decisions that affect the form and quality of growth. Thus regional visioning efforts must try to influence the future of the region through these individual decisions. Frequently this is done by promoting growth concepts designed to be implemented through these many decisions. Understanding the range of political will to use the wide range of possible growth concepts is important in crafting regional visions that can be effective. Unfortunately the nature of political will in the context of regional visioning is uncertain across specific issues, people, and time.

An embedded case study approach was utilized to explore the research questions. This research selected two public processes that utilized Advanced Scenario Analysis methods in their analysis of regional growth issues in Phoenix Arizona and Dallas Texas as case studies. Each case involves a public regional visioning process which utilized ASA and other public policy methods to development growth principles and concepts to guide regional land use decisions. Using qualitative and analytical analysis each case study is both descriptive and exploratory. Data for each case study was collected using (a) a review of documents produced for each public visioning process that, (b) interviews with the stakeholder leadership for each process to document and critically assess the process and its results, and (c) a random sample survey of the stakeholders from each

process to assess political will for implementation of the growth principles and concepts developed in each case. The descriptive portion of the case studies 1) documents the public visioning processes and methods used to develop regional growth principles and concepts; 2) provides a summary of why these methods were used; and 3) critically examines the methods and results. The exploratory portion of the case studies 1) empirically tests the research hypothesis and explores what factors where significant to the stake holders in forming their opinions; and 2) critically examines the role ASA methods played in developing growth principles and concepts; and 3) qualitatively and quantitatively assess the effectiveness of ASA methods in anticipating the range of political will compared to other policy analysis methods used to develop principles and concepts.

Chapter 2

REVIEW OF LITERATURE

The key to foresight is to envision a range of possible futures and scenario planning is one method be use to facilitate such visioning. Advanced Scenario Analysis (ASA) is a refinement of the theory and practice of scenario planning, so the literature of scenario planning is relevant to advance scenario planning. The literature of Advanced Scenario Analysis is not very extensive when compared to the literature of scenario planning as a whole. Scenario planning has a history that dates back to the 1950s and the literature of scenario planning began to emerge in the 1960s. This early literature is primarily that of the practitioner and it has not been until the last 20 years that literature of theory and evaluation has emerged. The literature of Advanced Scenario Analysis is relatively new, primarily from the last decade and like early scenario planning literature is primarily authored by practitioners suggesting methods or reporting results of using such methods. This literature review will look critically at scenario planning and how Advanced Scenario Analysis has emerged to address limitations of using traditional scenario planning to facilitate the use of foresight address public policy issues of high complexity and uncertainty.

Framework for Literature Review

There have been a number of excellent reviews of scenario planning (Bartholomew, 2005; Bradfield, Wright, Burt, Cairns, & Van Der Heijden, 2005; Chermack, Lynham, & Ruona, 2001; Nicol, 2005; Varum & Melo) as well as assessments and evaluations of scenario planning methods (Chermack, 2004a; Godet, 2000; Harries, 2003; Huss & Honton, 1987; Phelps, Chan, & Kapsalis, 2001; Paul J.H. Schoemaker, 1993). This literature review does not provide a comprehensive review of scenario planning literature; rather it focuses on the literature critical of traditional

scenario planning and how Advanced Scenario Analysis addresses this criticism. This literature review provides an overview of the history of traditional scenario planning as an introduction to and definition of scenario planning. This is followed by a critical review of scenario planning especially the limitations of using traditional scenario planning to address issues of high complexity and uncertainty. A review of decision making literature that relates to the mental limitations and cognitive bias of decision makers as well as models of public decision making is presented. Using the critic of traditional scenario planning and the review of cognitive biases as a critical framework, a review of the literature of practice and theory for Advanced Scenario Analysis is presented. A review of the literature of resiliency and the emerging field of anticipatory governance is presented to suggest that Advanced Scenario Analysis should be coupled with anticipatory governance implementation. Finally, the research presented in this paper expands on two topics, political will and planning ontology which are important components of the empirical case study analysis. A brief literature review is provided here as a basis for discussion in the methods and results section.

History of Scenario Planning

There are people that would argue using scenarios is hardwired into our brains and something we do on a daily basis (Klein, 1998), that formally scenarios have existed since Plato's Republic, and that Science Fiction is a form of scenario story telling (Alkon, 2001). However it is generally accepted that modern scenario planning as a formal planning tool has its roots in military strategy of the 1950s and 1960s and by the mid 1970s was a widely recognized business planning tool. The literature of scenario planning began to emerge in the mid 1960s and by the 1980s was a common topic of business literature. Most of the early literature was primarily a reporting of how scenario planning was being used by business and military planners, thus the gap in time

between practice and the literature. Most of the early authors were those engaged in these planning efforts and include the following:

- Herman Kahn, considered by many authors as the father of scenario planning, worked for the US Military in the 1950s at the RAND Corporation where he developed a technique of describing the future in stories as if written by people in the future. He adopted the term "scenarios" to describe these stories (Chermack, et al., 2001; Ringland, 1998, 2006). In 1961 he established the Hudson Institute where he expanded his scenario work to social forecasting and public policy (Kahn, 1965; Kahn & Wiener, 1967);
- In the late 1950s Gaston Berger established the Centre d'Etudes Prospectives in France, often called the heart of the French school of scenario planning, were he developed a method, 'La Prospective', based on normative scenarios of the future which were intended to be used as a guide in formulating public policy (Berger, 1964). Berger's approach to scenario planning was carried forward in the 1960s and 1970s by Pierre Masse and Bertrand de Jouvenel through various national planning efforts such as the 1965 French National Plan (Bradfield, et al., 2005). Since the 1970s Michel Godet has been one of the leading modern members of this French school (Godet, 1983, 1990, 2000, 2001; Godet, Roubelat, & Editors, 2000).
- Pierre Wack and Kees van der Heijden worked at Royal Dutch/Shell Oil where they developed scenarios for the oil industry which helped Shell Oil adapt to the energy crisis in the early 1970s (van der Heijden, 1996, 2000, 2005; van der Heijden, Bradfield, Burt, Cairns, & Wright, 2002; Wack, 1985a, 1985b);

- Peter Schwartz while at the Stanford Research Institute in the late 1970s worked with the EPA on scenario planning. Later he joined Wack at Royal Dutch Shell in the early 1980s, and then in 1987 established the Global Business Network to provide scenario planning consulting services to a number of companies (Schwartz, 1991);
- Gill Ringland worked for International Computers Limited in the early 1990s developing scenarios to anticipate changes in the information technology industry (Ringland, 1998, 2002, 2006).

By the end of the 1970s, scenario planning was well entrenched into business. Linneman found through a survey conducted in 1977 that 22% of Fortune 1000 companies were using scenario planning, though most for just a few years (Linneman & Klein, 1979). Two trends that boosted acceptance of scenario planning was the Strategic Planning movement which became popular in business planning in the 70s and 80s and the increasing dissatisfaction with forecasting that failed to predict the 1970s energy crisis and the 1980s financial crisis. Some strategic planning efforts used scenarios as a tool to understand opportunities and vulnerabilities (Godet, 2000; Menke, 1979; Mintzberg, 1994; Ring, 1988; Schoemaker, 1995; Paul J. H Schoemaker, van der Heijden, & M., 1992). At the same time there was a growing dissatisfaction with the accuracy of forecasting (Brewer, 1983; Lee, 1994; B. White, 2002; Zentner, 1982) and recognition that our ability to predict the future was very limited. This was a major point made by many advocates of scenario planning, the future was unknowable thus one must understand the possibilities for the future (Schoemaker, 1995; Schwartz, 1991; van der Heijden, 2000; Vanston, Frisbie, Lopreato, & Boston, 1977; Wachs, 2001; Wack, 1985a, 1985b; Zentner, 1982).

Though initially a used as a business planning tool, scenario planning began to be used as an urban and regional planning tool in the late 1980s and the 1990s. Cities such as Milwaukee Wisconsin and Arlington Texas were engaged in strategic planning efforts as part of long term planning efforts for their communities. Milwaukee's project, Goals for Greater Milwaukee 2000, was a regional visioning effort. Milwaukee identified four possible futures: a future where regional declining growth rates continued to decline, a future where growth rates stabilized, a future where the structure of the economy changed spurring new growth, and a future where resource limits change the community's world view and quality of life improves without increased consumption. Milwaukee's scenario planning effort did not result in a selection and though the first three scenarios where mutually exclusive, the fourth could have been applied to each of the first three (Roger Kemp, 1992). Arlington's project was an update of their comprehensive plan. Arlington identified three possible futures, a future where the city continues the transition from a rural agricultural town to a bedroom community of the region, a future where the city becomes a more urban but self contained small city, and a future where the city becomes an entertainment, office, and education center for the region. Arlington identified the pros and cons of each future and the actions that were anticipated to be required to implement each alternative. Arlington did select a preferred alternative which become the basis for their General Plan strategies (Dillon, 1989; McClendon & Quay, 1988).

Scenario planning has been used at a regional level to explore the impacts of various development policies on regional landscapes and resources . Scenario planning was used in the Portland Oregon region to help regional decision makers understand the ecological impacts of urban growth on the Willamette River valley (Hulse, et al., 2002). Four scenarios of future urban growth were developed using a Delphi process to identify four policy options for urban growth management of the region. The environmental

impacts of each scenario were assessed using the land use of each scenario as input into a series of environmental models. Though there was no formal public process to select a scenario the intent was to show the negative impacts of business as usual land use policies. This approach was also used to examine policy options of the upper San Pedro River basin in Arizona and New Mexico (Steinitz, 2003). In this case, ten land use scenarios were created that addressed two policy decisions, constrained or unconstrained development patterns, and the closing or expansion of the Fort Huachuca military base, and one economic condition, growth rate. For each future land use scenario estimates of future environmental impacts were developed. Though there was no formal policy adoption as part of this study, the intent was to guide policy makers in their decision making buy showing the impacts of land use decisions and the military base. Scenario planning was used to address the threat of volcanic activity in the Vesuvio volcanic area of Italy and the densely populated city of Naples, Italy (Torrieri, Concilio, & Nijkamp, 2002). Four different policy scenarios were developed with the purpose to examine, control and reduce the risk for the people concerned in case of a volcanic eruption. In each of these cases, though models were used to explore the impacts or implications of the scenarios, the goal of the effort was to find a desirable scenario that could then be used a model for policy development. In these cases scenarios were developed by experts or focus groups based on their experience and expertise of the issue being examined.

By the 1980s and 1990s scenario planning was a common topic within the business and long term planning literature with numerous examples of application and various methods being documented and proposed. Yet as observed by Georgantzas and Acar (Georgantzas & Acar, 1995) because this literature was primarily a reporting of practitioners work, there was little in the literature about the theory or critique of scenario

planning. It was not until the 1990s and 2000s that theory and critiques of scenario planning began to appear in the literature. Chermack (Chermack, et al., 2001) conducted a review of scholarly and business publications and found few efforts to evaluate the effectiveness or establish a theory of scenario planning. Bradfield et. al (Bradfield, et al., 2005) provides a thorough history of scenario planning and the literature that provides the foundation of traditional scenario planning. Bradfield suggests that the purpose of scenario planning can be describe by the nature of the decision making process in which it is being used. He suggests that that decision making processes can range from 'once only problem solving' to 'Onging Surviving' and the purpose of using scenario planning can range from 'Opening-up exploration' to creating 'Closure decisions'. Bradfield creates a classification system for scenario planning by creating a four cell matrix using these ranges for the horizontal and vertical axes. He then uses the four cells to describe four purposes for scenario planning:: making sense of a particular puzzling situation; developing strategy; anticipation; and adaptive organizational learning (see table 1 Purpose of Scenario Planning).

Table 1 Purpose of Scenario Planning

	Once Only Problem Solving	Ongoing Surviving/thriving
Opening-up exploration	Making Sense	Anticipation
Closure decisions	Developing Strategy	Adaptive organizational learning

(Bradfield, et al., 2005, Page 805)

Varum et.al. provides a detailed analytical review of scenario planning within peer reviewed journals, identifying key authors and topics (Varum & Melo). Harries (2003) reviewed the literature of scenario planning case studies, empirical studies, and

theoretical arguments evaluating scenario-based decision making. His summary was quite critical of this literature:

> Real-world evaluations lack measures of verification, are subject to biased sampling, rely on invalidated reports, do not explicitly define the reference goal or measure the reference goal inappropriately in terms of the method and are unable to distinguish between the effects of organization, method and environment. Theoretical evaluations are constantly evolving rationales about which completeness and sufficiency are difficult to assess (page 814).

All of these literature reviews report a wide divergence in the methods and techniques reported in the literature and conclude that there is no clear method to scenario planning. Bradfield et.al., Chermack et.al., and Harries also observe that there is still a lack of theory and evaluation within the literature(Bradfield, et al., 2005; Chermack, 2004b; Chermack, et al., 2001; Harries, 2003).

Critique of Scenario Planning

There are a number of articles that suggest weaknesses within scenario planning methods and application. Some of these weaknesses arise from failure of scenario planning to reflect real world conditions, including unanticipated event such as the recent collapse of the housing market or rare events such as an earthquake. Other articles suggest flaws in the procedures utilized in scenario planning and the failure of scenario planning to be successfully integrated into decision making. The following summarizes these weakness and concludes with a summary of how these weaknesses are related to Advanced Scenario Analysis.

Surprise and Rare Events

One common criticism of scenario planning is the lack of attention to rare events. Rowe (Rowe, 1981) is critical of attempts to assign probability to rare events and then use this probability to do risk assessment. Valid methods exist to objectively assess risk for ordinary events because a history of such event outcomes is known. However, for rare events inherently such a history does not exist. Thus subjective methods must be

used for risk assessment which are often flawed and result in inappropriate risk assessment. This subjective risk assessment is at the heart of early traditional scenario planning that relied on the Delphi method. Cross impact analysis was developed to try and assign probabilities to future scenarios by using the probability of the individual events that may lead to the future state represented by the scenario (N. C. Dalkey, 1971; Gordon & Hayward, 1968; Rochberg, 1970); however this method has been criticized an mathematically invalid (P. Kelly, 1976; McLean, 1976). Postma (Postma & Liebl, 2005) found that rare events were seldom included in scenario development even though they may have been anticipated. Such events were often considered impossible or inconsistent and excluded from further review. Yet, rare events should not be ignored. Taleb (Taleb, 2007) provides evidence of practitioners tendency to follow the average or probable and ignore the rare events leaving them unprepared when a rare event does occur. Citing examples of wars and market collapses he suggests that the consequences of ignoring such rare events and then having the event occur can be devastating, often resulting in major cultural, social and economic shifts. To the extent scenario planning does not address rare events then it is subject to Taleb's fatal flaw results. Unfortunately efforts to include in a scenario planning process the full range of possible futures often did not result in any strategic action (Wack, 1985b).

Procedure

Common among most scenario planning methods is the need to keep the number of scenarios to a manageable number, four to six (Godet, 2000). A number of methods have been used try and select the best or most likely scenarios from a wider range of possible scenarios. Dalkey and Helmer (N. Dalkey & Helmer, 1963) developed the basics of the Delphi technique while doing work for the US military at RAND corporation. This is a method that facilitates a group of experts to agree upon a set of

scenarios. This method has been criticized because the full range of possible scenarios is often limited by expert bias (Godet, 2000; Postma & Liebl, 2005). Supporters of cross impact analysis (Gordon & Hayward, 1968) suggested that such bias resulted from relationships between events that made some future scenarios dependent on a series of events occurring where one event triggered another event. Cross impact analysis attempted to utilize expert's opinion about the probability of connected future events to quantitatively estimate the probability different scenarios would occur in the future. However as mentioned earlier a number of authors have suggested these methods are mathematically flawed (P. Kelly, 1976; McLean, 1976). Another method frequently suggested to reduce the factors being considered, and thus the number of scenarios, is to evaluate the factors based on their level of certainty (high and low) and their level of importance to the business (high and low). Those factors of low certainty and high importance, hopefully two to three, are used to create the scenarios (Schwartz, 1991; van der Heijden, et al., 2002). However, this method of limiting the factors to be considered is becoming difficult because the number of issues where most of the factors have low predictability and high impact is increasing (Postma & Liebl, 2005) thus providing little guidance as to which factors should be eliminated. This was the case for Denver Water's scenario planning effort for which they were examining seven factors: shift in supply and demand; water quality changes; regional roles; economic, political and social trends; catastrophic events and failures; regulatory and environmental; and changes in technology. These factors were explored in a series of briefing papers and presented to their Board of Water Commissioners who ranked these factors based on their estimate of the level of uncertainty and importance. Initially it was hoped that this prioritization process would reduce the number of factors that would be explored, however, many of the factors were ranked as highly uncertain and of high importance (Quay, 2010).

Performance

Traditional scenario planning has also been criticized because of it lack of effectiveness in fostering actions or improving performance. Phelps (2001) found little positive difference in performance of companies in UK (Water and Information Technology) between those that used scenario planning and those that did not, and in fact found some indication that performance was less. Phelps found the only positive difference was in self reported subjective measures such as eliminating unnecessary processes and innovative management. Wack (1985b) also reported scenario planning processes that did not result in any strategic action. Bartholomew (2007) reported in his review of 80 regional scenario planning projects a number of factors that limited the success of these projects. These included project organizers limiting the number of scenarios reviewed, variation between scenarios being too small, scenarios based on a project sponsor agenda rather than a full review of future possibilities, and a failure of the scenario planning project to generate some type of policy result.

Decision makers often use traditional scenario planning as a means to pick a preferred or most likely future. Lempert and Schlesinger (Lempert & Schlesinger, 2000b) suggest that such methods imply that a future is knowable, when in fact in most cases it is not.

Summary of scenario planning critique and critical framework

Four key critiques of scenario planning that relate to Advanced Scenario Analysis are: 1) Limiting issues to a small set of 4 to 6 scenarios limits the number of factors about the future that can be considered; 2) limiting the number of scenarios introduces flaws such as stakeholder bias and over looking rare events; 3) assumptions that the future is knowable either predicatively or prescriptively; and 4) the lack of implementation resulting from scenario planning.

Decision Theory

Central to scenario planning is the decision making process itself. Scenario planning was conceived and has been utilized to make the decision making process more effective. Thus central to the effectiveness of scenario planning is how it facilitates decision making. The full body of literature devoted to the theory of decision making is well beyond the scope of this dissertation. Schoemaker (1993) has suggested that the weaknesses of scenario planning lie within the mental limitations and cognitive bias of decision makers. A portion of decision making literature does focus on these cognitive limitations of human decision making and the structure of public decision making. The following summarizes this literature and theory.

Public policy decisions are made by people involved in public policy processes (stakeholders, players, political elites, policy-watchers, policy-brokers, government officials, legislators) and formal and informal institutions (interest groups, parties, corporations, agencies, committees, advocacy coalitions). These people, the roles they play in the public policy process, and the institutions they are members of play a prominent role in the theories and models of public policy making (Bots, Twist, & Duin, 1999; Helco, 1978; Lowi, 1972; Lucy, 1988; Quay, 2005; Sabatier, 1988; Truman, 1995).

Learning and development of judgment about public policy occurs as stakeholders discuss policy within the framework of coalitions, networks, and collaborations. (Booher & Innes, 2002; Connick & Innes, 2003; Forester, 2001; Margerum, 2002). Habermas calls this public discussion communicative action where in stakeholders through discourse can form new judgments that go beyond traditional rationalizations of society and institutions (Habermas, 1984; Innes, 1998). Through this discourse, particularly for complex and uncertain issues, public decision makers are seeking learning that can simplify the decision making process (Forester, 1989 ;

Lindblom, 1959; Robertson, 1980). Thus one of the goals of individual learning and the diffusion of information within coalitions, networks, and collaborations is to simplify decision making. This is one of the goals of traditional scenario planning in regards to contemplation of the future, but it is also one of the cited weaknesses. However, a number of authors have suggested the opposite, that for some issues the information generated by traditional scenario planning becomes to complex and difficult for stakeholders to understand and accept as valid.

Habermas identifies three points of validity that must be inherent in statements made in this public discourse.

1. The statement is true and perceived as truth;
2. The statement is right within the context of the public issue according to the speaker and listener;
3. The intention of the speaker of the statement is as expressed and understood. (Habermas, 1984, p. 99 and 131)

Innes and Booher have identified several other Aspects of information that lead to its acceptance which include, creativity that encourages out of the box thinking, fair or shared knowledge that leads to equitable resolution, knowledge based in the full range of interests, knowledge that helps stakeholders learn something new about an issue and challenge accepted knowledge (Booher & Innes, 2002; Innes & Booher, 1999, 2003),

Sabatier has emphasized the role of substantive policy information in policy making and has identified factors that influence the effectiveness of information influencing public policy that include: perceived validity, the quality of the information and credibility of the source, the process of discourse wherein information is contemplated, timeliness of the information, extent to which the information conforms with stakeholders existing judgment and experience, how the information relates to core

values and secondary values, amount of consent on normative issues related to the information, and relevance of the information to the specific issue (Sabatier, 1978, 1988, 1991; Sabatier & Hunter, 1989).

Information that has the most influence on decision making is often that which has become imbedded in the institution's (network, coalition, collaboration, or agency) intellectual capital and thus has become almost invisible and unchallenged as assumptions or heuristics (Innes, 1998). These heuristics provide the basis for decisions made by individual stakeholders (Connick & Innes, 2003; Innes & Booher, 2003). This suggests that the more scenario planning creates accepted heuristics, the more likely it will be used as part of the public policy decision making process.

Economic expected utility theory and the models of rationality have long provided a framework for individual decision making (Plous, 1993), however new models of bounded rationality have been suggested as a better fit for decision making when limits in human cognition and environment make it difficult or impossible to seek optimal solutions (Forester, 1984; Gigerenzer & Selten, 1999). One area of the bounded rationality literature focuses on a model of people using simple heuristics to guide decision making process (Gigerenzer & Todd, 2000; Klein, 1998; Schon, 1983; Selton, 1999; Simon, 1956, 1990; Simon, et al., 1986). This model heavily relies upon past experiences and intuitive knowledge to provide a simple framework for making decisions. Though some of this literature focuses on how such a model is susceptible to human error (Bazerman, 2006; D. Kahneman, et al., 1982; Daniel Kahneman & Tversky, 1982a; Plous, 1993; Wilson & Schooler, 1991),. some of the literature examines effectiveness of this approach to decision making (N. Berg & Hoffrage, 2008; Martignon, 1999; Martignon, Katsikopoulos, & Woikeb, 2008; Wilson & Schooler, 1991), under what context such heuristics work best (Gigerenzer & Todd, 2000;

Goldstein et al., 1999; Daniel Kahneman & Tversky, 1982a, 1982b; Klein, 1998), and how heuristics or paradigms are developed and influence decision making in organizations, groups, and coalitions (Boyd & Richardson, 1999; René Kemp & Weehuizen, 2005; Kline, 2005; Kuhn, 1996; March, 1991; March & Simon, 1958; Pfeffer, Salancik, & Leblebici, 1976; Simon, 1965). This suggests that to the extent that scenario planning can develop simple heuristics it will be more likely accepted by people and learning organizations.

The early work of Herbert Simon is often cited as some of the founding literature of bounded rationality (Gigerenzer & Selten, 1999; Porac & Shapira, 2001). Simon characterizes bounded rationality as "shaped by a scissors whose two blades are the structure of task environments and the computational capabilities of the actor." (Simon, 1990, p. 7) suggesting that the effectiveness of heuristics for decision making is a function of these two factors, limits of human cognition and environment context. The heuristic literature discusses a number of classes of heuristics including the following:

- Imitation – Do what others have done that resulted in success greater than your own. This heuristic can be highly successful in stable environments where factors affecting an issue are not changing and the results of decisions being made by others is known. However, in cases where history is not a good predictor of the future, such as high uncertainty, or when issues are unique for each actor, this heuristic will be less successful (Goldstein, et al., 1999).
- Cultural Norms – Do what society says is appropriate. This heuristic is somewhat similar to the imitation heuristic, but rather than be based on an observation of success, it is based on what is the society's norm or tradition. Such norms generally come from experience within stable environments, and

thus are similar to imitation (Boyd & Richardson, 1999). However such norms can also lead to failure when there is environmental change (Diamond, 2005).

- Take the Best – When numerous options are available, consider options one at a time based on some assessment until an option is found that is acceptable based on the assessment chosen.. Assessments can be based on one or more factors. Options can be assessed randomly or in order of perceived value. (Goldstein, et al., 1999; Todd, 1999).
- Take the First – Choose the first or only option that comes to mind. This heuristic is more useful for those with a high knowledge level of the issue and options. When trying to identify options, particularly for experts, options do not come to mind randomly but rather is some general order of quality. This heuristic is of less utility for those with little knowledge about an issue (Goldstein, et al., 1999).
- Recognition – When faced with one or more options of which some are not recognized, select those that are recognized. Such a heuristic is a function of knowledge about the alternatives, if knowledge is broad and all options are recognized, this heuristic is of little use. In situations where knowledge is limited, this heuristic can be successful because the more successful options are likely to have received more attention and thus are more likely t be common knowledge. (Goldstein, et al., 1999).
- Anticipation - Anticipation is related to intuitive heuristics of representativeness and anchoring. In situations of uncertainty some decision makers will map as best they can this uncertainty on known events in an effort to provide a basis for decisions (representativeness). Others will utilize their experience to anchor the possibilities to past known events giving a point from

which to stretch experience to include some part of the uncertainty (anchoring). Heuristics that can expand the decision makers range of anticipation will help to provide the decision maker with a known framework to make decisions (Tversky & Kahneman, 1974).

- Availability/simulation – This heuristic class is similar to anticipation but relates more to the future than the past. Under this heuristic a person judges the probability that a future event will occur based on their ability to envision what might lead to such a future. This can either be through the recall of past events or creation of future scenarios (D. Kahneman, et al., 1982; Daniel Kahneman & Tversky, 1982b; Klein, 1998).

This body of research suggests that smart heuristics about highly complex and uncertain issues can be useful for policy learning through the communicative action discourse of networks, coalitions and collaborations.

Summary of decision theory and critical framework

Theories of human cognition suggest the following: 1) limitations of human cognition limits the number of scenarios that decision makers can consider at the same time, 2) assessing multiple scenarios requires pair wise comparison of risks, which is subject to judgmental bias, 3) decision makers and organizational learning requires information aids such as heuristics to simplify complexity and facilitate learning.

Advanced Scenario Analysis

The literature of Advanced Scenario Analysis is following the same course as that of early scenario planning literature. Most of the literature is either proposing a methodology or reporting results of an application of a methodology. Though there is little literature proving a general theory of ASA, the literature critical of scenario planning and the literature of decision making previously discussed does provide the

basis for general theory of ASA. In the following sections the author uses this literature to build a basic theory for Advanced Scenario Analysis, explores literature related to the methods of Advanced Scenario Analysis, and then explores the literature of practice.

A basic theory of ASA

The theory of Advanced Scenario Analysis is rooted in the theory of scenario planning. This dissertation proposes that there is a difference between traditional scenario planning and the emerging practice of Advanced Scenario Analysis. Traditional scenario planning can be framed by the literature of Schwartz, Kahn and Ringland wherein scenarios are established and decision makers then learn about the future by comparing these scenarios. As discussed previously, the number of scenarios that can be included in traditional scenario planning is limited by the limits and biases of human cognition to compare multiple scenarios, typically four to six. Such limitations sometimes result in inadequate views of the future and a failure to develop heuristics that decision makers can use to assist them in decision making. The theory of Advanced Scenario Analysis is that this weakness in scenario planning can be overcome by not having decision makers compare individual scenarios; rather methods are used to assess the scenarios as a whole to suggest a few heuristics about the future. Decision makers then learn about the future from these heuristics, rather than by comparing individual scenarios, and can use these heuristics as a guide for traditional decision making processes. Because this methodology does not require a decision maker to actually compare scenarios, it is not restricted by the limits of human cognition to compare only a limited number of options, as discussed early in the decision theory review. Thus the number of scenarios that can be used as part of the scenario planning process can include a larger number of scenarios embracing a wider range of scenarios. This helps avoid exclusion of rare events and decision bias in the selection of events.

Methods

Most Advanced Scenario Analysis methods are based on computational simulation or forecasting models which are used not to predict a future but rather to explore possible futures. This concept of exploratory modeling was introduced by Steve Bankes in the early 1990s where he proposed and explored how interaction with models and generating a wide range of scenarios based on ranges of for model inputs could be used to create a futures space with and ensemble of model runs (S. Bankes, 1992., 1993). Sykes and Dunham (Sykes & Dunham, 1995).

James Dewar (Dewar, 2002; Dewar, Builder, Hix, & Levin, 1993) introduced in the mid 1990s the concept of articulating the critical assumptions that are used in business planning, and then exploring the impact that would result if these assumptions were changed across a range of future values. Assumption based planning can be used as a diagnostic technique after a policy decision has been made to identify threats or opportunities for future success of the policy. This analysis is then used to develop contingency plans to assure success over time.

One of the more extensive efforts is by the Rand Corporation which is developing a set of robust decision making tools that are based on computer model based scenario planning (S. C. Bankes, et al., 2003; Lempert, et al., 2002, 2003; Popper, et al., 2005) Their approach is to use computer models driven by a scenario generator to model the full range of scenarios around a particular policy issue. This body of scenarios, called an ensemble, is then explored to understand the conditions which lead to success or failure of the policy. This method emphasizes using robustness criteria rather than optimal criteria for decision making, with the process seeking decisions that will meet minimum criteria of acceptance over the largest range of possible future scenarios. Their

method also encourages adaptation of policy over time, similar to Lindblom's theory of incremental change in public policy (Lindblom, 1959, 1979).

Aggregated risk analysis is similar to assumption planning but is uses uncertainty and risk analysis to articulate heuristics about opportunities and threats to goal achievement which are then used to develop a plan. This methods conceptual base is more rooted in uncertainty and risk analysis than it is in traditional scenario planning. This method relies on large number of scenarios which have been generated using a natural or human systems forecast model, such as a land use, transportation, or watershed hydraulic model, which uses a variety of factors to forecast a state of the system. Multiple scenarios are created by using a range of values for each factor as inputs to the model and creating a scenario for each of the possible combinations (or monte-carlo random selection thereof) storing the results in a single database. Statistical techniques are used to analyze the sensitivity of how each factor contributes to changes in system state between the scenarios (Morgan & Henrion, 1990; Quay, 1999). If a desired end state goal is known then a risk analysis of not achieving this desired end state (goal) can be prepared. The risk analysis and factor sensitivity analysis can be combined to assess how factors contribute to success or failure of this goal. The result is not a set of scenarios for decision makers to review, but rather information about what factors are the most important to the issue at hand. This method is particularly useful when the factors of analysis are spatially explicit (Attoh-Okine & Gibbons, 2001; City of Phoenix Planning Department, 1998; Quay, 1999).

Though the practice and literature of ASA primarily started in the 1990s, the methods of ASA have their roots in the earlier literature of traditional scenario planning and decision analysis. Certainly the work discussed in the decision theory review above which examined the cognitive bias of developing and comparing scenarios provided a

theoretical basis for flaws with traditional scenarios planning (D. Kahneman, et al., 1982; Daniel Kahneman & Tversky, 1982b; Tversky, 1972; Tversky & Kahneman, 1974). Many of the ASA methods described above have their roots in traditional scenario planning. Menke (1979) suggested the use of sensitivity analysis using multiple scenarios to test how important different factors are in affecting possible futures, thus providing a way to focus on those factors with the greatest impact. Martino and Chen (1978) introduced the concept of using cluster analysis on the output of a cross impact model to classify scenarios based on their similarity with various factors.

Practice

The following provides a review of the ASA literature of practice which consists primarily of government reports of planning projects that utilized Advanced Scenario Analysis methods as part of the planning process. Some of these reports provide little documentation of the methods and only report the results of the method application. Very few were published by peer reviewed journals and none provide an evaluation of the method or application.

Brownfield development is an example of an issue that involves a high complexity in the regulatory environment and a high degree of uncertainty in the conditions that will be found on any single site. A recent study utilized the Dempster-Shafer theory of combination as applied to hierarchical network of the factors related to brown-field development including technical issues, liability issues, financial issues, community concerns, and future land-use. This method identified a large number of future possibilities with an associated probability and implications of each possibility. Using the probability of each scenario, the overall uncertainty associated with various possible futures was then summarized to assist local decision-making for brown-field sites (Attoh-Okine & Gibbons, 2001).

An aggregated scenario planning approach was applied to the acquisition of 20,000 acres of desert for preservation by the City of Phoenix, Arizona. Developing a strategy for acquisition had been difficult because of the high degree of uncertainty related to the techniques that could be used to acquire the land, the uncertainty of available funds to purchase the lands, the nature of ownership of the properties (state and private ownership), the uncertainty of growth rates. The City developed a GIS based model to explore 65 different possible acquisition scenarios based on different techniques, funding levels, and growth rates. These scenarios were used to develop a risk analysis for failure to acquire those lands most highly desired for open space and strategic concepts to guide acquisition policies (City of Phoenix Planning Department, 1998; Quay, 1999)

The International Panel on Climate Change utilized in their 4th assessment report (IPCC, 2007a, 2007b) an aggregation of an ensemble of results from an ensemble of 26 global climate change models to explore the estimated temperature and precipitation impacts of climate change for 4 different emission reduction scenarios. The IPPC used the aggregation of the results to estimate a mean and variation for each of the emission scenarios and used the variation to characterize general probability of the mean, with low variation being more “likely” to occur than high variation results.

This approach was also used in New York City's Climate Risk report. New York's futures explored 4 major climate risk factors (CRF), temperature, precipitation, sea level rise and short term extreme events. To define these CRFs for New York the results from 16 climate change models for temperature and precipitation and 7 climate change models for sea level rise were examined for 3 of the IPCC emission scenarios (A1, A1B, B1) and 3 time slices, 2020, 2050, and 2080. A high and low range of potential change was created for each CRF in three steps. First the difference between

the baseline forecast for each Global Climate change model and the forecasts for each emission scenarios was calculated for each time slice. Second, for each time slice the results of all the model and emission scenario forecasts were averaged and the variation calculated. Finally, the low and high ranges were created based on the central tendency of the distribution (67%) for each time slice (New York City Panel on Climate Change, 2009).

Incremental worst case analysis or 'no regrets' is a method utilized when the consequences of failure are extreme and unacceptable, such as a failure of a water supply during drought. This method is similar to aggregated analysis, however, the database of scenarios is used to create a worst case timeline that is then used as a basis for planning to avoid failure. The aggregated database of scenarios is used to identify the worst scenario in each year. These are then combined to create a worst case timeline. This method was used by the City of Phoenix as part of its Water Resource Plan to create long range strategy for when (including lead times) water resource infrastructure, drought response activities, or new water rights had to be deployed to avoid failure if the worst case scenarios were realized each year (City of Phoenix Water Services Department, 2005; Quay, 2010).

Analysis of visioning opportunity and threats is a method used by various communities as part of their visioning processes. This method is a form of assumption based and aggregated scenario planning. It entails a large number of stakeholder groups creating scenarios that represent their desire for the future. All the scenarios developed by each group are placed in a data base. They can be combined to create a single "averaged" vision and the statistics of deviation from the average reported. The can also be compared with existing institutionally adopted scenarios, such as Comprehensive Plans and Transportation Plans to see where these existing plans may be in conflict

(sensitive) to the generated scenarios. This method was used within the State of Maryland as part of the Reality Check Plus visioning project (Chakraborty, In Press; Frece, et al., 2006) and by the North Texas region as part of the Vision North Texas visioning project (Vision North Texas, 2005).

Chakraborty et.al. used ASA methods to explore regional planning options for the Baltimore–Washington metropolitan region. They used econometric, land use, and transportation models to explore a range of futures for the region based on a set of controllable internal and uncontrollable external factors. Then using ASA methods they identified contingent and robust options that could be suggested for managing regional growth.

Resiliency and Anticipatory Governance

In response to this need for a new model of decision making under high uncertainty a new concept, called 'anticipatory governance', based on foresight and flexibility have emerged out of the fields of scenario planning for business and urban planning (Chi, 2008; Quay, 2009, 2010), adaptive management (Camacho, 2009), nanotechnology governance (David Guston, 2007), and adaptive capacity from the military (Bankston & Key, 2006).

The literature of anticipatory governance is new, and thus the method itself is not yet well defined in theory or example, however there is overlap with the literature of Advanced Scenario Analysis. Fuerth describes anticipatory governance as "a system of institutions, rules and norms that provide a way to use foresight for the purpose of reducing risk, and to increase capacity to respond to events at early rather than later stages of their development" (L. Fuerth, 2009; L. S. Fuerth, 2009). Lempert suggests that for issues of high uncertainty futures analysis must cover a broad range of possible futures (Lempert, et al., 2003; Lempert & Schlesinger, 2000b). Hallegatte and Easterling

suggests flexible actions which can change over time as the future unfolds and reduce the magnitude of lost investments (Easterling, et al., 2004; Hallegatte, 2009). Bankston , Camacho, Chi, and Fuerth suggest that constant monitoring and response to change is required for adaptation in changing environments to be successful (Bankston & Key, 2006; Chi, 2008; L. S. Fuerth, 2009).

The current literature and practice suggests anticipatory governance consists of four basic steps: envision and analyze a range of futures, anticipate adaptation, monitoring and evaluation, and adaptation (action) (Quay, 2010):

1. Envision and analyze a range of futures. Develop a set of possible futures that represents the full range of futures that we can currently foresee for a particular issue including futures that may represent rare events. Essential under anticipatory governance is the recognition that for some issues the future is not knowable and that predictions or forecast represent only one of many possible futures. Analysis is typically done on the full set of scenarios using aggregated averages, risk assessment, sensitivity analysis of factors of change or decisions driving the scenarios, identification of unacceptable scenarios or worst case, or assessment of common and different impacts among the scenarios.
2. Anticipate adaptation. Using the analysis of the defined range of futures, actions to adapt to individual or groups of these possible futures should be developed. Such strategies could include actions important to preserve future options, contingency plans to respond to specific scenarios, and no regrets or worst case strategies. Actions can be robust in that they work well across many possible futures. They can be modularized so that they can be implemented as needed or abandoned with minimal loss of investment.

3. Monitor and evaluate. Once a possible future is anticipated, the events and factors that may lead to that future can be identified. Monitoring these events and factors over time can provide a warning that a scenario may become a reality. It is possible that over time changes may occur that eliminate some possible scenarios or reveal new previously unanticipated scenarios. Ongoing evaluation of these changes and impact on anticipated actions can be conducted and plans for adaptation can be modified or focused.
4. Act to adapt. Action to adapt can occur initially and/or over time as monitored conditions indicate that action to adapt is warranted based on anticipated futures. Initial actions may be robust, that is actions that work well across a wide range of possible futures, or strategic in order to prepare for or preserve actions that may or may not need to be taken in the future. Decisions and implementation for adaptation actions will be spread over a long period of time and as monitored trends indicate change may be occurring, the decisions needed to implement anticipated adaption should be considered.

Case Study Literature

Two topics of research related to the case studies presented in this dissertation warrant some basic review, these are political will and urban ontology.

Political Will

Political decisions to take action are crucial to effective public policy, thus the factors that affect political action or in action are important if we want to explore public policy. Political will or support is often identified in planning literature as a major reason for public policy success or failure (Bassett & Shandas, 2010; J. R. Brown, Morris, &

Taylor, 2009; Burby, Salvesen, & Creed, 2006; Daniels, 2009; Norris, 2001; Roo, 2007; Seasons, 2008; Wheeler, 2000). Unfortunately these references to political will in the literature are primarily causal references to political will as a cause for success of failure, and the literature that explores and tries to define the concept of political will is fairly small (Hammergren, 1998; Malena, 2009; L. A. Post, Raile, & Raile, 2008; Treadway, Hochwarter, Kacmar, & Ferris, 2005), little (if any) address political will in the context of urban planning and urban issues. The following reviews some of the literature that does explore the concept of political will.

The concept of organizations as political arenas was introduced Mintzberg in the early 80s. His work was focused on organizations but also has relevance to public policy as a political arena. He conceptualized that individual contribution to political activity had two components, 'political will' and 'political skill'. Political will was defined as the motivation to expend personal resources to achieve some desired benefit. Political skill was defined the knowledge needed to execute political action in an effective manner (Mintzberg, 1985). Ferris, Fedor and King also distinguish between political skill and the desire to engage in political behavior. They attribute the importance of the issue at hand to the individual as a key factor in triggering the "will" to engage in political action (Ferris, Fedor, & King, 1994).

Treadway et al extend Mintzberg's model to explore components of political will and suggests political will is a function of a need for achievement and intrinsic motivation to pursue goals. Further he suggests that intrinsic motivation and thus "political will" can be driven by an inability to accomplish change through normal processes needed to achieve goals (Treadway, et al., 2005).

Brinkerhoff defines political will as "the commitment of actors to pursue particular objectives, undertake actions in support of those objectives, and sustain them

and the costs they may incur over time" (Brinkerhoff, 2009). His view focuses on people (actors) and actions by people, and he suggests that the level of political will for actions will vary among these people. Brinkerhoff suggests that measuring political will is challenging because of the complicity of political action. He suggests that political action is a function of will and capacity and that measuring political will by observing political action suffers from the difficulty of attributing no action to a lack of will or a lack of capacity. He also suggests that political will is not a binary state, a yes or no to action; rather it exists as degrees of will or support that can change over time. He also suggest that political will is subjective based on the individual perceptions of the actors. If one wish to measure political will, then rather than have such measures based on the subjective view of an observer, the measure should be based on the subjective views of the actors. Further the measure should be related to the meaningful components that make up political will for a particular issue (Brinkerhoff, 2007; Brinkerhoff, 2009).

Malena further explores political will by suggesting it has three components: political want, political can, and political must. Political want is described as the understanding and desire for something to happen because one understands the action and benefits. She also suggests that self-interest can be source of want and want can be influenced and change over time. Political can is described as political skill and capacity. Finally political must is defined as an event of influence that creates urgency to act, such as a crisis. Malena acknowledges that political activity is complex and occurs in group and organization structures, but she emphasizes that even in groups, individual political decisions are made before a group can agree to political action. Thus she suggest motivation is a key factor of political will (Malena, 2009).

Post suggests "political will is the extent of committed support among key decision makers for a particular policy solution to a particular problem" (Post, Raile, &

Raile, 2010, p. 358). He suggests that political will exists as a range of levels of will and that political will exists with a context that is specific to a particular problem. However Post suggest political will is not based on an individual's desires, but is based on how a group of people convene with common interests to create political will (Lori Ann Post, et al., 2010).

Summary of Political Will

The literature suggests several factors that affect an individual's political will for a proposed action. Treadway et. al. (2005) suggest a need for achievement and an intrinsic motivation to pursue goals is a factor. Malena (2009) suggest understanding of the action and benefits is a factor. Brinkerhaff (2007,2009) suggest t the factors are complex and that a measure of political will would be across a continum and can change over time. Ferris, Fedor and King (1994) suggest political will be different for different issues and a factor of the importance of the issue at hand. Finally Post, Raile, & Raile (2010) suggest political will is a factor of common interests of a group.

Urban Ontology

The concept of using ontology (T. Gruber, 2009; T. R. Gruber, 1993; Janowicz, Raubal, Schwering, & Kuhn, 2008; Smith, 2004) to classify content of documents is now widely used to classify the content of the every growing content on the world wide web (Davies, Fensel, & Harmelen, 2003). "Web Semantics" is now a standard web extension, with almost 20 different ontologies available for a variety of topics. There is literature that explores the concepts of an ontology for urban and regional planning (Caglioni & Rabino, 2007; Chaidron, Billen, & Teller, 2007; Janowicz, et al., 2008; Kaza & Hopkins, 2007; Métral, Falquet, & Vonlanthen, 2007; Teller J, Billen R, & Cutting-Decelle A-F, 2010; Teller, Cutting-Decelle, & Billen, 2009),.there is less literature that documents specific ontologies and most of this is focus on GIS applications (Hoekstra, Winkels, &

Hupkes, 2010; Janowicz, et al., 2008). There is currently no established word base ontology that can be used to classify content (web or otherwise) into urban planning subjects.

There are examples of efforts to create planning ontologies. Tools are being developed that can create an ontology by using text mining and natural language techniques to review documents under the guidance of experts in the targeted field (Mounce, Brewster, Ashley, & Hurley, 2009). Goyot, Falquet and Teller developed a document classification method based on a categorized thesaurus of 4,200 words or phrases (concepts) with 24 main themes or topics. A neural net is trained to ranked documents with a score for each of the 24 classes (main themes) and is then classified based on this score (Guyot, Falquet, & Teller, 2009). Most of this work is focused on classification of general planning documents or GOS databases, but there has been some work looking at content of policy documents. Antrop has looked at the content of design concepts used by landscape architects (Antrop, 2001), Kaza and Hopkins have looked at classify policy documents based on their temporal position within regulatory revue (Kaza & Hopkins, 2007), Rubin developed a classification system for strategic private and public sector proposals (Rubin, 1988)

Chapter 3

METHODS

As discussed in Chapter 2 the literature for the ASA methods is not well developed, particularly the academic literature that describes ASA methods, theory, and critically reviews the application of methods. The goal of this dissertation is to fill these gaps in the literature by providing a theoretical basis for ASA methods, information on their application, and a critical evaluation of the effectiveness of ASA methods using empirical tests. The literature review argues the case for the use of heuristics generated from ASA methods in decision making. This research conducted an assessment of ASA methods and an evaluation of their effectiveness using case studies of two public regional planning policy processes, one in the Phoenix region (AzOne Reality Check) and one in the Dallas-Fort Worth region (Vision North Texas), that utilized ASA methods to develop heuristics for use in regional growth decision making. These cases provide the basis for and assessment of ASA methods and an evaluation of their effectiveness. This chapter provides details of the methods used to develop these case studies and empirical tests.

A section on research design provides details of the case study design including a justification of why a case study method is appropriate to answer the research questions and the research units of analysis for the embedded case studies. A section on case study design provides information on case study selection, approaches to data collection, case study protocol, interview design and survey design. A section of this chapter examines the validity of the research design including the quantitative methods that were used to analyze the stakeholder survey, test the hypothesis of this research, and explore explanatory factors. Appendix B and C provides the stakeholder survey for the AzOne Reality Check case study and the Vision North Texas case study. Appendix D and E

provides a list of the regional growth heuristics (Strategic heuristics) statements developed by the AZ One Realty Check and the Vision North Texas processes. Appendix F and G provides the interview questions for AzOne Reality Check and North Vision Texas

Hypotheses, Assumptions, and Research Questions

To test the research theory the following hypothesis was proposed: Public policy heuristics developed using Advanced Scenario Analysis methods will better articulate the uncertainty of political will inherent within the political process than heuristics developed using other methods of policy analysis and development.

To measure political will it was assumed that 1) a measurement of an individual's opinion of usefulness of a strategic heuristic for decision making and 2) an indication of disagreement with the heuristic, would serve as a self interest proxy for measuring the political will of the individual for the heuristic.

Three research questions were used to test this hypothesis and explore the validity of the test and the factors associated with accepting or rejecting the hypothesis:

1. Within the context of public policy processes do strategic heuristics derived from Advanced Scenario Analysis methods generate a wider range of opinions of usefulness and agreement (political will) than heuristics developed through other planning methods?
2. Do the characteristics that stakeholders believe make heuristics more useful for decision making correspond to the factors the literature (see Summary of Political Will Literature) suggests are important to political will?
3. Is a stakeholder's opinion of a heuristic's usefulness or agreement (political will) influenced by other factors such as the topic or language structure of

the strategic heuristic, organization membership, or level of participation in the visioning project?

To create empirical test to explore these questions and the central hypothesis, eight more specific hypotheses were used to craft specific statistical tests:

Hypothesis A : the usefulness ratings of the heuristics when grouped by method will be significantly different. This was to affirm that there is a difference in usefulness ratings between methods.

Hypothesis B: the usefulness ratings of the heuristics based on ASA methods will be higher than the usefulness ratings of heuristics based on other methods. It was anticipated that this hypothesis would be found not to be true because the range of responses from ASA method heuristics will be wider thus centering its value closer to the average of the scale.

Hypothesis C: the range of usefulness ratings for heuristics derived using ASA methods will be larger than the range for other methods.

Hypothesis D: the percent of respondents disagreeing with heuristics derived using ASA methods will be higher than other methods. Disagreement is considered to indicate low political will, thus a wide range of disagreement levels would indicate a wider range of political will.

Hypothesis E: Respondents reasoning for indicating a heuristic is useful will correlate with factors suggested by the literature as being important to levels of political will, specifically 1) a need for achievement (success), 2) common interests (recognized) , and 3) Importance of the issue at hand (relevance). This was established to test the validity of using usefulness as a proxy for political will.

Hypothesis F: The topical content and structure of language used in the strategic heuristic will not be correlated to usefulness or disagreement levels. This hypotheses was

developed to test if there may be other factors , such as content and language structure, that influenced assessments of usefulness or disagreement.

Research Design

The embedded case studies developed for this research are both descriptive and exploratory using qualitative and quantitative methods of analysis. Two case studies were used; one of the Phoenix region (AzOne Reality Check) and one of the Dallas-Fort Worth region (Vision North Texas). Each regional visioning process utilized ASA methods to develop heuristics about regional growth. The two case studies were used to provide an assessment of ASA methods and an evaluation of their effectiveness.

Both the Vision North Texas and Phoenix AzOne Reality Check were public regional visioning processes that were initiated through a partnership between the Urban Land Institute (ULI) and various local public and private institutions interested in gaining a consensus among stakeholders on regional growth principles and concepts. The primary goal of these events was to develop a set of concepts and principles that would form a regional vision that would be embraced and used by local decisions makers to guide growth at a local and regional scale. Both hosted public events which used the ULI reality check Lego method[1] (Urban Land Institute, 2007)and a Delphi method (Adler & Ziglio, 1996; N. C. Dalkey, 1969) to engage stakeholders in a discussion about the qualitative and spatial character of regional growth. Subsequent to these events, both projects used expert opinion, traditional scenario planning, and advanced scenario analysis to develop reports that documented these events and proposed concepts and principles for guiding regional growth. A principle is defined as a rule or standard that is considered to be a desirable action or end product. "Balance jobs and housing" would be

[1] The ULI Lego technique (Urban Land Institute, 2007) is a method whereby people can show how they would spatially allocate growth in a region by placing Lego blocks on a map of the region. One color block for residential and one color block for commercial. Blocks can be stacked to show higher density.

a principle. A concept is an observation of a trend or fact without implying desirability that would make people think about regional growth. "Most new development was located on State owned land" would be a concept.

For example one of the principles developed by the AzOne Reality Check process was “Create a diversity of housing options understanding the importance of affordability”. A similar principle “Sustain and facilitate a range of housing opportunities and choices for residents of multiple age groups and economic levels” was developed by the Vision North Texas process. Appendix C and D list the principles and concepts developed by the AzOne Reality Check and Vision North Texas processes respectfully and identifies what method of analysis was used to develop the principle or concept. These growth principles and concepts are in effect simple heuristics or rules, here called strategic heuristics, which are intended to broaden organizational learning and to serve as a guide by decision makers within regional institutions when making decisions about growth strategies and policies.

The descriptive portion of the case study are intended to provide background of each regional visioning project including the events, processes, and players involved and were developed through a review of documents produced as part of the public policy process and interviews of the key individuals involved in the planning and implementation of each project. Each case study includes a description of the ASA method utilized, how it was incorporated within the public policy process, what the results of applying the method were, and how the method affected the public policy.

The exploratory portion of each case study provides an empirical quantitative evaluation of the effectiveness of the ASA methods and the factors contributing to their effectiveness. The publically generated strategic heuristics developed by these regional visioning processes were used as the basis for tests of sub Hypothesis A through F (see

Hypotheses, Assumptions, and Research Questions). These tests were implemented through a two-part survey. First, stakeholders in the public policy process were asked to assess how useful the regional growth principles and concepts (strategic heuristics) will be to future regional and local public policy decision making. Second stakeholders were asked to compare the usefulness of two heuristics (strategic heuristics), one derived from an ASA method and one from a non-ASA method, such as the Delphi method. As part of this paired comparison, the stakeholders were asked which of a series of factors were important in making their decision in choosing one of the two compared heuristic as more useful. Results from the survey were used to test if there are significant differences between stakeholder responses to ASA-based heuristics and non ASA- based heuristics and to examine what factors explain respondent's responses for level of usefulness.

Justification of methods

Embedded descriptive and exploratory case studies are frequently used to address research questions related to public policy (Scholz & Tietje, 2002; Yin, 2003a, 2004) and best fit the research questions for the following reasons: 1) Public processes are typically single complex and unique events, that exist only for a set period of time and are not repeated. Each application of an ASA method to any public process will be conducted within the unique context of the public process and thus will likely generate unique results. Case studies have been cited as a valid method for documenting such unique events where the temporal, spatial, and institutional factors should be recognized (United States General Accounting Office, 1990; Verschuren, 2003; Yin, 2003b). 2) ASA methods are relatively new and currently there are few documented cases of implementation. One Aspect of this dissertation is to provide a description of ASA methods to public policy makers so they can evaluate their utility for their own public policy processes. Case studies have long been recognized as a valid teaching tool

(Scholz & Tietje, 2002) and provide practitioners a way to learn by example. 3) There is little existing critical research of ASA methods as actually applied to public policy making, thus one Aspect of this dissertation is exploratory. Case studies have been cited as a valid method for the initial exploration of a topic as a prelude to further research (Hedrick, Bickman, & Rog, 1993; Yin, 2003b). 4) Embedded cases studies which include empirical analysis of data collected as part of the case study (Yin, 2003b) have been cited as a valid method for exploring causal relationships (Scholz & Tietje, 2002; Verschuren, 2003).

An embedded case study approach was selected because of the complexity of public policy processes/issues and the opportunity to collect both qualitative and quantitative data with similar units of analysis for each case study. . Embedded case studies are considered useful when: 1) multiple units of analysis, such as different types of stakeholders and different events, exist within a single case study (Yin, 2003b), 2) the interests of multiple stakeholders and institutions are involved 3) the complexity of the issues means there will be more than one factor and/or system of importance, and 4) different modes of thought (intuitive and analytical) are involved in the case study development (Scholz & Tietje, 2002). These characteristics fit well with the case studies examined for this dissertation because they have multiple units of analysis , such as functional areas of growth principles (transportation, environmental, etc) and types of stakeholders (policy analysts and decision makers, public and private sector, etc), multiple factors influencing the public process such as events and printed reports, and include qualitative observations through interviews and quantitative data through surveys.

The descriptive part of the case studies were developed using a combination of a literature review, interviews, and surveys. There was no critical literature available for either case study. Each public process was reported in the local papers and some trade

publications but these included only short descriptions of the purpose and process or brief reporting of attendance and the agenda. Each process produced documents that reported the results of various activities and events conducted through the process as well as proposed growth principles and concepts. However, these reports were intended to provide information to stakeholders and included little if any information about the details of the process or activities such as why the activities and methods were chosen or how the strategic concepts were developed. Interviews are cited as a valid method of obtaining information about a public process. Interviews of the key leaders for each public visioning project were used to document intended goals and details of the processes and methods utilized. These interviews were also used to document leadership's opinions of success or failures of the process. Surveys are also cited as a valid method for obtaining information about a public process. Surveys of stakeholders were used to assess their perceptions about the process and the results.

The exploratory part of the case studies was developed using the stakeholder survey results. Though it would have been preferred to use a controlled double blind study to explore the causal factors for why stakeholders perceive one heuristic more useful than another, for these case studies of public processes such a method would have been difficult to achieve for several reasons:

1. Trying to create a controlled experiment would be very difficult. Various models and theories of the institutional process of public policy making cite that it is a very complex system with a wide range of recognized external factors (Easton, 1995; Sabatier & Enkinsmith, 1988), not based on a rational method (Lindblom, 1959), with many stages and sub systems (Helco, 1978; Kingdon, 2003; Ripley, 1995) and rarely just involves one event (Greenburg, Miller, Mohr, & Vladek, 1977). Trying to control the factors

associated with these processes without substantially altering the actual process would be difficult if not impossible.

2. As discussed earlier, each public policy process is unique to the issue and community. Creating a control group that would address the same issue in the same community is impractical given these are public processes which are greatly driven by the stakeholders themselves (Forester, 1989 2001).
3. Random field testing of application of ASA methods at this time would currently not be possible because of the limited number of applications of ASA methods.
4. Attempts to structure a before and after test would require knowledge of an issue and community where such a method would be used before it is implemented so extensive interviews and observations could be done before the process starts. This would be very difficult. Knowledge of where such a method is going to be used would only be known after organizers had made the decision to move forward. By that time, many of the post method factors will have already been affected by the process of just convincing stakeholders to use the process.[2]

A multiple versus single case study approach was used to strengthen the external validity of this dissertation research. External validity is often cited as one of the weaknesses of case study research because there are only a few cases. This is often

[2] An attempt was made to conduct a controlled before and after test of the Phoenix ULI AzOne Reality check event in May of 2008. With the permission of the local ULI a pre/post survey was designed, was reviewed and approved by the ULI event leadership, was approved by ASU research review board, and prepared to be deployed. However the ULI decided at the last minute that it did not want the University conducting a survey of event participants and conducted the survey themselves. Unfortunately the methodology utilized for the survey greatly limited its utility for this research. This is an example of how hard it is to try and create control tests of actual public policy making processes (Quay, 2008c).

characterized in the context of these case studies representing a sample selected from a population of possible case studies that is being to estimate the characteristics of the population. Having a limited number in the sample makes it difficult to conduct a statistically valid assessment of the population's characteristics. However, in the context of public policy processes, each event should be viewed as a unique event, not as one case in a population of similar events. Each event has its own context both spatial, temporal, and topical. Thus external validity of public process cases studies should not be viewed in terms of adequate sample size, but rather as describing or exploring the range of contexts within which unique events can occur. The context of public policy processes can vary widely across place, issue, and governmental institution. Examining a wider range of different contexts will help to better define the domains the methods apply to and strengthen the application of this research.

Thus two similar public policy making processes have been selected for the case studies. These are Vision North Texas and AzOne Phoenix. Both are public policy process based on the national ULI Reality Check process that is focused on initiating public dialogue about regional growth issues. These case studies were selected for the following reasons:

1. Both events produced reports within 18 months prior to the survey, so the process was still fresh in the minds of organizers and stakeholders that were surveyed.
2. Both events used similar public policy processes providing a basis of comparison and contrast between the two events.
3. The organizers of both events have agreed to cooperate with the case study development.

4. The units of geography, political institutions, issues, and APS methods used are different providing a range of context for the policy making process. The Dallas-Fort Worth region includes 9 counties and two major cities while the Phoenix region covers primarily one county. Dallas-Fort Worth has very active council of governments while Phoenix' is relatively weak. Rural-agricultural interests represent a much stronger culture in Dallas-Fort Worth than the Phoenix region. These differences are explored by comparing and contrasting results from each case study in the analysis and conclusions chapter.
5. Several other ULI Reality check processes have occurred in other regions and more are planned providing an opportunity for other researchers to expand this initial research.

Definitions

Several terms used within this dissertation have a specific meaning in the context of the research. These are:

- Public policy - is defined here as the combination of basic decisions, commitments, and actions made by those who hold or affect government positions of authority (Gerston, 2004).
- Institution -is defined as a formal structure of government that has the responsibility for public policy or a formal organization of people that have rules of behavior, norms, roles, and physical arrangements such as buildings and information, and a common interest in public policy (McCool, 1995).
- Public policy making process - this is the formal and informal processes in which institutions and individuals develop public policy to resolve a social issue.

- Public policy decision maker -This refers to elected officials that formally make decisions public policy.
- Stakeholders - As discussed in the literature review models of public policy making suggest that policy development processes involve more than just public policy decision makers but a wide range of people and institutions. Stakeholder is the term used to refer to people and institutions that have some interest in the outcome of a public policy process and participate in the process. This includes not only those who make the decision but all those who support the mechanics of the public policy making process, those that influence the decision makers, and those directly affected by the policy decision that participate in some manner in the development or approving the public policy.
- Strategic heuristic - this is a rule or set of rules that is intended to provide guidance to the public policy making process (See Units of Analysis - Strategic heuristic for more detail). For example the following are two strategic heuristics developed as part of the AzOne Reality check process to be used as a guide for regional growth policy decisions:
    1. Establish a multi-modal transportation network that provides connectivity to employment, housing and urban cores.
    2. Conserve open space as a cornerstone of the region.
- Political will-this is a measure of the extent of support an individual has for using a strategic heuristic as part of their decision making process.
- Useful and Usefulness - The term useful is being used to encapsulate the idea that use of a strategic heuristic as part of the dialogue associated with the formulation of public growth policy (zoning, transportation, general plan,

infrastructure) will benefit the process by leading decision makers to make better decisions than if the strategic heuristic was not available. In this context "usefulness" is defined as the benefit that a stakeholder gains from using a strategic heuristic to assist in them in either effectively influencing public policy or in making a public policy decision. This benefit, or self interest is considered a proxy for measuring political will.

Units of Analysis

In social science research what is being studied is considered to be the unit of analysis (Babbie, 2009). This dissertation studies two initial units of analysis, strategic heuristics and stakeholders. Strategic heuristics are studied using the opinions of stakeholders about the usefulness of strategic heuristics and the characteristics of the heuristics, such as method used to create the heuristic. Stakeholders are studied using their opinions aggregated by the characteristics of the stakeholders, such as occupation. The units of analysis for case studies of complex issues often have sub units or embedded units of analysis which can be used to further describe and explore a case study (Scholz & Tietje, 2002; Yin, 2003b). Each of the units of analysis for the case studies of this research have additional units of analysis. The following examines each of these units of analysis, their embedded units of analysis, and why each unit of analysis is being studied.

Stakeholders

A key phrase in each of the two main research questions is “public policy decision makers can use”. In these questions the focus is on “public policy decision makers”; thus they are the first unit of analysis in this research. This is important to note because even though the focus of the research is on ASA methods, it is an examination of policy makers opinions that is used to explore the effectiveness of ASA methods. Embedded in this initial unit of analysis of stakeholders is a second level which classifies

the stakeholders based on their role in the decision making process (See Table 1 Individual Role in Public Decision Making Process) and the institutions of which they are members (See Table 2 Institutions Involved in Public Decision Making Process).

The roles in decision making processes represent the activity each person engages in as part of the decision making process. For example in a zoning case, a professional planner may not be authorized to make a decision but may make a recommendation to a legislative body that actually makes a decision. A neighborhood resident neither makes the decision nor does he officially advise the legislative body, but his/her interests may be affected by the zoning and he/she will have the right to petition the legislative body. The role a stakeholder has in the decision making process can influence their knowledge and perception of what decision making heuristics are useful to them. Neighborhood residents may have less knowledge of the details of a particular growth issue compared to a policy analysts that specializes in the issue. This may influence how they perceive a heuristic being useful to them in the decision making process. Thus differences in the role stakeholders have in decision making is useful in explaining the variance in perceptions of different strategic heuristics (Webber, 1984, 1987).

What institutions the stakeholders are affiliated with can also influence their knowledge and perceptions of the process and issues. Organizational learning is theorized to have an important impact on policy making. For example, stakeholders of a special interest group often enter a public decision making process with the knowledge and biases of their special interest group (Sabatier & Jenkins-Smith, 1993a, 1993b). Thus individual roles and institution affiliation of stakeholders is also a factor useful in explaining the variation in stakeholder perceptions of growth principles and concepts.

Table 2, Individual Role in Public Decision Making Process, provides a list of individual roles and Table 3 Institutions Involved in Public Decision Making Process provides a list of institutions that were used to classify stakeholders. These were derived from attendance rosters of those attending regional planning events for each case. The final unit of analysis is the combination of individual role and institution that can be assigned to each stakeholder. Table 4 shows the units for both institutions and persons. There are inherently some limitations on the combinations between role in decision making and institutions. For example one cannot be a Business Person and be Not Affiliated with an Institution, given that a business is an institution. Thus the gray cells in Table 3 are the applicable combinations of Role in Decision Making Process and Institution involved in Decision Making Process.

Table 1 Individual Role in Public Decision Making Process

Role	Description
Resident	Individuals whose personal rights or personal interests in regards to where they live will be affected by the public decision making process.
Business Person	Individuals whose business, financial, or commercial rights or interests will be affected by the public decision making process.
Private Advisor	An individual employed to represent the interests of an institution other than a government agency
Public Advisor	Government employee involved in providing support to the public decision making process
Legislator	Individuals who are elected or appointed with the responsibility of making a policy decision based on authorization from some governmental code.

Table 2 Institutions Involved in Public Decision Making Process

Institutions	Purpose
Non-Profit Service Agencies	Provide services within a not for profit business model
Business/ Corporations	Provide services are products within a for profit model
Special Interest Groups	Represent the common interest of the individual members
Advisory: University or Research Institution	Provide unbiased advice to a public policy development processes.
Governments: Local, State or Federal	Protect rights, health and safety of those working or living within the authority of a government.

Table 3 Institutions and Decision Making Roles of People

Institutions / People	Not Affiliated with an Institution	Non-Profit Service Agency	Business / Corp.	Special Interest Group	University or Research Institution	Local, State or Federal
Resident						
Business Person						
Private Advisor						
Public Advisor						
Legislator						

Strategic heuristics

As discussed in the review of decision making literature, heuristics can play an important role in decision making. In public policy processes, these heuristics are part of the policy learning process which occurs during discourse between the various stakeholders of the public policy. These strategic heuristics are crafted to be used by a decision maker as the basis for making a decision in more of a rational fashion as opposed to an intuitive fashion using basic general heuristics such as availability, representiveness, anchoring, or affect, thus avoiding bias or error in application (Bazerman, 2006; D. Kahneman, et al., 1982; Daniel Kahneman & Tversky, 1982a).

The strategic heuristics developed as part of the public policy process for each case study are the second unit of analysis for this dissertation. Each of the case studies was a public regional visioning process. One of the goals of each process was to gain consensus on a set of growth principles and concepts that would be used to guide stakeholder decision making regarding regional growth issues such as land use and transportation. In this research these growth principles and concepts are considered to be

strategic heuristics for regional growth decision making and are the focus of stakeholder's perceptions of the results of these regional visioning processes Two characteristics of these strategic heuristics, the method used to create them and their functional focus related to growth, represent embedded units of analysis.

These strategic heuristics were developed through a wide range of methods, including ASA methods. For each case study a list of strategic heuristics developed for the public process was compiled through a review of secondary source documents and key policy making process organizer interviews. As part of the analysis strategic heuristics were classified based on the method used to generate them and the topic or issue the strategic heuristic addresses. These strategic heuristics form the basis of the broader stakeholder survey. Appendix C and D is the initial list of strategic heuristics developed by the AzOne and Vision North Texas projects. A single list of public policy methods used by both the Dallas and Phoenix cases studies to develop their strategic heuristics was finalized after the organizer interviews in order to provide some level of comparison between the two case studies. Table5, Reality Check Policy Analysis Method, is a list of the methods used to create these strategic heuristics.

Another embedded unit of analysis for the strategic heuristics is the functional or issue topic of the heuristic. Regional growth issues involve a wide range of sub topics each related to some functional aspect of regional growth, such as transportation and land use. Though the dynamics of growth is a function of the interrelationships between these various functional aspects of growth, often discussions about public regional growth policy and will focus on one or more of these functional topics. Thus heuristics developed by these public processes will generally be focused on one of these functional topics. Some stakeholders may be interested more in one functional topic than others and will be more focused on heuristics related to functional topics in which they are

interested. Thus differences in the functional topic of a heuristic is useful in explaining the variance in perceptions of different strategic heuristics Based on the initial key stakeholder interviews the following topics were selected: Transportation, Density, Urban Form/Structure, Quality of Life, Economic, and Environmental.

Table 4 Reality Check Policy Analysis Methods

Consensus	A group process where discussion of an issue resulted in a development of strategic heuristics that was agreed to by consensus.
Expert Opinion	An expert in the field of the issue at hand develops a strategic heuristic based on his expert review of the facts.
Traditional Scenario Planning	A method where decision makers or policy analysts develop strategic heuristics by comparing and contrasting two to four scenarios of possible futures developed by some scenario generating methodology (model, expert opinion, etc).
ASA Basic	A method to identify strategic heuristics utilizing one or more simple advanced scenario techniques analyze in aggregate a wide range of scenarios (10s to 1,000s), such as ranges, mean and standard deviation, significance of difference.
ASA Advanced	A method where strategic heuristics are identified using a more rigorous ASA method, aggregated goal risk assessment, factor sensitivity, pattern recognition, robust decisions, no regrets, or worst case decision paths.

Case Study Design

Each case study was developed as an embedded case study following a standard protocol (See Table 6 Case Study Protocol) and includes a qualitative description and assessment of the case as well as an analytical assessment. The descriptions and qualitative assessment were developed from secondary sources and interviews of stakeholders. The analytical assessment was developed from the results of a stakeholder survey. The following provides details of the case selection process, data collection, and interview and survey design.

Table 5 Case Study Protocol

Step	Description
1	Initial literature search to build initial case description – This was based on primary documents of the public policy process as well as secondary literature and documents about the policy process.
2	Key Stakeholder Interviews – This consisted of interviews with four of the stakeholders in the Dallas case and five in the Phoenix case that were involved in the design and or implementation of the public policy process. Table 4 Interview Guidelines was used to conduct these interviews.
3	Key Stakeholder review and comment – Key stakeholders were given an opportunity to comment on the list of strategic heuristics (see Units of Analysis - Strategic Heuristics), method classification, and general stakeholder survey list.
4	Key stakeholder pilot survey - This was a testing of the stakeholder survey by some of the key stakeholders that were interviewed.
5	General Stakeholder Survey
6	Analysis of interview and survey results -

Case Selection

For this research the number of potential cases is limited by the extent to which ASA methods have been used for urban and regional public policy processes. Based on a review of the literature (academic and professional) only five such cases were found which are described in Appnedix A Potential ASA Case Studies. The criteria used to assess these five cases are listed in Table 7, Case Selection Criteria.

Table 6 Case Selection Criteria

#	Criteria
1	Must be related to a urban/regional public policy process.
2	Must be an issue with high uncertainty defined as follows, either one or more factors are not linear or more than three factors.
3	Must be a complex issue defined as follows, issue must either a) involve the interaction between two or more urban and/or environmental systems, or b) involve two or more levels of government in decision making process.
4	Must have used an Advanced Scenario Analysis method.
5	Must be considered successful by the organizers
6	The people involved in the ASA and decision making process must be available to be interviewed.
7	Cases should be of different geographic scales or areas.
8	The issues being addressed should be similar.

Based on these criteria a simple description for each case was developed that included; the public policy issue, uncertainty, complexity, scenario generation, ASA methods used, evidence of success, and people involved. Based on a review of each case and the selection criteria, the Visions North Texas and the AzOne Reality Check projects were selected as the two case studies. The Desert Preserve Allocation study is now over 10 years old, many of the participants are no longer readily available for interviews or surveys. Also it is also likely that given the time gone past, responses to the interview and survey questions would not be as detailed or perhaps accurate as if it was a recent study. The Vision North Texas project, Maryland Reality Check, and AZOne Reality Check projects all covered regional growth issues, thus would represent the same geography and topic. Visions North Texas was selected over Maryland's reality plus because their implementation reflects both and "assumption planning" and "aggregated scenario planning" approach (see literature review for description of these methods). The Phoenix Water Resources Plan was not selected primarily because the nature of the issue is different than all the others and the author was one of the primary policy managers for this project.

Data Collection

Data collection for the case study questions came from three sources, secondary sources such as reports and articles, primary interviews with a small set of the key stakeholders, and a primary survey of a wider set of stakeholders.

Secondary Sources

A few articles and several reports are available for the cases which primarily focus on the results of the projects and only briefly describe the techniques used. These secondary sources were used to frame this research approach and conduct a case

selection. They were also used to construct an initial description of each case study including timeline of events and results.

Initial Interviews

Initial interviews were conducted of the key public process organizers to document each case and develop the stakeholder survey. An initial informal interview with the project managers identified from the literature, George Boswell from the AzOne project and Karen Walz from the Vision North Texas project, was conducted to identify the general scope of the project and to develop a list of key organizers to interview for each case study. These interviews were conducted as structured face to face interviews and were used to refine the research questions, answer some of the basic descriptive case study questions, obtain leads for more secondary literature, verify that the research questions were appropriate to this case, prepare and analyze a stakeholder list for the survey, refine stakeholder survey questions, and identification of policy analysis methods used to develop the strategic heuristics and who was involved. Several key stakeholders for each case study were asked to take a trial pilot of the broader stakeholder survey, and contacted afterward to identify any issues of concern. Design of the interview process is discussed below in Interview Design.

Stakeholder Survey

A web based survey was conducted for a random selected sample of stakeholders of the Phoenix and Dallas regions. The web based survey was by invitation (Leeuw, Callegaro, Hox, Korendijk, & Lensvelt-Mulders, 2007) based on a random selection from the stakeholder list, with follow-up to encourage participation. The stakeholder survey has two key sections. In the first sections the stakeholders were asked to rate each strategic heuristic as to its usefulness. In the second section the stakeholders were asked to judge which of two paired strategic heuristics were more useful. This was followed by

a set of questions asking the stakeholder why they considered one strategic heuristic to be more useful than the other. Design of the survey and survey technique is discussed below in Stakeholder Survey Design.

Interview Design

As part of the case studies, interviews with the key policy process organizers and managers were used to gather descriptive data about public policy process and how ASA methods were used in the process. These interviews also identified basic information needed for the stakeholder surveys, including what strategic heuristics were developed for or by the public policy process, methods used to create the strategic heuristics, and a list of stakeholders from which to randomly select to stakeholders to send a survey request. The interviews for both case studies were structured around a set of guidelines (see Table 8 Interview Guidelines). For each case study a unique set of interview questions were developed based on the initial literature review and constructed timelines. Appendix E and F are the interview questions developed for each case study. The emphasis on these interviews was to identify what the goals of the public process were, what were the methods used in the public policy process and why these methods were chosen.

Table 7 Interview Guidelines

- Interviews will be scheduled for no more than 1 hour.
- Interviews will be faced to face where possible with a phone interview as a second choice.
- Interviews will be taped.
- The interviewer will initially follow a standard interview form which will then be followed by a less formal process to begin developing a stakeholders list.

Stakeholder Survey Design

The stakeholder survey was a web based random sample survey, using a stakeholder list generated from the initial interviews. The list for Phoenix was generated by combining lists of elected officials and members of the American Planning Association in Maricopa and Pinal County. Duplicates were removed. The list for Dallas was the interest list generated by Vision North Texas that contained the emails for local planners, elected officials, and anyone that had attend or requested information about a Vision North Texas event over the last 5 years. Each list contained over 1,500 stakeholders.

A desired sample size of 300 was determined based on the estimated sample needed to conduct a chi-square analysis on a table of 30 cells (5 by 6 matrix) with 5 to 10 responses in each cell (Blalock, 1979). Three hundred survey invitations were initially sent to those randomly selected from each of the Phoenix and Dallas lists (600 total). Each survey request was coded to the individual to whom the survey was sent, duplicate surveys were avoided, and a follow-up-was made to those not responding within two weeks. Only one follow-up was sent (see Research Validity). For those who did not respond another respondent was selected randomly from the list and sent a survey request. This was repeated until the goal of 300 respondents for each case was achieved. Survey responses were maintained on a secure survey and links between the identities of those responding to the survey were deleted as soon as the survey had been returned.

Both the Phoenix and Dallas surveys include a common set of questions to identify the stakeholder and institutional characteristics of each survey respondent. These follow the values for the embedded units of analysis for stakeholders listed in Table 2 Individual Role in Public Decision Making Process and Table 3 Institutions Involved in Public Decision Making Process. Each respondent was asked to identify which value

best represents their role in the decision making process for their region and represents the organizations which they are a member.

Also the survey included questions to determine the respondent level of participation and awareness of the reality check events for their region. Each survey included a question asking if the respondent had participated in a reality check event for their region and if they had read one of more of the reality check reports created for their region.

Two approaches were used to assess if respondents found the strategic heuristics developed using ASA methods more useful than those created by other methods. In the first approach respondents were asked to assess a list of strategic heuristics which include heuristics created from various methods including ASA methods. The results from this question were used to test the significance of differences in perceptions between groups representing the various values of the embedded units of analysis. The second approach asked the respondent to assess two paired heuristics, one created using a ASA method and one created using another methods. Respondents were then asked to indicate why they chose one heuristic over another. The results of this question were used to explore why stakeholders preferred one heuristic over another. The following discusses these two approaches in more detail.

Assessment of all Heuristics

In the first section of the survey a set of strategic heuristics (see Units of Analysis - Strategic Heuristics) developed by the regional visioning project for which the respondents were stakeholders was presented to each respondent with a likert scale to indicate to what degree the respondent perceived the strategic heuristic would be useful to them in making decisions about growth. The term useful is being used to encapsulate the idea that use of the strategic concept as part of the dialogue associated with the

formulation of public growth policy (zoning, transportation, general plan, infrastructure) will benefit the process by leading decision makers to make better decisions than if the strategic heuristic was not available.

For any respondent there are a number of reasons one may say that a strategic heuristic is not useful. They may find the concept or principle described in the heuristic to be limited in its scope or detail. They may not understand the concept or find the language used to be confusing. Table 9 provides a list of these possible reasons. One of these is that the respondent may disagree that the concept is viable functionally or politically. Given this research is focused on an attempt to measure how "useful" a respondent perceives a heuristic and not the political acceptability of a heuristic this last reason was considered a bias to this attempt to measure usefulness. For example, a person opposed to a principle may find a heuristic based on this principle not useful to decision making because it may be influential in making people agree with the principle, thus undermining his political viewpoint. In this case the respondent's assessment of usefulness was biased by his disagreement with the principle on which the heuristic was based. In order to reduce this bias as much as possible three approaches were taken in the design of the question. First the "agree-disagree" likert item scale which is commonly used to assess perceptions about statements was not used to avoid confusion about what type of assessment the respondent is being asked. Second, only strategic heuristics that had been previously identified as having a strong approval rating were included (Quay, 2008b). Third, for each strategic concept the respondent was asked to indicate if they disagree with the concept. For those strategic heuristics foe which the respondent indicated he was in disagreement, the rating of usefulness was disregarded in further statistical analysis.

For the purposes of assessment the non neutral Likert scale developed for the positive and negative affect scale (PANAS) (Watson, Clark, & Tellegen, 1988) was used. This scale was developed to assess a respondent's degree of realizing a feeling or emotion. Given that this research is attempting to measure a respondent's feeling about the term "useful", this would appear to be similar to the PANAS scale and thus was assumed to be a validated Likert scale for this purpose. The original PANAS scale had a neutral value which was removed for this research (see validity) The scale used was as follows: very slightly or not at all, a little, quite a bit, extremely.

In this Likert assessment of attitude towards usefulness there is inherently no neutral level. However, in some cases a respondent may not be able to assess the usefulness because they are not familiar with the topic or the public decision making process for such a topic. To accommodate this case an undecided/don't know category was provided. In subsequent statistical analysis the assessment of useful for these cases was discarded and not assessed as a neutral response.

For both the Phoenix and Dallas case studies, close to 100 strategic concepts where identified (See Appendix D and E for list of these strategic heuristics). Based on pre-surveys it as determined that respondents found being presented with more than 20 heuristics to rate made the survey to long. To keep the number of heuristics to 20 per survey, but still include most of the heuristics in the study, three steps were taken. First, key stakeholders were asked to identify the most important heuristics. This was used to narrow the heuristics to about 80. Second, five separate surveys were created by randomly selecting 20 of the heuristics for each survey. Each survey included at least 4 ASA heuristics. All 5 surveys contained two control heuristics that were the same across all surveys. Third, during delivery of the surveys the survey delivered was randomly selected from one of these five surveys.

Analysis of the results for individual heuristics was conducted on each survey set comparing by method and topic. For all surveys the results were analyzed by totaling the results by heuristic method and topic and normalizing by the percent the heuristic group represented of all heuristics. Results from the control heuristic questions, the stakeholder and institution questions, and the paired comparison questions from each survey set were compared to see if there was a significant difference in responses between survey sets.

Paired Comparison

In the second section of the survey a pairing survey method was used to try and provide a higher resolution response to ranking the importance of the heuristics and to provide a basis for exploring why differences between the two exist. Within the larger set of strategic heuristics, heuristics that have similar content but as a result of different methods were paired Only pairings of similar topical content were used to avoid bias resulting from different opinions of the content (such as transportation and environment) as opposed to the usefulness of the concepts. For each pair, the survey respondent was initially asked to pick which item they think will be more useful for helping to make decisions about the future of their community.

The following is an example of this comparison:

> Please indicate which of the following concepts do you think will be the more useful for the process of making decisions about the future of your community in regards to the positive and negative aspects of regional growth?
>
> Concept A: Create new core urban centers allowing compact, higher density development including mixed-use buildings.
>
> Concept B: Create a polycentric region with a variety of employment centers of different sizes.
>
> Concept A Concept B Neither/Both

The second part of this question asked the respondent why one concept is more useful than the other. Using the list of theoretical concepts of decision making discussed earlier, a list of reasons why one strategic concept is more useful than the other was presented to the respondent. These were worded as positive statements and the respondent was asked to rate how much they agree with the statement using the following non neutral likert scale: Strongly Agree, Agree, Disagree, Strongly Disagree. Table 9, Example of Reasons Question, provides an example of this list of reasons. This list of reasons was derived from a review of decision making theory and how heuristics are used in decision making (see Decision Theory in the Literature Review).

Research Design Validity

Several aspects of the research design helped to strengthen the validity of the research, these are discussed here based on four accepted tests of validity: construct validity, external validity, internal validity and reliability (Yin, 2003b) as well as a review of the validity of the data analysis.

Construct validity

As discussed earlier the first unit of analysis of this research is the stakeholders and institutions involved in the public process. The research questions focus on how the ASA methods are viewed as useful and why. This is a highly subjective measure; however it was measured by the stakeholders not the researcher. Methods were used to try and reduce bias in gathering stakeholder's opinion.

1. Bias in attitude scales was minimized by using scales that measure only one attitude, are linear, and where ever possible were consistent in words used. To avoid “middle of the road” bias, all scales consisted of an even number range with no value in the middle, forcing a decision above or below the middle. Also, "not applicable" and "do not know" responses were placed off

to the side of the scale so it is not perceived as part of the scale. (Oppenheim, 1999)

Table 8 Example of Reasons Question

If you selected A or B, please indicate how you agree with the following statements about the concept you selected above as being more useful.

	Strongly Agree	Agree	Disagree	Strongly Disagree
I believe the strategic concept is truthful.				
I recognize the strategic concept.				
I understanding the strategic concept better than the other concept.				
The strategic concept is simple.				
The strategic concept is complex.				
The strategic concept challenges traditional thinking.				
The strategic concept is innovative				
The strategic concept is fair.				
The strategic concept will lead to an equitable resolution of an issue.				
The strategic concept is relevant to the issues of growth important to me.				
I can imagine this strategic concept being successful.				

2. To avoid "agreement" bias, when assessing beliefs, positive versus negative formats were avoided. Measures of perception usefulness were used in paired comparative belief statements. Here is example language:

   Which statement do you agree is the most useful?

   A. Create new core urban centers allowing compact, higher density development including mixed-use buildings.

   B. Most tables created scenarios with a polycentric region with a variety of employment centers of different sizes.

To insure that respondents clearly relate these comparisons to each other and do not confuse them with being separate questions, they were worded similar and tightly grouped on the web survey (Christian & Dillman, 2004).

3. To avoid response bias from "hard to survey respondents" only one follow-up request was used (Olson, 2006).
4. To shorten the time required to complete the web survey and thus encourage full responses (non-response bias) open ended questions were limited (in number and size of space provided for response) and clear (language and form).
5. Comparative statements were used for attitude questions to improve cognitive thought (Fricker, Galesic, Tourangeau, & Yan, 2005).

External validity

Because of the wide range of ways APS methods can be applied and the small number of current implementations, conducting two case studies helps broaden the context being studied and provide some level of replication. This will increase generalization of the case studies to other policy processes by providing examples of different context such as geography, institutions, issues, and ASA methods used.

Internal validity

Having embedded units of measure allowed testing to see if there is possible bias in perceptions of usefulness that results from other factors, such as stakeholder role in decision making; stake holder socio-economic status (gender, age, race, or income); level of involvement in special policy making process events, special topical issues (environment, economy, transportation).

Reliability

A case study protocol was followed to enhance the openness and provide documentation of the procedures used in the case study analysis and a database of information collected was maintained.

Validity of data analysis

For each of the questions several units of measurement are known and coded (but not shown on the survey) for method and stakeholder. These provide a basis for a series of hypothesis tests to determine if method or stakeholder values are related to the responses.

Likert scales are ordinal scales and thus based on rules of the validity for math operations for ordinal values are normally restricted to non-parametric analysis, however, the practice of assigning weights to Likert scales and treating them as ratio values though debated in the literature is widely done (Aczel, 1986; Adams, 1965; Clason & Dormody, 1994; Gob, Mccollin, & Ramalhoto, 2007). This debate can be characterized in two ways: 1) Validity of analysis methods should be based on the validity of mathematical operations. Since addition and division are not valid operators for ordinal data, statistics such as an arithmetic mean would not be considered valid. However, counts of ordinal values in a sample can be considered interval. Thus if one assumes that the ordinal values are comparable between respondents then non-parametric test based on the proportions of response or ranking are valid. 2) Flexibility in statistical methods based on research questions. In the case of PANAS Watson et. al. do treat the Likert as a cardinal scale for testing if there is an association between groups (methods and stakeholders).. However, the likert scale was considered ordinal for purposes of testing magnitude and direction of associations (justification below). Based on previous surveys of Reality Check attendees (Quay, 2008c) it was also assumed that the distribution of

likert responses would not be normal for many of the questions. Grouping of Likert questions was assumed to be independent because the questions were randomly ordered. Grouping of respondents was assumed to be independent because survey responses were done individually by each respondent. Two non-parametric statistical tests were used to assess differences between various groups of likert questions the Mann-Whitney test and the Pearson Chi-Square test. In Mann-Whitney test the distribution of the null hypothesis was assumed to be normal and in the Chi-Square test the distribution of the null hypothesis was a Chi-Square distribution.

Because the likert scale is not interval or ratio, a mean is not a valid operation, and cannot be used to assess the direction. However, the un-weighted count of those agreeing (both Likert agreeing and strongly agreeing) and un-weighted count of those disagreeing (both Likert disgreeing and strongly disagreeing) are both ratio numbers. Thus they both can be converted to percent of total respondents and the disagree percent can be subtracted from the agree percent providing a metric of direction in agreement and magnitude of agreement for each group. These metrics can then be compared to provide a metric of difference in direction and magnitude of agreement.

Chapter 4

RESULTS

This chapter presents the detailed results of two case studies that were used to explore the two hypotheses of this research: Public policy heuristics developed using advanced scenario analysis methods will 1) be considered by public policy stakeholders as more useful for their decision making processes than heuristics developed using other methods of policy analysis, and 2) represent a wider range of opinion (agreement and usefulness) than heuristics developed using other methods of policy analysis. This chapter first presents a case study context which reviews the structure of the two case studies, strategic growth concepts / heuristics as the primary unit of analysis for the case studies, the methods used within each case study to generate these strategic growth concepts, and how the case studies were used test the research hypotheses. This chapter then presents the results from the case studies as it applies to why the results affirmed or did not affirm the hypotheses.

Case Study Context

The case studies utilized in this research are two regional visioning projects, Phoenix and Dallas-Fort Worth regions, that were conducted between 2006 and 2010. These are hereto referred to as the Project(s) or as AzOne for the Phoenix region and Vision North Texas (VNT) for the Dallas Fort Worth region. Both projects had the same general purpose, regional visioning, and similar organizational structures, used similar public processes and produced similar products, and has similar scales. Both AzOne and Vision North Texas defined multi-county regions that exceeded past traditional definitions of region. AzOne included two counties comprising a region roughly 13,000 square miles in size. and Vision North Texas included 10 counties comprising an area roughly 8,000 square miles. Each estimated its regional population at 4 million people.

Appendix A provides a more detailed comparative description of each project. The following provides a summary of the Project's purpose, processes, and use of strategic growth concepts / heuristics.

Case Study Project Structure.

The purpose of each Project was to engage regional stakeholders in a discussion about future growth of the region. Each Project was initiated in response to concern that past regional governance practices were leading to a future undesirable and unsustainable state for the region. Each hoped to effectuate a change in governance practices that would result in a more desirable and sustainable region. To accomplish this each Project was designed after similar regional visioning efforts in Utah, Las Angeles and Tampa. The primary goal of each project was to have regional stakeholders come to agreement on a set of strategic growth concepts that could be used by regional and local decisions makers, private and public, to guide planning decisions that would lead to more sustainable actions. To accomplish this each project sponsored a series of activities and events to engage stakeholders in discussion about the region's future. The primary product of these activities was several published documents reporting the results of the stakeholder discussion.

Each project had embedded values that were manifested in the direction and focus on certain issues. The underlying goals of the ULI Reality Check projects nationwide is in line with the current new urbanism and urban sustainability movements and can be summarized in four underlying themes:

1. Regional growth is evitable,
2. The density of the region should increase to minimize the impacts of growth,

3. Quality of life increases with the concentration of growth into multi-use centers or cores, and
4. Successful and vibrant urban regions have high transit opportunities.

Most of each Project's activities are planned around promoting these themes, however both projects have supported an open process where all ideas are considered valid and discussed, even if they are in conflict with these themes.

Within the case studies projects there were three general types of actors: stakeholders, experts, and project staff. Stakeholders are those whose day to day activities are affected in some way by regional growth. This includes business people who represent their business, elected officials and government officials representing a government institution, and residents representing the place they live. These roles were not mutually exclusive. Experts are those who advise stakeholders on issues of regional growth. This includes consultants, academics, and staff from various government and special interest groups. These experts were not necessarily objective in their opinions rather they were considered by some stakeholders as experts in their fields. Project staff were those primarily responsible for organizing and managing the projects activities and producing the projects public documents. Each Project had an informal regional organization that managed the project. In each case this informal organization was a coalition of formal organizations which had a steering committee and various working committees. Each Project had assigned staff from the partnering organizations, though Vision North Texas was better funded than AzOne and thus had more paid staff available to work on the Project.

Strategic Growth Concepts/Heuristics.

The primary output of each Project was a set of strategic growth concepts. These concepts were intended to be heuristics (rules) that would be used by public and private

decision makers when making decisions about issues related to regional growth. Each project presented such growth concepts in the reports the documented the Project activities and events. A list if the strategic growth concepts / heuristics extracted from these reports for each Project can be found in Appendix D which lists the 65 heuristics for AzOne with the reporting documents used as the source, and Appendix E which list the 61 heuristics for Vision North Texas with the reporting documents used as the source. These strategic growth concepts / heuristics can take several forms. Some, such as "Establish a multi-modal transportation network that provides connectivity to employment, housing and urban cores," are suggested objectives for the region's future. Some, such as "Preserve open space as a cornerstone of the region," are principles intended to steer future regional decisions in a general direction. Some, such as "Significant investment in new transportation infrastructure will be needed to keep up with the expected growth," are intended to be observations about future needs or consequences resulting from regional growth. Others, such as "More than half of the table scenarios provided passenger rail service to Maricopa and Casa Grande," are observations intended to frame possible futures for the region (good and bad).

These strategic growth concepts are referred to as strategic growth concepts / heuristics or just heuristics in the remaining portions of this chapter.

Methods to Develop Strategic Growth Concepts / Heuristics.

Each project utilized different events and activities to educate and engage the stakeholders of their region in discussions about regional issues and possible futures for their region. Most of these events resulted in the development of strategic growth concepts \ heuristics. Within these activities several different methods of policy analysis were used to develop these strategic growth concepts / heuristics. These ranged from consensus processes, to more elite policy analysis, to more objective quantitative

analysis. The following discusses the six basic methods utilized by the Projects, which when discussed collectively in the remaining sections of the chapter are referred as Method.

Consensus - CON.

This method was primarily a modified Delphi technique used as part of an event that convened groups of stakeholders (5 to 20) to reach consensus on a list of growth concepts. This was typically an informed consent consensus, where anyone that disagreed with an item could veto the item by objecting, however, in many cases people who only slightly disagreed remained silent allowing the item to move forward as a consensus item. These events were typically facilitated by a either a designated professional who worked in the field of regional growth or by a professional facilitator. The development of consensus items was not spontaneous. As discussed earlier the Projects had themes that they were trying to promote, and these Delphi processes would frequently be seeded by presentations on pressing regional issues, various proposals to respond to these issues, "consensus" results from other previous events, and the general virtues of the Project underlying themes.

An example of a consensus derived strategic growth concept / heuristic is " Preserve open space as a cornerstone of the region." one of the AzOne heuristics. This was one of the strategic growth concepts that resulted from the various table discussions at AZOne's first regional growth event.

Expert opinion - EXO.

Experts were widely used in both Projects. In the context of this research the definition of an expert is fairly loose, anyone who was recognized as experienced in a relevant issue and whose experience was judge by stakeholders or Project staff and leaders as relevant to the Project's mission. Experts ranged from Robert Grow Chairman

and founder of Envision Utah to me in my role as an executive with the City of Phoenix. Experts contributed to strategic growth concepts / heuristics in several ways. Experts as individuals or in groups similar in the form of Blue Ribbon panels contributed publications and written materials, such as list of sustainable growth principles, that were used by staff directly in Project documents or to seed other methods. Experts were used to draft section of Project documents, and there writings included strategic growth concepts / heuristics. Experts made presentations at events and their comments would be included by staff in Project documents. Lastly each Project had a number of working committees that included experts and their committee contributions often found their way into Project documents.

An example of an expert opinion is "Create mixed use and transit oriented developments that serve as centers of neighborhood and community activity." This heuristic from Vision North Texas was one of the "Principles of Development Excellence" developed by a blue ribbon panel convened by the North Central Texas Council of Governments intended to provide a guide for sustainable development.

Traditional Scenario Analysis - TSP.

Traditional scenario analysis is the comparison of several (typically less than 5) scenarios to identify common or disparate features of the scenarios. This may be qualitative based on a visual comparison or quantitative through the comparison of metrics that summarize or describe a scenario (See Traditional Scenario Analysis in the Literature Review for more detail). Both Projects created scenarios that were used as a basis for traditional scenario analysis. The Vision North Texas utilized several spatially explicit regional growth scenarios created by the North Central Texas Council of Governments staff to provide a initial starting point for their futures discussions. These

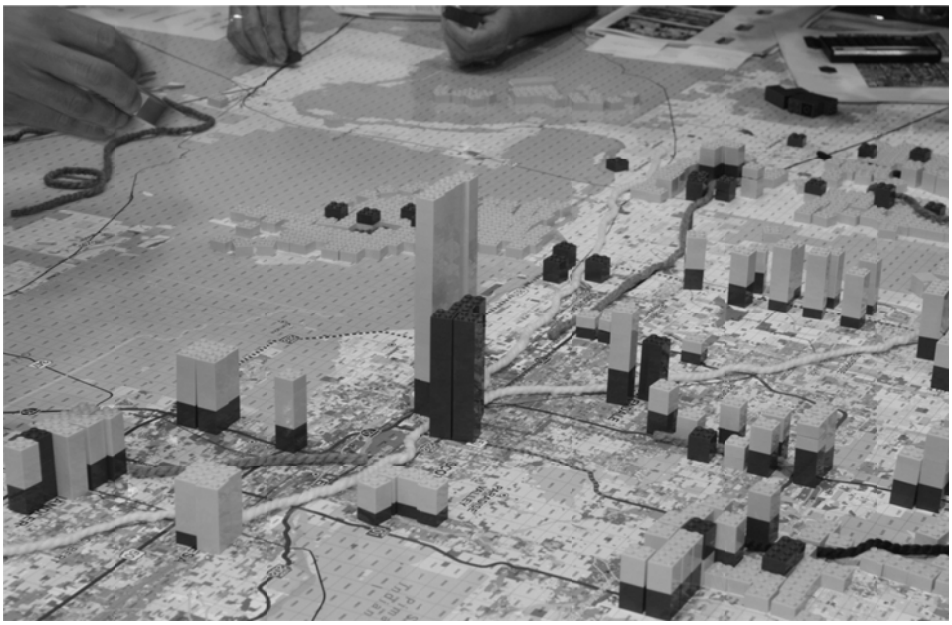
included a business as usual, rail, polycentric, and infill. These were used to develop strategic growth concepts / heuristics using traditional scenario analysis.

AzOne and Vision North Texas utilized a Lego based growth allocation exercise in group settings to have stakeholders create spatially explicit growth scenarios based on the stakeholders ideas about regional growth. In brief, a group of people are given a bag of yellow Legos each representing a certain number of new houses and a bag of red Legos representing a certain number of new jobs, and they are directed to place the Legos on a map of the region where the group decides growth should occur. The result is spatial scenario of regional growth (see Figure1 Lego Exercise). Both Projects used these scenarios as a basis for traditional scenario analysis by comparing one group's scenario with another group's scenario.

An example of a heuristic derived from traditional scenario analysis is "Some workshop scenarios had most of the new development located close to the Fort Worth and Dallas downtowns." This heuristic is from Vision North Texas and was derived by comparing the Lego scenarios developed by a small number of groups at one of their sub-regional workshops.

Advanced scenario analysis is similar to traditional scenario analysis except the number of scenarios compared is much larger (10s to 100s) and the analysis is primarily quantitative (See Advanced Scenario Analysis in the Literature Review for more detail). Both Projects used the scenarios generated by the Lego group exercise as a basis for advanced scenario analysis (see Traditional Scenario Analysis above for more detail of the Lego exercise) AzOne collected detailed information about the spatial attributes of each group scenario created at both of its Lego exercises, which was used to develop an extensive advanced scenario analysis (Quay, 2008a, 2008b).

Figure 1: Lego Regional Growth Exercise at an AzOne Workshop



Advanced Scenario Analysis - ASP.

An example of a heuristic derived from Advanced Scenario Analysis is "On average, over 50% of new employment was placed within two miles of a major transportation corridor." This heuristic is from AzOne and was derived from an analysis of all the group scenarios created at the first AzOne Lego exercise.

Guided Expert Opinion - EGS.

Guided expert opinion is a method used by Vision North Texas in the later part of the Project, particularly for the development of their North Texas 2050 report. This is an extension of the Expert Opinion method were experts utilize input from stakeholders, such as those coming from consensus methods, to craft new strategic growth concepts that blend multiple stakeholder and expert opinions.

An example of a heuristic derived from guided expert opinion is "Identify and support functional, sustainable infrastructure and institutions that offer North Texans access to affordable, nutritious foods, opportunities for physical activity, and access to wellness and primary care services." This heuristic is from Vision North Texas and was

included in their "North Texas 2050" report under a Healthy Communities scenario description (Vision North Texas Research Team, 2010) and was based on wide range of ideas included with the Regional Choices report (Walz et al., 2008) which came from stakeholder input. The concept of Healthy Communities was not a central theme in earlier reports.

Expert Advanced Scenario Analysis - AES.

Expert Advanced Scenario Analysis is also a method used by Vision North Texas in the later part of the Project, particularly for the development of their North Texas 2050 report. This method is an extension of advanced scenario analysis in that experts use concepts derived from advanced and traditional scenario analysis to craft new scenarios and strategic growth concepts / heuristics. In the case of Vision North Texas this method was primarily used to create a set of scenarios presented in the North Texas 2050 report that reflected concepts derived from advanced scenario analysis of the group scenarios created in the various workshops using the Lego visioning effort, and concepts derived from other methods as well (Consensus and Expert Opinion).

An example of a heuristic based on this method is "A region with different sorts of communities and centers, built on the traditional character of regional communities but designed to meet the needs of the region's future markets." This heuristic is from Vision North Texas "North Texas 2050" (Vision North Texas Research Team, 2010) under "Scenario 4: Diverse, Distinct Communities" and was derived from a scenario analysis in earlier reports (Walz, et al., 2008) that described the different centers in urban and non urban areas that emerged from the group scenarios of the sub-regional workshops.

Method for Hypothesis Testing

The two hypotheses for this research are Public policy heuristics developed using advanced scenario analysis methods will 1) be considered by public policy stakeholders

as more useful for their decision making processes than heuristics developed using other methods of policy analysis, and 2) represent a wider range of opinion (agreement and usefulness) than heuristics developed using other methods of policy analysis.

To test these hypotheses a survey was conducted of how stakeholders for each Project rated the usefulness and agreement of the heuristics of each Project. On each survey five types of questions were asked: 1) background of the respondent, 2) rating the usefulness of a set of heuristics, 3) indicating if they disagree with the heuristic, and 4) a pair wise comparison of why a highly rated heuristic was rated higher than a lower rated heuristic.

Given past experience with surveying subgroups of the stakeholders in Phoenix, I was concerned that if the survey was too long, people would not take the time to finish the survey once they started it. Based on several pretest of the survey it was determined that about 15 minutes was reasonable amount of time to encourage people to finish a survey, and around 20 heuristics was the maximum that could be completed in this time frame. Given the large number of heuristics collected for each Project (AzOne 65 and Vision North Texas 61) covering all heuristics required creating survey groups each receiving a survey with a subset or the heuristics. Five survey groups were created for each project. The heuristics for each survey group were randomly selected and placed in a random order on the survey. Twenty questions were selected for the AzOne survey and 22 questions selected for the Vision North Texas survey. Random selection was constrained by the method of each heuristic to insure that the number methods represented on the survey was the same for each survey. Also three specific heuristics (selected at random) were placed on each survey.

Case Study Results

The following sections detail the results of the two Projects, AzOne and Vision North Texas. These results are separated into four sections, survey bias, hypotheses test results, exploration of factors affecting respondents usefulness ratings and disagreement, and comparison of the case studies.

Survey Bias

Because the survey method consisted of five survey groups with different questions in each group, if there was some factor that caused one group to respond to the survey more than another, this could bias the results for individual heuristics which may have been on (or not) the survey sent to this survey group. Three tests were used to test for such bias, a test for bias based on the number of valid and total survey returns by each survey group, a test for bias based on the percent of methods within all heuristics and the % of methods represented in the survey response, and a test for bias based on a comparison of the heuristic usefulness ratings between survey groups for four heuristics that were on each of the five survey groups. This test did not reveal and significant evidence that the survey method introduced bias into the survey results. The following details the results of these tests for the AzOne and Vision North Texas (VNT) surveys.

AzOne Survey Bias Test Results

The AzOne survey resulted in 328 returned surveys but not all of these were considered valid. Some respondents returned incomplete surveys which were rejected as invalid surveys. The valid survey count for the AzOne survey was 271. Figure 2 compares the total number of surveys received by each survey group, which ranged from 61 to 72 per group, with the number of valid survey responses, which ranged from 48 to 64 per group. A Chi Square test of this cross-tabulation resulted in a Chi Square value of 1.462 with a degree of freedom of df=4 and a probability of p=0.83. Using a

significance test of 0.05 this result is not significant and it was assumed the difference in response by group was due to random error, thus no relationship or bias between response rate and group was found.

Figure 2: AzOne Total and Valid Survey Responses by Survey Group

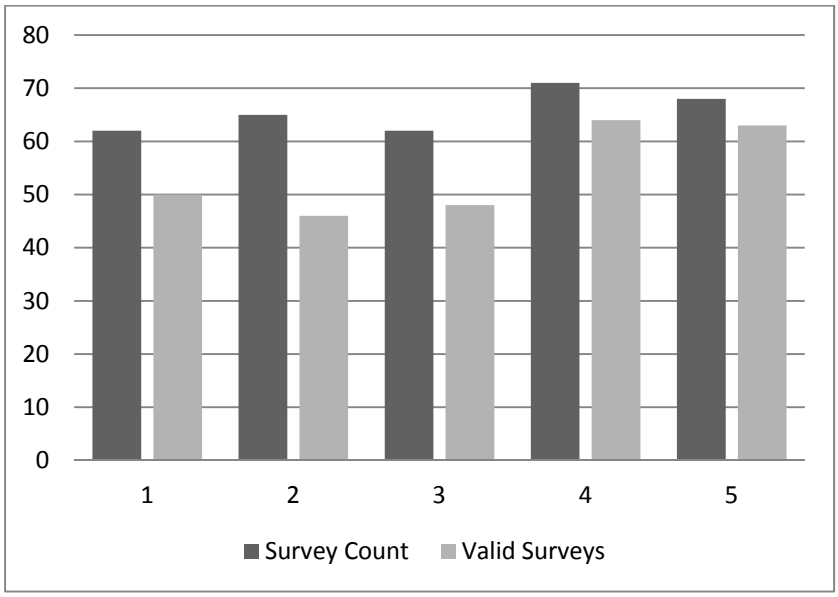


Figure 3: AzOne % of Survey Response and % of Heuristics Method

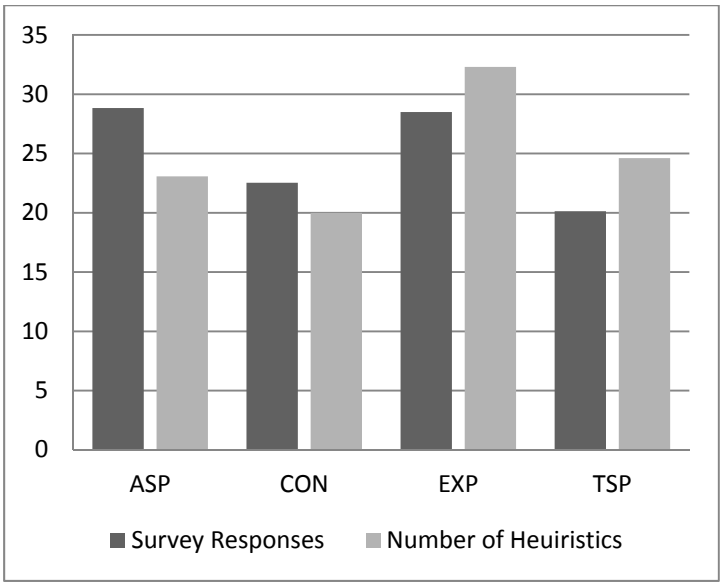


Figure 3compares the percent of surveys received by method type with the % heuristics contributed by each method. Conducting a Chi-Square cross-tabulation test

between survey count and method yielded a Chi Square value of 1.476, with a degree of freedom of 3, and a probability of p=0.678. Thus using a 0.05 significance test this result is not significant and it was assumed that the differences were random, and no evidence of a relationship or bias was found.

Three heuristics were placed on the surveys for all survey groups allowing for a test of bias between survey groups. If there is no bias between survey groups then the ratings for these three heuristics should be the same between the five survey groups. A Chi Square and Lamda Symetric test were used to test the relationship between each heuristic's ratings (4 Very Useful to 1 Not At All Useful) and each group. None of these test, shown in Table 5: Results of Test for Relationship Between Heuristic Ratings and Survey Group for Three Heuristics on all AzOne Surveys, were significant at the 0.05 significance level.

Table 9: Results of Test for Relationship Between Heuristic Ratings and Survey Group for Three Heuristics on all AzOne Surveys

	Pearson Chi Square			Lamda Symetric	
Heuristic	Value	df	Sig	Value	Sig
H01TRNCON	14.636	12.000	.262	.040	.069
H18TRNTSP	13.577	12.000	.329	.029	.147
H82TRNASP	12.142	12.000	.434	.027	.384

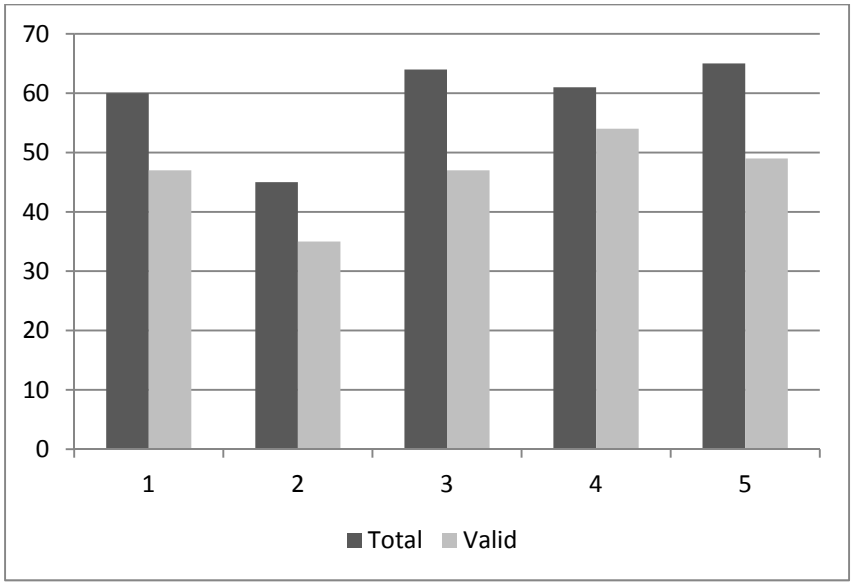
Vision North Texas (VNT) Survey Bias Test Results

The VNT survey resulted in 296 returned surveys but not all of these were considered valid. Some respondents returned incomplete surveys which were rejected as invalid surveys. The valid survey count for the VNT survey was 231. Figure 4 compares the total number of surveys received by each survey group, which ranged from 45 to 65 per group, with the number of valid survey responses, which ranged from 35 to 54 per group. A Chi Square test of this cross-tabulation resulted in a Chi Square value of 0.58 with a degree of freedom df=4 and a probability of p=0.97. Using a significance test of

0.05 this result is not significant and it was assumed the difference in response by group was due to random error, thus no relationship or bias between response rate and group was found.

Figure 5 compares the % of surveys received by method type with the % heuristics contributed by each method. Conducting a Chi-Square cross-tabulation test between survey count and method yielded a Chi Square value of 1.77, with a degree of freedom of 5, and a probability of p=0.78. Thus using a 0.05 significance test this result is not significant and it was assumed that the differences were random, and no evidence of a relationship or bias was found.

Figure 4: VNT Total and Valid Survey Responses by Survey Group



Four heuristics were placed on the surveys for all survey groups. If there was no bias between survey groups then the ratings for these three heuristics should be the same between the five survey groups. A Chi Square and Lamda Symetric test were used to test the relationship between each heuristic's ratings (4 Very Useful to 1 Not At All Useful) and each group. None of the results from these tests, shown in Table 11, were significant at the 0.05 significance level.

Figure 5: VNT % of Survey Response and % of Heuristics Method

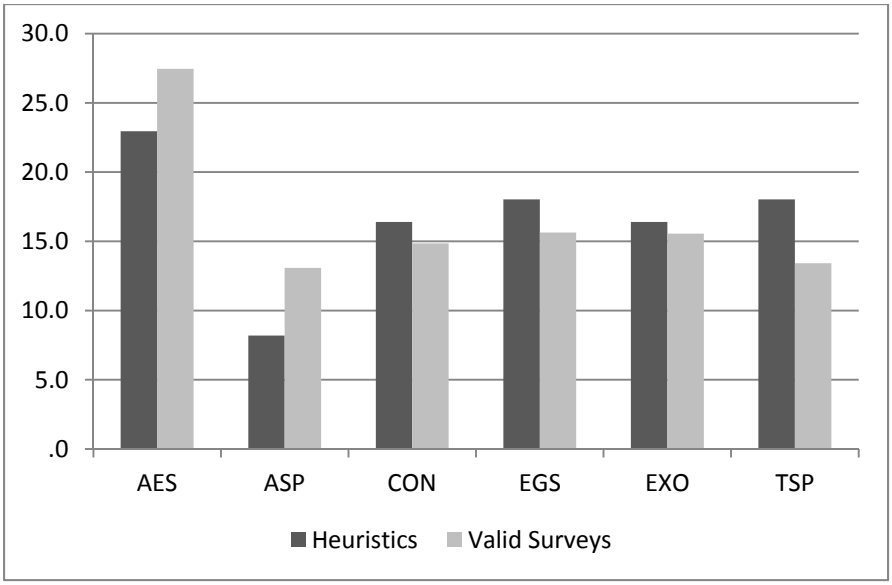


Table 10: Results of Test for Relationship Between Heuristic Ratings and Survey Group for Three Heuristics on all VNT Surveys

	Pearson Chi Square			Lamda Symetric	
Heuristic	Value	df	Sig	Value	Sig
H22UFGAES	11.330a	12	.501	.013	.670
H44ECOASP	8.347a	12	.757	.024	.510
H48TRNTSP	11.918a	12	.452	.037	.332
H61TRNEGS	3.839a	12	.986	.037	.510

Case Study Hypothesis Test Results

This research proposed seven secondary hypotheses used to craft specific statistical test. The first two hypotheses (A and B) suggested there would be relationships between the method used to develop a growth concept/heuristic and how useful survey respondents will indicate the heuristic is for their decision making processes: A) it is suggested that usefulness ratings will be different based on the method used to develop the heuristics; and B) that those heuristics developed using advanced scenario analysis methods will be rated more useful than those developed with other

methods. To determine if there is a significant relationship between method of developing the heuristics and the usefulness rating for the heuristic, a Pearson Chi Square and Lamda Symetric was used to test the significance of a relationship between the two. To test if heuristics developed by one method are rated higher or lower than another, it was assumed that the Usefulness Likert scale used in the survey consists of equal intervals (the difference between Extremely Useful and Quite a Bit Useful is the same as the difference between Quite a Bit Useful and A Little Useful). Given this assumption, using a scale of 4 for Extreme, 3 for Quite A Bit, 2 for A Little, and 1 for not at all, a mean usefulness for each heuristic and heuristic method group was calculated. The mean useful rating for each method was compared using a student t test for mean difference to test the significance of magnitude and direction of difference.

The next two hypotheses (C and D) suggested that advanced scenario methods, both "Advanced scenario analysis" and "Advanced Expert Scenario Analysis" will generate heuristic that have a wider range of opinion of "usefulness" and agreement than other methods. This wider range in opinion was measured in two ways, the range of the usefulness ratings and the range in percent respondents who disagreed with each heuristic.

For the test of range of usefulness and range of percent disagree two ranges were used to compare the methods, the full range, and the range of the 2nd and 3rd quartile of the mean usefulness ratings. For the Vision North Texas survey, because the Advanced scenario analysis and Advanced Expert Guided Scenarios are both based on advanced scenario analysis methods, these were combined into one category "Advanced Scenario - ASA and AES". Also since both "Expert Opinion" and " Expert Opinion Guided By Stakeholders" are based on the opinions of experts, these methods were also combined into one category " Expert - EXO and EGS"

The following provides the results of the tests for these two hypotheses for each case study.

AzOne Results

Figure 6, AzOne Percent Usefulness Rating by Method, compares the percent of each usefulness rating (not at all useful, a little useful, quite a bit useful, and extremely useful) that was selected for each method from all surveys. This shows a difference in ratings between the consensus methods and other methods. The results for the Pearson Chi Square, Lamda Symetric and Cramer's V tests are shown in Table 12. These tests are significant at the 0.05 significance level, thus the null hypothesis is rejected and the first hypothesis that the usefulness ratings of the heuristics when group by method are significantly different is assumed to be true. This establishes that there is some relationship between method and usefulness rating.

Figure 6: AzOne Percent Usefulness Rating by Method

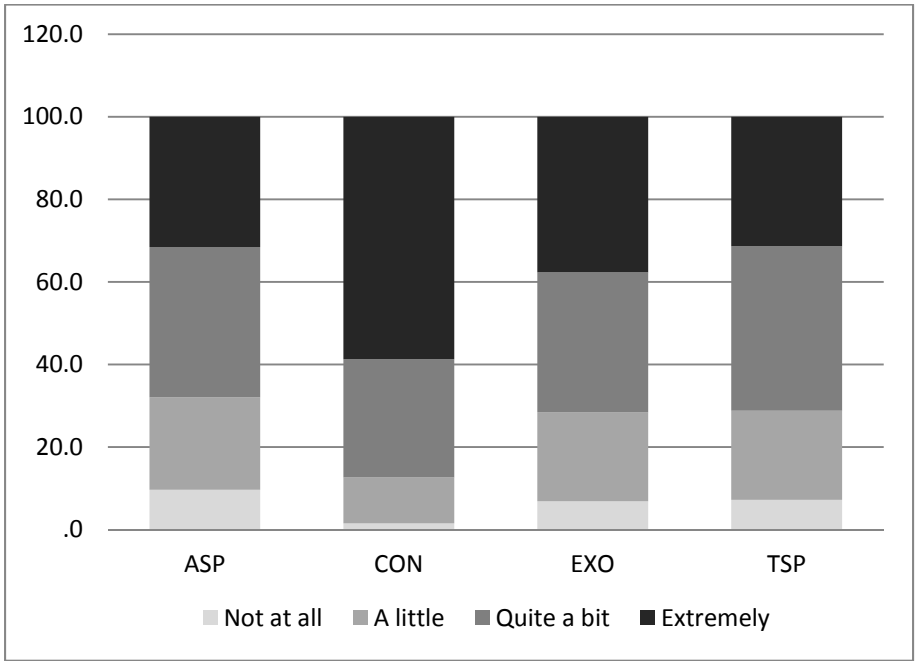


Table 11: AzOne Test Results for Usefulness Rating by Method

Test	Value	DF	Sig (2 Tail)
Pearson Chi-Square	287.354	9	.000
Lambda Symmetric	.055		.000
Cramer's V	.138		.000

It is evident in Figure 6, AzOne Percent Usefulness Rating by Method, that heuristics derived from Advanced Scenario Analysis methods have fewer "Extremely useful" ratings and more "Not at All Useful" ratings than the CON Consensus method heuristics. Table 15, AzOne Mean Usefulness Rating for Each Heuristic, provides the mean usefulness ratings for all AzOne heuristics, sorted by mean. This table shows that only a few ASA method heuristics are at the top of the table. Table 13 shows the mean estimates of usefulness rating by method group. This table shows that the Consensus method heuristics had the highest mean rating and the ASA method heuristics had the lowest mean rating. Table 14 provides the Student t Means Difference test results for each possible pairing of heuristic method groups. Using the 0.05 significance level, all but two of the six mean comparisons shows a significant difference between the mean usefulness rating estimates.

Table 12: AzOne Usefulness Rating Mean Estimates by Method Group

Heuristic Method	N	Mean	Std. Deviation
All Heuristics	5021	3.07	.919
CON Consensus	1131	3.45	.749
EXO Expert	1431	3.02	.931
TSP Traditional Scenario	1011	2.95	.904
ASP Advanced Scenario	1448	2.90	.957

No significant difference was found between the Expert Opinion and Traditional Scenario Planning, and between Traditional Scenario Planning and Advanced scenario analysis. Thus the hypothesis that heuristics developed by ASA methods will be considered more useful is rejected, and it is found that the heuristics developed using the

Consensus and Expert Opinion are considered more useful than ASA heuristics.

Table 15, provides the mean usefulness rating for each of the AzOne heuristics in or from most useful to least useful.

Table 13: AzOne Results of Student t Mean Difference Test for Heuristic Method Groups

Mean Difference t Test	Sig.(2 Tail)
CON <> EXO	0.000
CON <> TSP	0.000
CON <> ASP	0.000
EXO <> TSP	0.063
EXO <> ASP	0.000
TSP <> ASP	0.151

Significant at .05 %

Table 14: AzOne Mean Usefulness Rating for Each Heuristic

CODE	Average Usefulness Rating 4 High 1 Low	Standard Deviation	Method
08UFGCON	3.7	0.6	Group Consensus
09UFGCON	3.6	0.7	Group Consensus
80UFGEXO	3.6	0.7	Expert Opinion
010TRNCON	3.5	0.7	Group Consensus
06QLFCON	3.5	0.7	Group Consensus
12QLFCON	3.5	0.7	Group Consensus
31UFGTSP	3.5	0.6	Traditional Scenario Planning
38UFGEXO	3.5	0.7	Expert Opinion
39UFGEXO	3.5	0.7	Expert Opinion
43UFGEXO	3.5	0.7	Expert Opinion
49UFGTSP	3.5	0.7	Traditional Scenario Planning
85UFGASP	3.5	0.6	Advanced scenario analysis
03TRNCON	3.4	0.7	Group Consensus
04QLFCON	3.4	0.8	Group Consensus
10UFGCON	3.4	0.8	Group Consensus
32UFGEXO	3.4	0.7	Expert Opinion
51UFGEXO	3.4	0.8	Expert Opinion
07UFGCON	3.3	0.7	Group Consensus
11.0QLFCON	3.3	0.8	Group Consensus
14TRNEXO	3.3	0.7	Expert Opinion
47QLFCON	3.3	0.7	Group Consensus
52QLFASP	3.3	0.9	Advanced scenario analysis
54UFGEXO	3.3	0.8	Expert Opinion
75UFGTSP	3.3	0.7	Traditional Scenario Planning
77UFGEXO	3.3	0.8	Expert Opinion

CODE	Average Usefulness Rating 4 High 1 Low	Standard Deviation	Method
81UFGASP	3.3	0.7	Advanced scenario analysis
82TRNASP	3.3	0.8	Advanced scenario analysis
05QLFCON	3.2	0.9	Group Consensus
13QLFCON	3.2	1.0	Group Consensus
33UFGTSP	3.2	0.9	Traditional Scenario Planning
61UFGTSP	3.2	0.9	Traditional Scenario Planning
78UFGEXO	3.2	0.8	Expert Opinion
50UFGTSP	3.1	0.7	Traditional Scenario Planning
72UFGEXO	3.1	0.9	Expert Opinion
30TRNTSP	3.0	0.8	Traditional Scenario Planning
41UFGASP	3.0	0.8	Advanced scenario analysis
64UFGEXO	3.0	1.0	Expert Opinion
67UFGEXO	3.o	1.0	Expert Opinion
83TRNASP	3.0	1.0	Advanced scenario analysis
18TRNTSP	2.9	0.9	Traditional Scenario Planning
23TRNTSP	2.9	0.9	Traditional Scenario Planning
44UFGEXO	2.9	0.8	Expert Opinion
27TRNTSP	2.8	1.0	Traditional Scenario Planning
60UFGASP	2.8	0.9	Advanced scenario analysis
65UFGEXO	2.8	0.8	Expert Opinion
76UFGTSP	2.8	0.8	Traditional Scenario Planning
79UFGTSP	2.8	0.9	Traditional Scenario Planning
24TRNASP	2.7	0.9	Advanced scenario analysis
36UFGEXO	2.7	0.9	Expert Opinion
55UFGEXO	2.7	0.9	Expert Opinion
28TRNTSP	2.6	0.8	Traditional Scenario Planning
69UFGEXO	2.6	0.9	Expert Opinion
26TRNASP	2.5	1.0	Advanced scenario analysis
45UFGEXO	2.4	1.0	Expert Opinion
63UFGASP	2.4	0.9	Advanced scenario analysis
70UFGASP	2.4	0.9	Advanced scenario analysis
71UFGASP	2.4	0.9	Advanced scenario analysis
59UFGEXO	2.3	1.0	Expert Opinion
29TRNTSP	2.2	1.0	Traditional Scenario Planning
56UFGEXO	2.2	0.9	Expert Opinion
57UFGTSP	2.2	0.9	Traditional Scenario Planning
62UFGASP	2.2	1.0	Advanced scenario analysis
73UFGASP	2.2	0.9	Advanced scenario analysis

Table 16, AzOne Range of Usefulness Means by Method, presents the full and quartile ranges for each of the methods in the AzOne case study and Figure 7, Figure 7: AzOne Scatter Plot of Mean, Range, and Quartiles of Usefulness Means by Method,

shows these ranges graphically. The "Expert Opinion" method has the largest full range. The TSP method has 2 outlier values (see Figure 7) and excluding these the ASA method has the second largest full range. Advanced Scenario Analysis methods have the largest quartile range with Expert Opinion methods having the second largest range.. Thus one of the two measure of range were supports the hypothesis that ASA methods create a wider range of usefulness ratings with the second test showing it is at least larger than at least one other method.

Table 15 AzOne Range of Usefulness Means by Method

Method	Full Range	2nd & 3rd Quartile Range
Advanced scenario analysis	1.23	0.83
Group Consensus	.51	0.20
Expert Opinion	1.39	0.66
Traditional Scenario Planning	1.37	0.40

Figure 7: AzOne Scatter Plot of Mean, Range, and Quartiles of Usefulness Means by Method

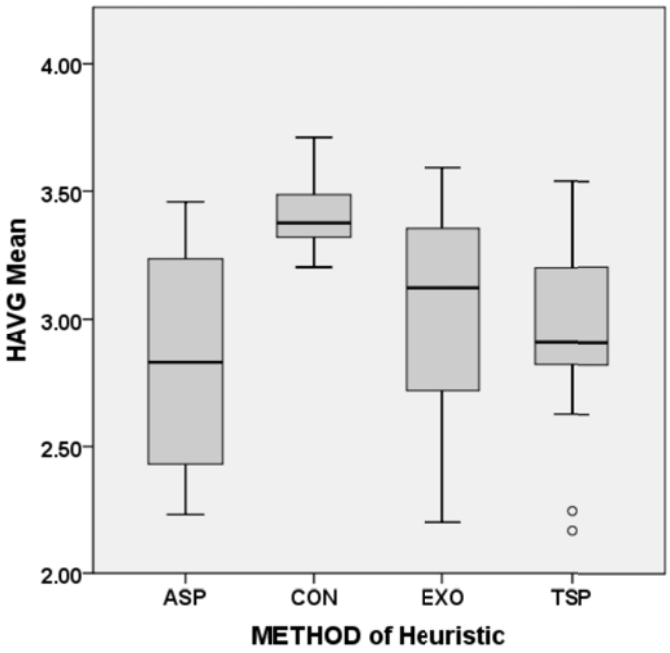


Figure 8, AzOne Percent Disagreeing with Heuristic, shows the distribution of percent disagree with the highest level of percent disagree at 53%. Some heuristics had no respondent indicate they disagreed with the heuristics with most heuristics having levels of percent disagree under than 10%. Figure 9 shows the mean percent disagree for each heuristic in the AzOne case study. All methods except the "Group Consensus" method show a broad range of levels for percent disagree with the ASA method having the highest average. The ASA method has the highest mean percent disagree.

Figure 8: AzOne Percent Disagreeing with Heuristic

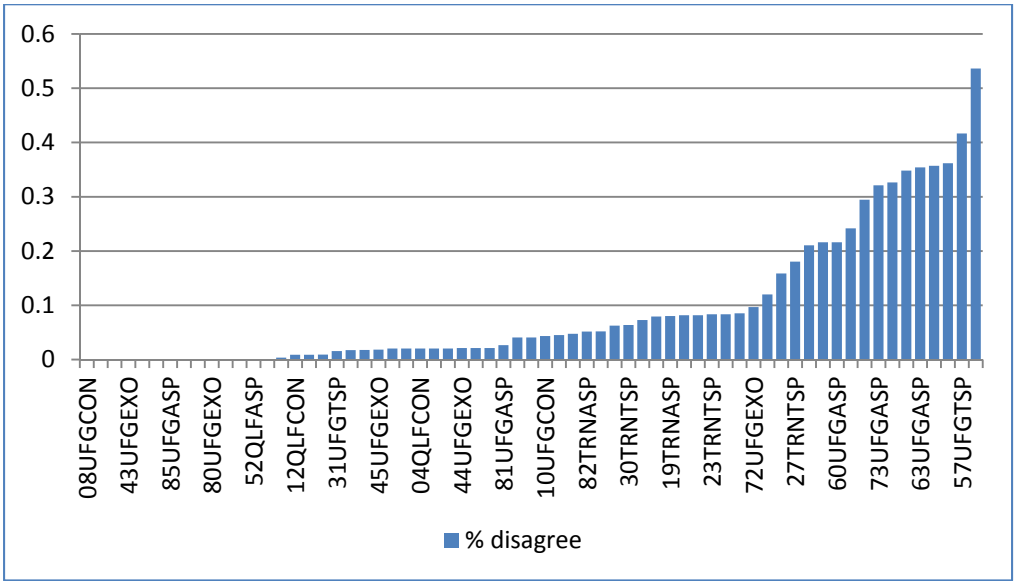


Table 17, AzOne Mean Percent Disagree by Method, shows the full and quartile range for the AzOne survey and Figure 10 shows these ranges graphically in a box plot. For the AzOne survey Advanced scenario analysis has the largest full range and largest quartile range and has the highest maximum and mean percent heuristic disagreement among all methods, even including the outliers for "Expert Opinion" and "Traditional Scenario Planning". Thus both of the two measure of range support the hypothesis that ASA methods create a wider range of heuristic agreement than other methods.

Figure 9: AzOne Percent Disagreeing with Heuristic by Method

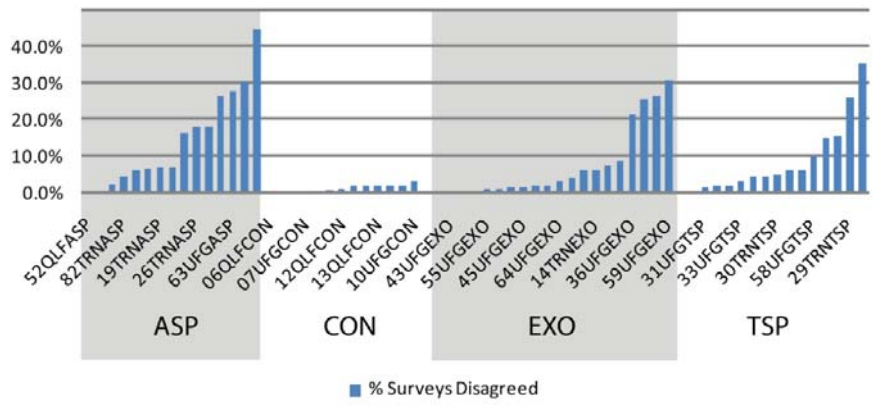


Table 16: AzOne Mean Percent Disagree by Method

Method	Mean % Disagree
Advanced Scenario	17%
Consensus	1%
Expert	12%
Traditional Scenario	12%

Table 17: AzOne Range of Heuristic Percent Disagree by Method

Method	Full Range	2nd and 3rd Quartile Range
Advanced scenario analysis	.54	0.27
Group Consensus	.04	0.02
Expert Opinion	.36	0.09
Traditional Scenario Planning	.42	0.13

Vision North Texas (VNT) Results

Figure 11, VNT Percent Usefulness Rating by Method, compares the percent of each usefulness rating (not at all useful, a little useful, quite a bit useful, and extremely useful) that was selected for each method from all surveys. This shows the difference in ratings between various methods of creating growth heuristics. The results for the Pearson Chi Square, Lamda Symetric, and Cramer's V tests are shown in Table 19, Table 19: VNT Test Results for Usefulness Rating by Method.

Figure 10: AzOne Scatter Plot of Mean, Range, and Quartiles of Heuristic Percent Disagree by Method

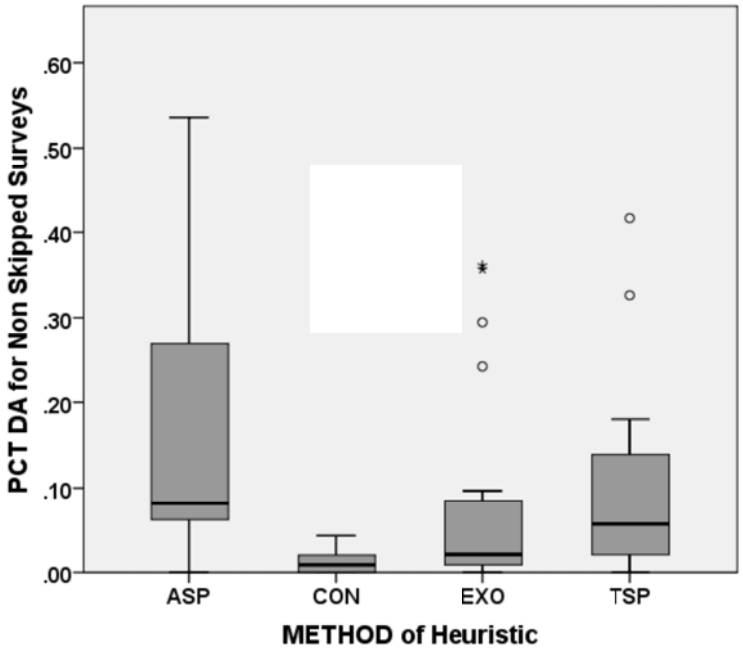
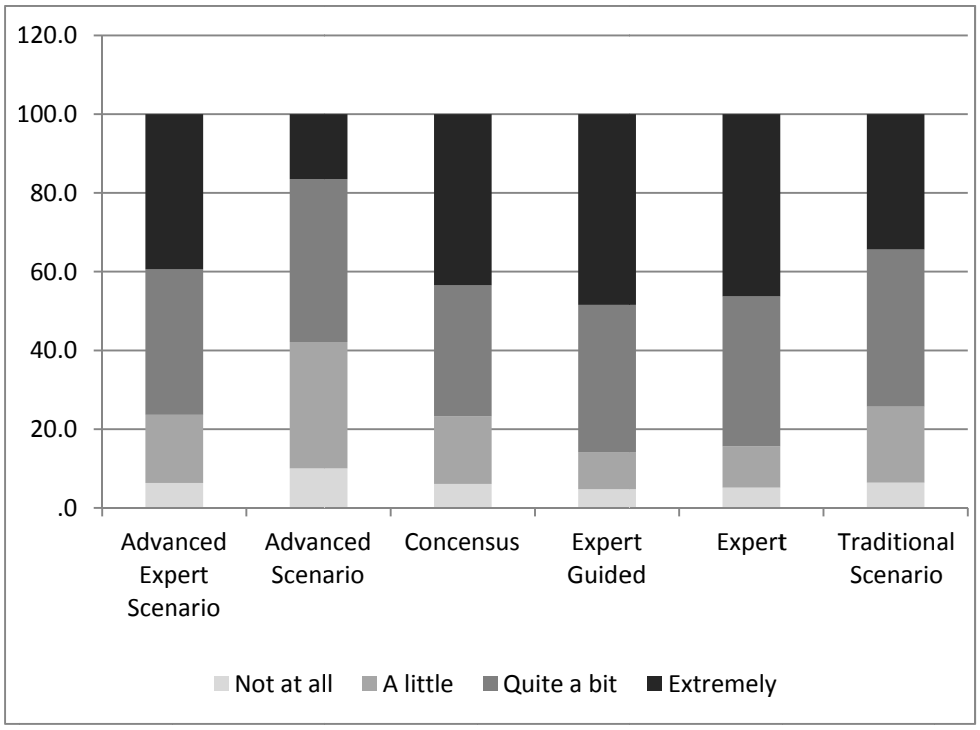


Figure 11: VNT Percent Usefulness Rating by Method



These tests are significant at the 0.05 significance level, though the relationship is fairly weak. Thus the null hypothesis is rejected and the first hypothesis that the usefulness ratings of the heuristics when group by method are significantly different is assumed to be true. This establishes that there is some weak relationship between method and usefulness rating within the Vision North Texas case study.

It is evident in Figure 11 that ASA Advanced scenario analysis method heuristics have fewer number "Extremely useful" ratings and more "Not at All Useful" ratings than all the other method heuristics. Table 20, VNT Usefulness Rating Mean Estimates by Method Group, shows the mean estimates of usefulness rating by method group. This table shows that the Expert Guided heuristics on average had the highest mean rating and the ASA method heuristics had the lowest mean rating. Table 21provides the Student t Means Difference test results for each possible pairing of heuristic method groups. Using the 0.05 significance level, only three of the fifteen mean comparisons cannot be rejected as being samples of the same population of mean usefulness ratings. These were "Consensus" and "Advanced Expert Scenario", "Expert Guided Scenario" and "Expert Opinion", and "Advanced Scenario" and "Traditional Scenario". Thus the hypothesis that heuristics developed by ASA methods will be considered more useful is rejected, and it is found that the heuristics developed using the "Expert Guided Scenario" and "Expert Opinion" are considered more useful than ASA heuristics.

Table 18: VNT Test Results for Usefulness Rating by Method

Test	Value	DF	Sig (2 Tail)
Pearson Chi-Square	287.37	15	.000
Lambda Symmetric	.03		.000
Cramer's V	.137		.000

Table 19: VNT Usefulness Rating Mean Estimates by Method Group

	N	Mean	Std. Deviation
All Heuristics	5098	3.09	.898
EGS Expert Guided	797	3.29	.826
EXO Expert	793	3.25	.843
CON Consensus	757	3.14	.911
AES Advanced Expert Scenario	1400	3.09	.902
TSP Traditional Scenario	684	3.02	.891
ASP Advanced Scenario	667	2.64	.873

Table 20: VNT Results of Student t Mean Difference Test for Heuristic Method Groups

Mean Difference t Test	Sig.(2 Tail)
CON <> EGS	0.000
CON <> EXO	0.011
CON <> AES	0.249
CON <> TSP	0.012
CON <> ASP	0.000
EGS <> EXO	0.338
EGS <> AES	0.000
EGS <> TSP	0.000
EGS <> ASP	0.000
EXO <> AES	0.000
EXO <> TSP	0.000
EXO <> ASP	0.000
AES <> TSP	0.084
AES <> ASP	0.000
TSP <> ASP	0.000

Significant at .05 %

Table 21: VNT Mean Usefulness Rating for Each Heuristic

CODE	Avg Usefulness Rating 4 High 1 Low	Standard Deviation	Method
15TRNEGS	3.57	0.644	Expert Opinion Guided By Stakeholders
60UFGEGS	3.53	0.735	Expert Opinion Guided By Stakeholders
39UFGCON	3.46	0.873	Group Consensus
12UFGEGS	3.45	0.678	Expert Opinion Guided By Stakeholders
62ECOEGS	3.45	0.678	Expert Opinion Guided By Stakeholders
77ENVAES	3.42	0.834	Advanced Expert Scenario Analysis
68ENVCON	3.41	0.818	Group Consensus
17QLFEGS	3.40	0.704	Expert Opinion Guided By Stakeholders
03UFGEXO	3.38	0.701	Expert Opinion
16ENVEGS	3.38	0.807	Expert Opinion Guided By Stakeholders
08TRNEXO	3.36	0.786	Expert Opinion
02UFGEXO	3.34	0.779	Expert Opinion
69ENVCON	3.33	0.770	Group Consensus
72ENVAES	3.31	0.845	Advanced Expert Scenario Analysis
10UFGEXO	3.30	0.797	Expert Opinion
04ECOEXO	3.29	0.806	Expert Opinion
13ENVEGS	3.28	0.889	Expert Opinion Guided By Stakeholders

CODE	Avg Usefulness Rating	Standard Deviation	Method
46TRNTSP	3.28	0.817	Traditional Scenario Planning
14QLFEGS	3.27	0.835	Expert Opinion Guided By Stakeholders
05UFGEXO	3.27	0.920	Expert Opinion
06ENVEXO	3.27	0.855	Expert Opinion
27UFGAES	3.26	0.788	Advanced Expert Scenario Analysis
23UFGAES	3.23	0.864	Advanced Expert Scenario Analysis
48TRNTSP	3.23	0.848	Traditional Scenario Planning
01UFGEXO	3.22	0.813	Expert Opinion
59UFGEGS	3.19	0.844	Expert Opinion Guided By Stakeholders
20UFGAES	3.19	0.888	Advanced Expert Scenario Analysis
61TRNEGS	3.18	0.881	Expert Opinion Guided By Stakeholders
65ENVCON	3.17	0.905	Group Consensus
67ENVCON	3.15	0.901	Group Consensus
21TRNAES	3.15	0.871	Advanced Expert Scenario Analysis
09ENVEXO	3.15	0.890	Expert Opinion
64ENVCON	3.14	0.860	Group Consensus
19UFGEGS	3.13	0.840	Expert Opinion Guided By Stakeholders
24UFGAES	3.13	0.841	Advanced Expert Scenario Analysis
53ENVTSP	3.11	0.805	Traditional Scenario Planning
51UFGTSP	3.09	0.830	Traditional Scenario Planning
78ENVAES	3.09	0.918	Advanced Expert Scenario Analysis
22UFGAES	3.07	0.864	Advanced Expert Scenario Analysis
76ENVAES	3.06	0.907	Advanced Expert Scenario Analysis
66ENVCON	3.05	0.952	Group Consensus
71ENVAES	3.03	0.917	Advanced Expert Scenario Analysis
43UFGTSP	3.00	0.833	Traditional Scenario Planning
07QLFEXO	2.99	0.934	Expert Opinion
57ENVTSP	2.98	0.854	Traditional Scenario Planning
75ENVAES	2.97	0.974	Advanced Expert Scenario Analysis
63ENVCON	2.92	0.862	Group Consensus
58UFGCON	2.91	1.041	Group Consensus
70ENVCON	2.87	0.840	Group Consensus
54UFGASP	2.85	0.909	Advanced scenario analysis
55UFGASP	2.82	0.796	Advanced scenario analysis
41UFGTSP	2.81	0.833	Traditional Scenario Planning
47TRNTSP	2.77	0.876	Traditional Scenario Planning
73ENVAES	2.76	0.908	Advanced Expert Scenario Analysis
74ENVAES	2.72	0.956	Advanced Expert Scenario Analysis
45UFGASP	2.63	0.820	Advanced scenario analysis
11UFGASP	2.57	0.871	Advanced scenario analysis
44ECOASP	2.55	0.894	Advanced scenario analysis
42UFGTSP	2.51	1.052	Traditional Scenario Planning
40UFGTSP	2.49	0.996	Traditional Scenario Planning

Table 23, Range of Usefulness Means by Method , presents the full and quartile ranges for each of the methods in the AzOne case study and Figure 12, VNT Scatter Plot of Mean, Range, and Quartiles of Usefulness Means by Method, shows these ranges

graphically. The "Advanced Scenario" methods have the largest full range followed by "Traditional Scenario Planning" method. The "Group Consensus" method quartile range is slightly larger than the "Advanced Scenario" methods. Thus one of the two measure of range supports the hypothesis that ASA methods create a wider range of usefulnes ratings with the second test affirm it is larger than all other methods except the Group Consensus.

Table 22: VNT Range of Usefulness Means by Method

Method	Full Range	2 & 3rd Quartile Range
Advanced Scenario - ASA and AES	.87	0.43
Group Consensus	.59	0.44
Expert - EXO and EGS	.59	0.19
Traditional Scenario Planning	.79	0.33

Figure 12: VNT Scatter Plot of Mean, Range, and Quartiles of Usefulness Means by Method

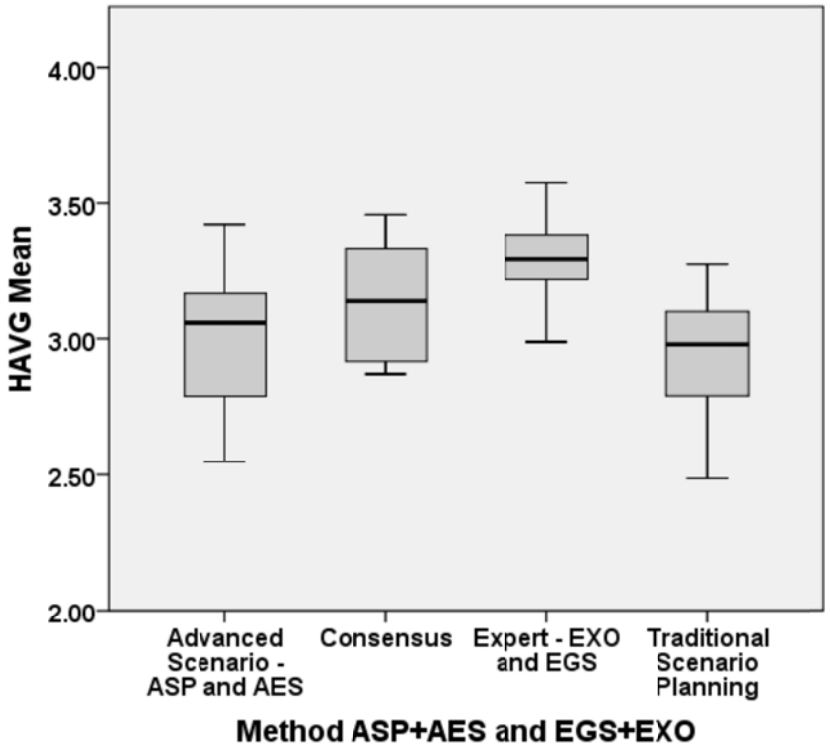


Figure 13: VNT Percent Disagreeing with Heuristic

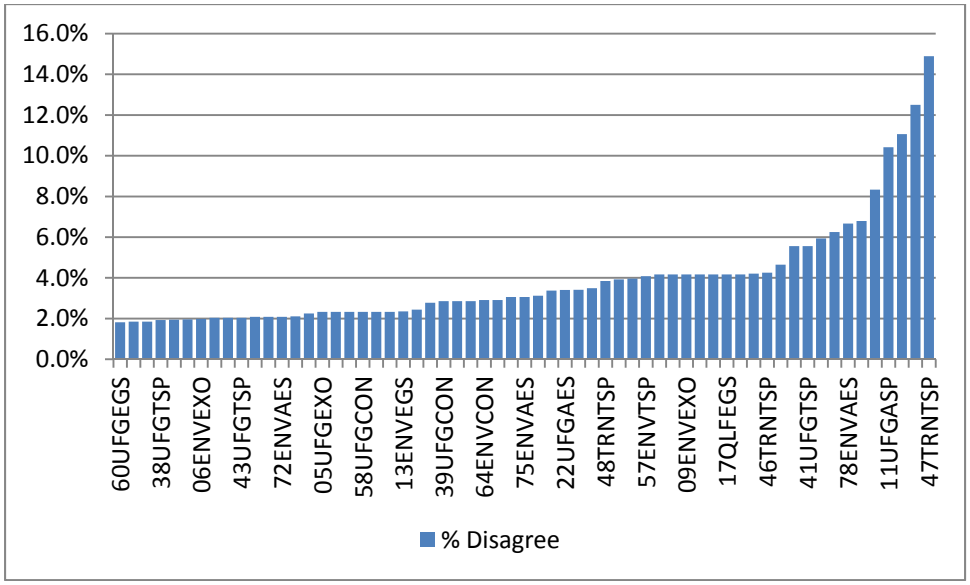


Figure 14: VNT Percent Disagreeing with Heuristic by Method

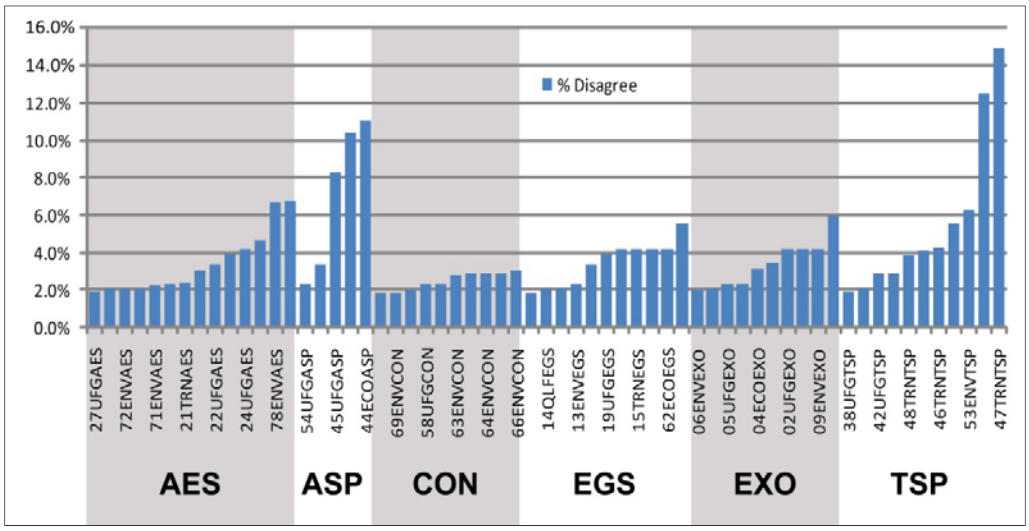


Figure 13, VNT Percent Disagreeing with Heuristic, shows the distribution of percent disagrees. This follows a similar pattern for the AzOne case study but the levels of disagreement are much lower with the highest level of disagreement being 15%. All heuristics had some respondents indicate they disagreed with the heuristics with most heuristics having levels of percent disagree under than 5%.

Figure 14, VNT Percent Disagreeing with Heuristic by Method, and Table 24, VNT Mean Percent Disagree by Method , show the mean percent disagree for each heuristic in the Vision North Texas case study. The Consensus" and Expert methods all had flat levels of percent disagree, while the other methods show a broad range of levels for percent disagree with the TSP method having the highest heuristic percent disagree and the ASA method having the highest mean percent disagree.

Table 23: VNT Mean Percent Disagree by Method

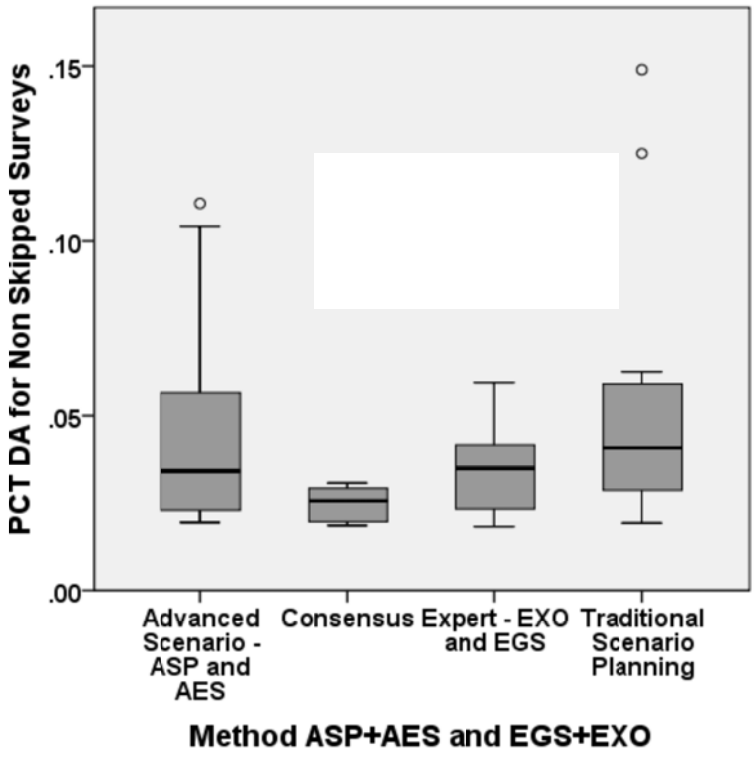
Method	Mean % Disagree
Advanced Scenario - ASA and AES	4.4%
ASA Advanced Scenario Analysis	7.1%
AES Advanced Expert Scenario Analysis	3.4%
Group Consensus	2.5%
Expert - EXO and EGS	3.4%
EXO Expert Opinion	3.4%
EGS Expert Opinion Guided by Stakeholders	3.5%
Traditional Scenario Planning	5.6%

Table 25, VNT Range of Heuristic Percent Disagree by Method, shows the full and quartile range for the AzOne survey and Figure 15, VNT Scatter Plot of Mean, Range, and Quartiles of Heuristic Percent Disagree by Method, shows these ranges graphically. For the VNT survey if the outliers for "Traditional Scenario Planning" are ignored "Advanced scenario analysis" has the largest full range among all methods, otherwise it has the second largest full range. "Advanced scenario analysis" does have the largest quartile range with "Traditional Scenario Planning" having the second largest. Thus one of the measures supports the hypothesis that ASA methods create a wider range of heuristic agreement than other methods and one measure indicates that it is at least larger than two other methods.

Table 24: VNT Range of Heuristic Percent Disagree by Method

Method	Full Range	2nd and 3rd Quartile Range
Advanced Scenario - ASA and AES	.09	0.044
Consensus	.01	0.010
Expert - EXO and EGS	.04	0.020
Traditional Scenario Planning	.13	0.034

Figure 15: VNT Scatter Plot of Mean, Range, and Quartiles of Heuristic Percent Disagree by Method



Exploration of Why Heuristics Are Rated Useful and Disagreed With

Hypothesis E suggested that respondents reasoning for indicating a strategic is useful will correlate with reasons of self interest, and Hypothesis F suggested that the topical content and structure of language used in the strategic heuristic will not be correlated to usefulness or disagreement levels.. These were established to test the validity of using usefulness as a proxy for political will. Several approaches were used to explore why respondents rated heuristics useful or disagreed with them: 1) a survey

question that asked respondents to indicate which of two heuristic was more useful and then selected a reason why it was more useful, 2) the relationship between a heuristics usefulness and disagreement, and 3) an analysis of the content of a heuristic and the relationship of content to usefulness and disagreement.

Paired Heuristics

In order to try and determine why respondents rated some heuristics more useful than others, a paired comparison questions was included on the survey. This question paired a heuristic each respondent rated usefulness highly, always an ASA method, with a heuristic the respondent rated usefulness as low. Each respondent was asked to evaluate why they rated one heuristic higher than the other based on the level of agreement or disagreement (Strongly Agree, Agree, Disagree, Strongly Disagree) with 11 statements (See Table 26 Statements about being more useful). It was assumed that this Likert scale is an interval scale with Strongly agree a value of 1 and Strongly Disagree a value of 4.

Table 25: Statements About Being More Useful.

Code	Reason Statement
Q27 Why -Truthful	I believe the strategic concept is truthful.
Q28 Why -Recognize	I recognize the strategic concept.
Q29 Why -Understand	I understand the strategic concept better than the other concept
Q30 Why -Simple	The strategic concept is simple.
Q31 Why -Complex	The strategic concept is complex.
Q32 Why -Challenges	The strategic concept challenges traditional thinking.
Q33 Why -Innovative	The strategic concept is innovative
Q34 Why -Fair	The strategic concept is fair.
Q35 Why -Equitable	The strategic concept will lead to an equitable resolution of an issue
Q36 Why -Relevant	The strategic concept is relevant to the issues of growth important to me
Q37 Why -Successful	I can imagine this strategic concept being successful.

In the paired question section of the survey each respondent was asked to evaluate why they rated one heuristic higher than another. Table 27, Table 26: AzOne Results of Reason for Preference Questions, presents the mean agreement values for each

reason statement for the AzOne survey and Table 28, VNT Results of Reason for Preference Question, for the VNT survey. These were divided into five groups (High Positive, Medium Positive, Low Positive, Neutral, and Low Negative), for which there is no significant difference among the means in the groups, but there is significant difference in the means between groups (based on Student t test of mean difference). Both the AzOne and the VNT Survey respondents agreed on the items in the High and Medium Positive groups. In general, heuristics that the respondents recognized, were relevant to the issues they were interested in, were considered truthful, would be successful and fair were rated more useful than other heuristics. They also agreed on complexity as a factor that was considered a negative factor.

Table 26: AzOne Results of Reason for Preference Questions

Group	Reason Statement	N	Mean 1 Strongly Agree 4 Strongly Disagree	Std. Deviation
High Positive	Q28 Why -Recognize	184	1.54	.571
	Q36 Why -Relevant	184	1.61	.626
	Q27 Why -Truthful	187	1.64	.544
	Q37 Why -Successful	184	1.67	.613
Medium Positive	Q34 Why -Fair	180	1.91	.591
Low Positive	Q30 Why -Simple	184	2.07	.787
	Q35 Why -Equitable	178	2.11	.685
	Q32 Why -Challenge	183	2.15	.857
	Q29 Why -Understand	182	2.18	.883
Neutral	Q33 Why -Innovative	182	2.28	.782
Low Negative	Q31 Why -Complex	182	2.70	.795

A linear regression between the usefulness value of the preferred heuristic and the Reasons for Preference factors showed a weak though significant correlation for some of these factors for both the AzOne and VNT Surveys. Table 29, AzOne Regression Results for Usefulness Value and Reasons for Selecting Usefulness Value, and Table 30, Table 29: VNT Regression Results for Usefulness Value and Reasons for Selecting Usefulness Value, provide the results for these regressions. Both were stepwise

regressions with the Reason factors reversed (ie Strongly agree was a 4 and strongly disagree was a 1) and the Q31 Why - Complex factor was forced into the regression. This factor was loaded to test for a negative contribution. Both are significant but explain less the 20% of the variance in the sample. The AzOne regression included 4 of the top five rated reason factors (Recognize, Relevant, Truthful, and Fair). The VNT regression only included 1, Relevant, the other factors (Challenge and Innovative) were among the Low Positive factors. Relevant was the largest contributing factor in both regressions. The complex factor was negative in both regressions though it was the weakest factor and its significance was very small (>.5) and would not have been included in the regression if not forced. There were anomalies in these regressions. Equitable in the AzOne regression and Challenge in the VNT regression though they were both Low Positive factors loaded with a fairly large negative coefficients and were significant (<.07) even more so than the Complex factor.

Table 27: VNT Results of Reason for Preference Questions

Group	Reason Statement	N	Mean 1 Strongly Agree 4 Strongly Disagree	Std. Deviation
High Positive	Q36 Why -Relevant	135	1.53	.570
	Q28 Why -Recognize	137	1.59	.522
	Q27 Why -Truthful	136	1.61	.533
	Q37 Why -Successful	136	1.71	.543
Medium Positive	Q34 Why -Fair	136	1.88	.493
Low Positive	Q35 Why -Equitable	131	2.02	.588
	Q32 Why -Challenge	136	2.04	.759
	Q33 Why -Innovative	136	2.14	.722
Neutral	Q29 Why -Understand	133	2.27	.750
	Q30 Why -Simple	136	2.29	.709
Low Negative	Q31 Why -Complex	135	2.42	.717

Table 28: AzOne Regression Results for Usefulness Value and Reasons for Selecting Usefulness Value

AzOne	R	R Square	F	Sig.	
Regression	0.426	0.181	6.126	0.000	
Coefficients					
	Un-standardized		Standardized		
Independent Factors	Beta	Std. Error	Beta	t	Sig.
(Constant)	2.48	0.27	0.00	9.24	0.000
Q27 Why -Truthful Reversed	0.10	0.07	0.12	1.38	0.169
Q28 Why -Recognize Reversed	0.15	0.07	0.20	2.21	0.028
Q34 Why -Fair Reversed	0.08	0.07	0.12	1.13	0.258
Q35 Why -Equitab Reversedle	-0.12	0.07	-0.19	-1.87	0.063
Q36 Why -Relevant Reversed	0.18	0.06	0.26	3.26	0.001
Q31 Why -Complex Reversed	-0.02	0.04	-0.04	-0.61	0.543

Table 29: VNT Regression Results for Usefulness Value and Reasons for Selecting Usefulness Value

VNT	R	R Square	F	Sig.	
Regression	.407	.166	5.915	.000	
Coefficients					
	Un-standardized		Standardized		
Independent Factors	Beta	Std. Error	Beta	t	Sig.
(Constant)	3.30	0.28	0.00	11.68	0.000
Q36 Why -Relevant Reversed	0.20	0.05	0.34	3.80	0.000
Q32 Why -Challenge Reversed	-0.10	0.05	-0.23	-2.11	0.037
Q33 Why -Innovative Reversed	0.08	0.05	0.17	1.78	0.077
Q31 Why -Complex	-0.02	0.05	-0.05	-0.50	0.616

Effect of Reasons For Preference on Disagreement on

Some survey respondents were presented with a paired heuristic comparison where the heuristic that the rated less useful was a heuristic that they also indicated the disagreed with the heuristic. For the AzOne survey this was a small sample, 20 responses. Table 31, Table 30 : AzOne Reasons Agreed Heuristic is More Useful than Disagreed Heuristic, shows the mean ratings for these 20 responses. These means have higher values than for those that did not indicate they disagreed with the lower rated

heuristic, but using a independent pairs Student t test, none of these reasons are significantly different at the 0.05 significance level. These are similar in order to full sample response to these questions, the top four in this list are the same top four found in Table 27 for the full sample. However now there are four items that tend more towards the disagree side of the scale, Complex, Innovative, Understandable, and Challenging.

Table 30 : AzOne Reasons Agreed Heuristic is More Useful than Disagreed Heuristic

Why Agreed Heuristic is better than Disagreed Heuristic	N	Mean 4 Agree 1 Disagree	Std. Deviation
Q27 Why -Truthful	20	1.55	.510
Q28 Why -Recognize	19	1.58	.507
Q37 Why -Successful	19	1.63	.597
Q36 Why -Relevant	19	1.68	.749
Q34 Why -Fair	19	1.89	.658
Q35 Why -Equitable	19	2.05	.780
Q30 Why -Simple	19	2.16	.898
Q32 Why -Challenge	19	2.32	.946
Q29 Why -Understand	19	2.32	.885
Q33 Why -Innovative	19	2.47	.841
Q31 Why -Complex	19	2.84	.688

Most of these reasons suggest that how a person views the content of a heuristic influences why one heuristic is rated higher than another, and perhaps why one person may disagree with a heuristic and another not. Thus perhaps content does play a role in assessment of the usefulness of a heuristic.

Affect of Content on Heuristic Usefulness and Disagreement.

The results of the reasons why analysis suggest that there may be two aspects of content influencing opinions of heuristics, one positive and one negative. Two of factors in Table 31 that people indicated were NOT factors in why they rated suggest factors related to readability of a heuristic. These results would suggest that readability is not an important factor in assessing a heuristic. This seems a bit counter intuitive, in that the easier a heuristic was to read, the higher would be the level of understanding, and thus the

higher the usefulness rating . Three of the higher factors, recognize, relevant, and successful suggest that the subject matter of a heuristic may be related to opinions of usefulness. Two test how content may affect usefulness and disagreement, to content classification schemes were created, one based on readability and one based on subject matter of content. Using these classification methods the relationships between the content of each heuristic and the average usefulness ratings and percent disagreement of each heuristic were explored.

To obtain statistically significant results for such tests one needs ideally a large sample with high variation in values between sub groups, such as content classes. The number of heuristics for each case study, 65 AzOne and 66 VNT limits the ability to conduct such tests across multiple sub groups unless variance between groups is high. Though there is much consistency between the AzOne and Vision North Texas results, there is one item for which there is a wide difference, respondent disagreement with heuristics. The VNT survey and AzOne survey showed a similar profile of disagreement by heuristic (See Figure 8 AzOne Percent Disagreeing with Heuristic and Figure 13 VNT Percent Disagreeing with Heuristic); however, the Vision North Texas survey showed very low responses of disagreement, with the highest heuristic disagreement count or 14.9% of the respondents, while the AzOne survey had percent disagreement as high as 53%.. Given this low level of disagreement in the VNT survey results I decided not to pursue the content analysis on the VNT survey and focused on the AzOne survey where variance was larger.

Content Readability.

The first scheme used two metrics used in the education literature to measure the readability level of paragraph, the Flesch Ease of Reading and the Flesch Kincaid reading grade level score (Farr JN, Jenkins JJ, & Paterson DG, 1951; Flesch, 1948; Kincaid JP,

Fishburne RP Jr, Rogers RL, & Chissom BS, 1975). The assessment tools found in Microsoft Word 2003 were used to evaluate each heuristic and assign it a Flesch Ease score and a Flesch Kincaid grade level. The Flesch Reading Ease test creates higher scores for material that is easier to read and lower scores for material that is more difficult to read. The Flesch Kincaid scores estimates a grade level of education that is required to understand the material being scored. Table 32 shows the results of a correlation between these scores and average usefulness rating and percent disagreement for each heuristic was conducted. In both cases at a 0.05 significance level there is a significant correlation between readability and both mean usefulness and percent disagree.

Table 31 : Correlation of Readability and Percent Disagree and Mean Usefulness

		Percent Disagree	Mean Usefulness
Flesch Ease	Pearson Correlation	0.407	-0.384
	Sig (2 Tailed)	0.001	0.002
	N	65	65
Flesch Kincaid	Pearson Correlation	-0.332	0.282
	Sig (2 Tailed)	0.007	0.023
	N	65	65

Table 32 : Linear Regression between Readability and Usefulness/Disagreement

Independent	Dependent	R	R Square	Adjusted R Square	df	F	Sig.
Flesch Kincaid	Mean Usefulness	0.28	0.08	0.06	1	5.43	0.023
Flesch Ease	Mean Usefulness	0.28	0.08	0.06	1	4.61	0.036
Flesch Ease	Percent Disagree	0.34	0.11	0.10	1	6.97	0.011
Flesch Kincaid	Percent Disagree	0.33	0.11	0.10	1	7.78	0.007

These results seem to affirm that complexity and understanding are not factors affecting opinions of usefulness. Grade level was positively correlated with usefulness, the higher the grade level the more useful, and negatively correlated with percent

disagree. Ease or reading was negatively correlated with mean usefulness, the easier a heuristic was to read the lower the mean rating, and positively correlated to percent disagree.

However this relationship is not very strong. Table 33 provides the results of four linear regressions between Flesch Kincaid / Flesch Ease and mean usefulness / percent disagree. Although the correlation is significant for all four of these at the 0.05 significance level, the amount of variation explained by these regression models (adjusted r square of .06 to .1) is very small. Thus though there is evidence that readability effects usefulness and disagreement, the effect is small.

Content Subject.

The secondary hypothesis suggests that ASA methods generate specific content that generates a wide response in usefulness and disagreement regardless of the content subject matter. To test this, the effect that the subject of a heuristic's content has on opinions of the heuristics usefulness and disagreement must be assess. This required developing another unit of analysis related to content. An ontology (T. Gruber, 2009; T. R. Gruber, 1993; Janowicz, et al., 2008; Smith, 2004) using a modified semantics approach was developed to score the content of the heuristics. Though there is literature that explores the concepts of an ontology for urban and regional planning (Caglioni & Rabino, 2007; Chaidron, et al., 2007; Janowicz, et al., 2008; Kaza & Hopkins, 2007; Métral, et al., 2007; Teller J, et al., 2010; Teller, et al., 2009),.there is less literature that explores semantic urban ontology and most of this is focus on GIS applications (Hoekstra, et al., 2010; Janowicz, et al., 2008). Thus currently there is no established word base ontology that can be used to classify content (web or otherwise) into urban planning subjects. Given the limited scope of the classification needs of this research, a word based ontology was created by identifying 15 regional planning topics related to the

AzOne project and listing words related to each topic using the words found in the AzOne heuristics as the source. Table 34 presents this initial ontology.

Each heuristic was assigned a standardized theme score based on a measure of how well the heuristic words matched the related words for each theme. This was done using the following method. The words for each heuristic were compared with the theme word list and the number of matches was counted and divided by the total words in the heuristic, thus create a value that represented the a % of words in the heuristic that matched words in the themes related word list. This was done for all themes for each heuristic. The mean and standard deviation of each theme's % of words values across all heuristics was calculated. A final theme score was calculated by subtracting the theme's % of word value from the theme mean and dividing by the theme standard deviation, thus creating a score that expressed theme's percent of words value in units of standard deviations from the mean. This was done for all themes for each heuristics, giving each heuristic a standard them score for each theme category.

To create a another unit of analysis for this research, the first being Planning Method used to create the heuristics, a heuristic content classification scheme was developed based on the approached developed by a factor analysis of the standard theme scores. The following is a summary of this scheme,. Using an Exploratory Factor Analysis (EFA) a balanced model that loaded 10 factors grouped into 4 components was developed. Table 35 is the rotated component matrix with the theme score loading values by component. Based on how the subject matter of the theme scores grouped for each component, content subject descriptions were created for each component (see Table 36).

Table 33 : AzOne Regional Growth Ontology

Theme	Description	Code	Words
Central	Focus growth on central parts of Region	SCENTRAL	centers, Central, compact, core, cores, Downtown, existing, infill, redevelopment, urban
Housing	Issues related to housing	SHOUSING	affordability, apartments, attached, condominiums, diversity, homes, housing, mixed-use, ownership
Growth	Growth related	SGROWTH	capacity, development, employment, growth, infrastructure, jobs, sprawl
Transportation	General Transportation	STRANSP	202, bus, commute, commuter, freeway, freeways, highway, I-10, I-17, Loop, multi-modal, passenger, rail, rapid, ridership, transit, transportation
Theme	Description	Code	Words
Transit	Related to Transit, Bus, Rail	STRANSIT	bus, multi-modal, passenger, rail, rapid, ridership, transit
Urban Form	Related to the physical form of the urban area	SURFORM	centers,compact,connecting,connection,connectivity,cores,corridor,corridors,density,developable, developed,dispersed,district,elevation,form,infill,linkage,linkages,linking,mixed-use,neighborhoods,open, patterns, polycentric, proximity, redevelopment, sprawl
Foresight	Related to looking to the future	SFUTURE	future, planned, scenario, scenarios
Place Specific	Identifies specific places	SPLSPEC	Apache, Buckeye, Casa, Coolidge, County, East, Eloy, Florence, Goodyear, Hassayampa, Maricopa, Mesa, north, Phoenix, Picacho, Pinal, Santan, Scottsdale, south, Sun, Superstition, Surprise, Tempe, Tucson, Vista, Vistas, West, Wickenburg
Economy Financial	Related to the region's economy or financial issues	SECOFIN	billion, business, cents, employers, employment, financial, Fund, invested, investment, job, jobs, market, million, Money, revenue

Theme	Description	Code	Words
Environmental	Related to the environment of the region	SENVIRO	Conserve, green, Mountains, natural, open, Preserve, preserved, Protect, protected, space, sustainable, washes
Quality of Life	Related to the region's quality of life	SQUALFE	affordability, diverse, diversity, education, livable, play, quality, recreation, variety, vibrant
Open Space and Recreation	Related to open space and recreation	SOPNREC	Conserve, Mountains, Preserve, recreation, safe, trails, washes
Land Use	Related to the region's land uses	SLANDUS	acres, activity, apartments, attached, buildings, commercial, condominiums, developable, developed, development, land, mixed-use, neighborhoods
State Land	References to State land	SSTATE	trust, state

Table 34 : Content Exploratory Factor Analysis Component Matrix

	Component			
	LTRAN	LURBFORM	LGROWECO	LSPRAWL
Theme Scores	1	2	3	4
STRANSIT Transit Content	.952			
STRANSP Transportation Content	.943			
SCENTRAL Central Content		.839		
SURFORM Urban Form Content		.833		
SLANDUS Land Use Content		.518		
SECOFIN Economic Financial Content			.895	
SGROWTH Growth Content			.873	
SSTATE Mention of State Land Content				.735
SFUTURE Foresight Content			-.240	.704
SPLSPEC Specific Place Content		-.320	-.420	-.621

Table 35 : AzOne EFA Component Descriptions

Components	Content Description
LTRAN	General transportation issues with a focus on transit
LURBFORM	General issues of urban form and land use patterns with an emphasis on centralization of the region
LGROWECO	Issues related to the regional economy, public finance, and benefits and impacts of regional growth
LSPRAWL	Issues related to different possible futures for the region with an emphasis on the regions edges and state trust lands.

To confirm this Content classification scheme a confirmatory factor analysis (CFA) was done using structural equation modeling with AMOS. Figure 16, Structural Equation Model for AzOne Content Classification Scheme, shows the model that was developed using the factors from the EFA and the components as latent factors. The theme score of specific place content loaded with a negative contribution in the EFA model. In order to make it easier to build the CFA model this factor was reversed in the CFA model (values multiplied by -1). This model came to equilibrium with regression weights similar to the EFA factor loading values. Table 37 lists some of the goodness of fit statistics for this model.

Table 36 : AzOne CFA Goodness of Fit Statistics

CMIN

Model	NPAR	CMIN	DF	P	CMIN/DF
Default model	36	29.716	29	0.428	1.025
Saturated model	65	0	0		
Independence model	20	236.912	45	0	5.265

Baseline Comparisons

Model	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2	CFI
Default model	0.875	0.805	0.997	0.994	0.996
Saturated model	1		1		1
Independence model	0	0	0	0	0

RMSEA

Model	RMSEA	LO 90	HI 90	PCLOSE
Default model	0.019	0	0.097	0.651
Independence model	0.256	0.225	0.289	0

The CMIN to DF ratio is close to 1 which is indicates a good model fit, well below the general rule of 2 or 3. The Baseline Comparison stats (NFI, RF, IFI, TLI, CFI) are all very close to 1 indicating a good model fit. Finally the RMSEA value of 0.019 is well below the accepted standard of .05 and "p value" for testing the null hypothesis that the population RMSEA is no greater than .05 (PCLOSE) is also higher than the stricter

rule of thumb of .5. In summary this is model is a good fit for the underlying data (T. A. Brown, 2006; Byrne, 2010).

Using this structural equation model a factor score for each of the latent variables (LTRAN, LGROWECO, LSPRAWL, and LURBFORM) were calculated for each heuristic. These content factors (latent) factors provide the metric for a content unit of analysis. For each heuristic, the largest content factor was used to classify each heuristic into one of these content groups. Figure 17 shows the percent of total heuristics in each content class. Using this new unit of analysis, effects of content on usefulness and disagreement were explored.

Figure 16 : Structural Equation Model for AzOne Content Classification Scheme

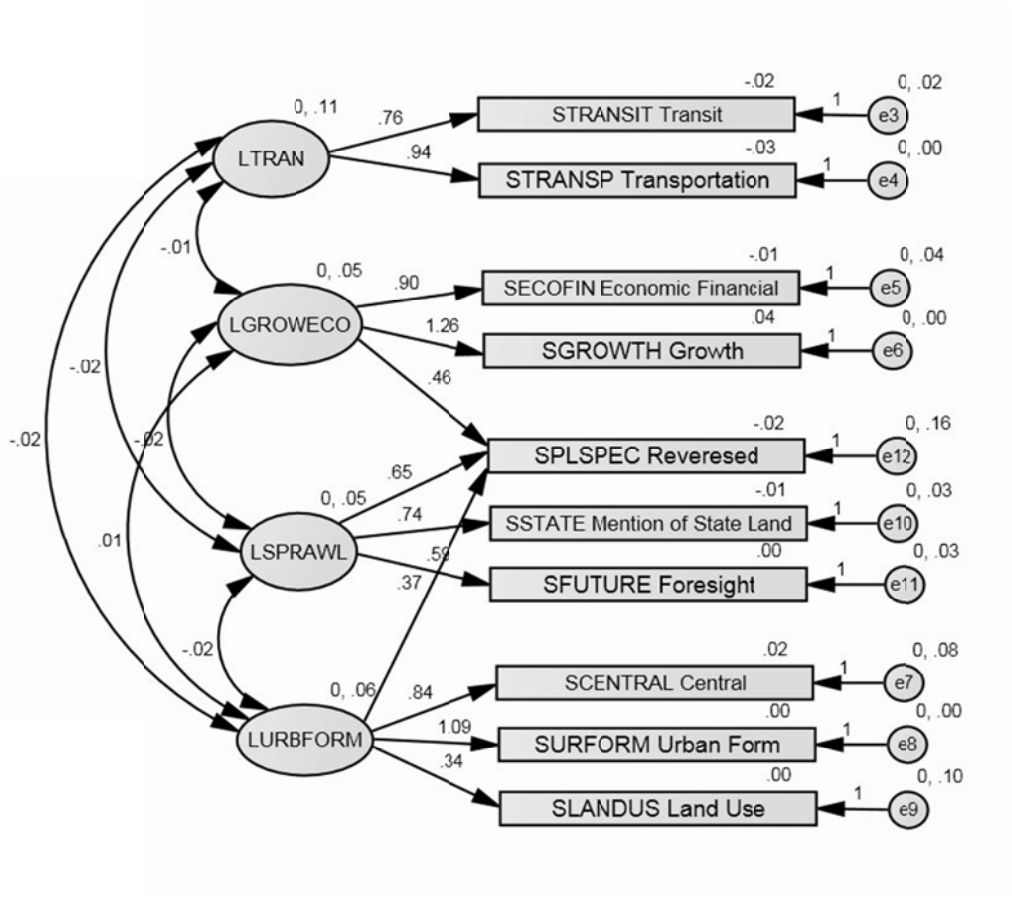


Figure 17 : Percent of Total Heuristics by Content Class

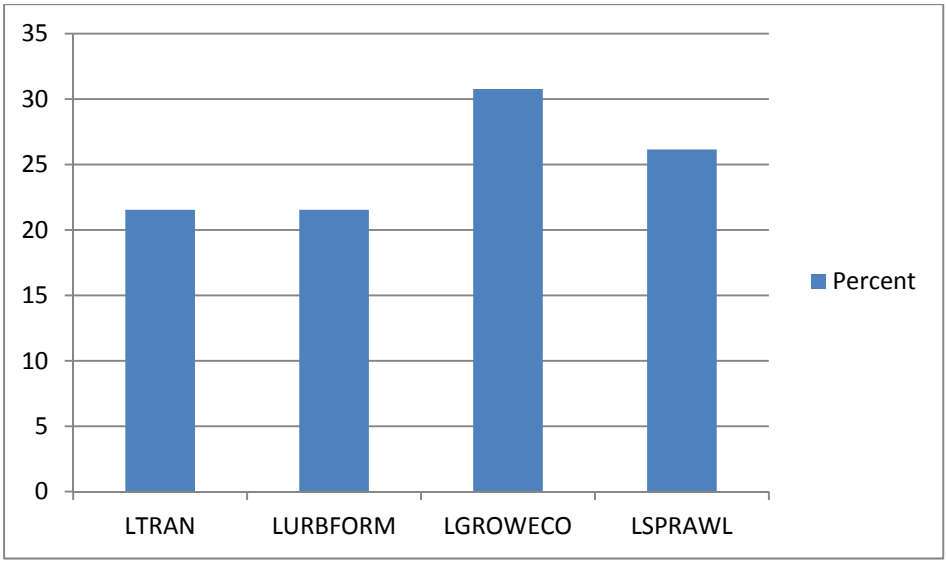


Table 39 shows the mean usefulness rating by content class. Urban Form and Growth Economics content classes are higher than Transportation and Sprawl content classes. Table 40 shows the results of a Chi Square test between usefulness rating and content class, indicating at the 0.05 significance level the correlation between these two is significant. Table 41 shows the results of a student t test on the differences in usefulness means between content class groups, which shows that there is a significant difference between the Transportation / Sprawl content classes and the Urban Form / Growth Economics content classes.

Assuming that this now implies an ordinal relationship between content classes and their effect on usefulness, with Transportation and Sprawl being equal and lower that Urban Form and Growth Economics which are equal, a new ordinal content class can be created with Transportation and Sprawl having a value of 1 and Urban Form and Growth Economics a value of 2. A linear regression, using this classification factor as the independent value and usefulness rating as the dependent variable (Table 38), results in a small positive correlation that at the 0.05 significance level is significant. These results

suggest that there may be a small effect from heuristic content on respondent's opinion of the usefulness of the heuristic, with heuristics with Urban Form and Growth Economics content generating slightly higher usefulness ratings than other heuristics.

Table 37 : Results Linear Regression between Usefulness Rating and Ordinal Content Class

Regression Summary Usefulness Rating as Dependent	R	R Square	Adjusted R Square	Std. Error of the Estimate	
	.152	.023	.023	.906	
ANOVA	Sum of Squares	df	Mean Square	F	Sig.
Regression	51.883	1	51.88	63.230	.000
Residual	2186.757	2665	.821		
Total	2238.640	2666			
Coefficients	Unstandardized Coefficients		Standardized Coefficients		
	Beta	Std. Error	Beta	t	Sig.
(Constant)	2.643	.055		47.815	.000
Ordinal Content Class	.279	.035	.152	7.952	.000

.

Table 38: Mean Usefulness Rating by Content Class

Content Classification	N	Mean Usefulness Rating	Std. Deviation
LTRAN	1293	2.96	.944
LURBFORM	1061	3.23	.874
LGGROWECO	1317	3.20	.838
LSPRAWL	1350	2.92	.968

Table 39 : Chi Square Test of Usefulness Rating and Content Class

	Value	df	Sig. (2-sided)
Pearson Chi-Square	126.111	9	.000
Likelihood Ratio	127.411	9	.000
N of Valid Cases	5021		

Table 40 : Results of Difference in Mean Usefulness Rating between Content Classes (student t)

Sig of t comparing Heuristic Mean Rating			
	LTRAN	LURBFORM	LGROWECO
LTRAN	0.000	0.000	0.344
LURBFORM		0.432	0.000
LGROWECO			0.000

Table 42 shows the mean percent disagreement with the heuristic by content class. Transportation has the highest level of disagreement and Urban Form has the lowest. Table 43 shows the results of a Chi Square test between heuristic disagreement and content class, indicating at the 0.05 significance level the correlation between these two is significant. However Table 44 shows the results of a student t test on the differences in percent disagreement between content class groups which indicate there is a no significant difference in mean disagreement between these content classes.

Figure 18 shows a box plot of percent heuristic disagreement by class. This graph shows that the transportation content class does have the highest mean disagreement and the largest range, however it also shows that the other content classes have outliers of high disagreement that are somewhat evenly distributed between the content classes.

Table 41 : Mean Percent Disagree by Class Content

Content Classification	N	Mean Pct Disagree	Std. Deviation
LTRAN	14	0.11	0.1178
LURBFORM	14	0.05	0.1007
LGROWECO	20	0.07	0.1024
LSPRAWL	17	0.08	0.1017

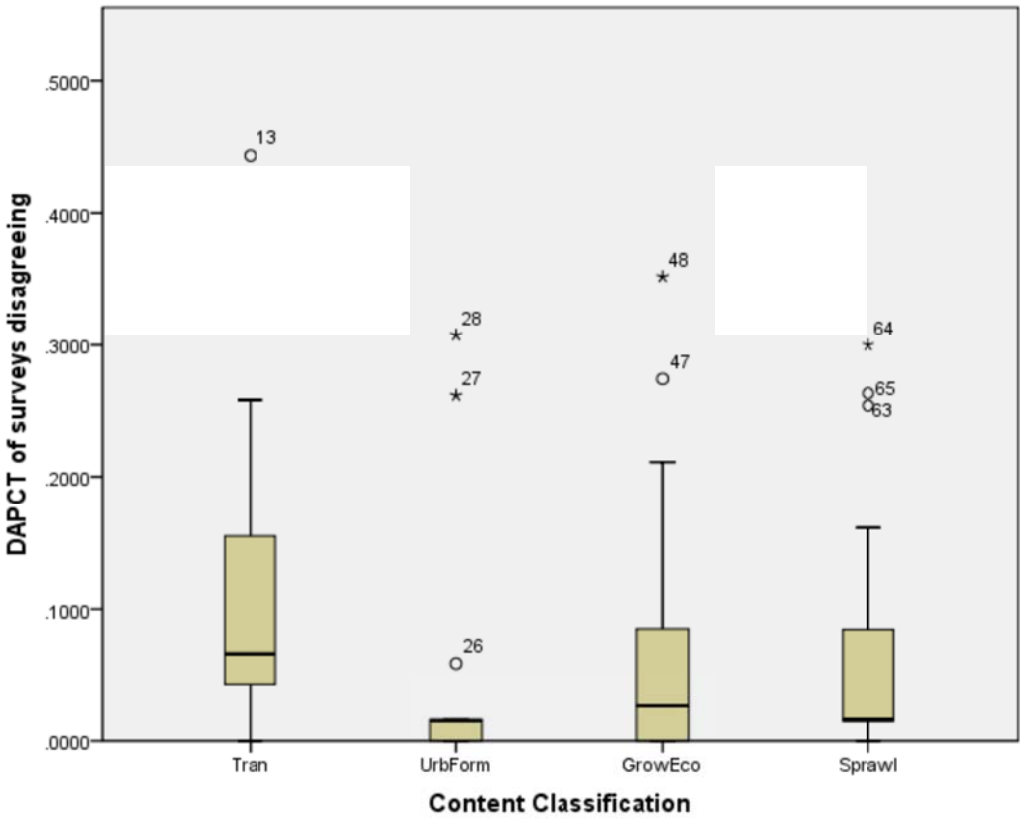
Table 42 : Chi Square Test of Disagree and Content Class

	Value	df	Sig. (2-sided)
Pearson Chi-Square	353.4	3	.000
Likelihood Ratio	209.6	3	.000
N of Valid Cases	5021		

Table 43 : Results of Difference in Mean Percent Disagree between Content Classes (student t)

	LURBFORM	LGROWECO	LSPRAWL
LTRAN	0.133	0.256	0.344
LURBFORM		0.569	0.477
LGROWECO			0.860

Figure 18 : Quartile, Mean, and Outliers for Percent heuristic Disagreement by Content Classes



Heuristic content was not equally distributed among the methods used to create the heuristics. Figure 19 shows the percentage of heuristics by method found in each of the four main content classifications. Traditional scenario planning and ASA methods dominated the Transportation class. Expert Opinion dominated the Growth and Economy class. The other two content classes Urban Form and Sprawl were equally distributed among the methods, though ASA methods were absent from Urban Form and Traditional Scenario Planning was absent from Sprawl.

These distributions were statistically significant at the .05% test, Table 45 shows the results of a Chi Square test of Heuristic counts by Method and Content.

Figure 19: Percentage of Heuristics by Method and Content

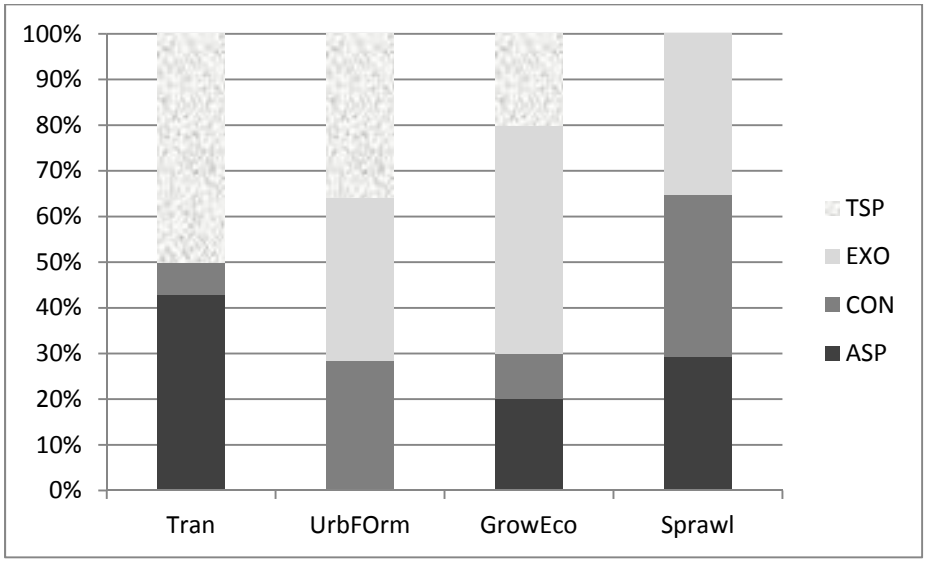


Table 44: Chi Square Test of Method and Content

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	25.923	9	.002

Chapter 5

CONCLUSION

The primary goal of this research was to establish the viability of advanced scenario analysis as a tool for enhancing social resilience for issues of high uncertainty such as climate change and regional growth. This research does make progress towards this goal in several ways.

1. This research provides a critical empirical assessment of advanced scenario analysis as a planning tool to enhance the social resiliency of public planning and decision making.
2. This research fills a gap in the academic planning literature by providing a literature review that focuses on advanced scenario analysis methods and fields related to the core components and theory of these methods.
3. This research defines and tests a case study methodology using embedded empirical analysis to assess the viability of policy development methods within the context of active public policy processes that can be applied to other studies of public policy.

However, even with these contributions, this research only scratches the surface of the use of advanced scenario analysis as a tool for foresight. The following discusses in more detail these three contributions, a fundamental question about the paradigm of foresight raised by this research, and further research that is needed to advance ASA methods and foresight in general.

Advanced Scenario Analysis as a Tool for Foresight

Implementing visions of regional sustainability is done within the bounds of social, environmental, economic, and political systems. Unfortunately the future state of these systems is highly uncertain and forecasting their future state is difficult if not

impossible. This uncertainty inherent in regional systems is a significant challenge to developing and implementing short term and long term regional management strategies. The capacity of regional management systems to successfully adapt to change is a key component of resiliency, which has emerged in the literature as a critical component of sustainability. Two key factors for resilience are the ability to 1) anticipate change and 2) effectuate a response. If decision makers are unable to anticipate and adapt to change, long term plans are unlikely to be sustainable. Given our currently ability to forecast the future of regions is significantly limited the traditional method of predict and plan will not be suitable for issues of high uncertainty such as regional planning and climate change; however, anticipation does not require a forecast. A new paradigm is emerging which embraces uncertainty by using foresight to explore a wide range of possible futures and then anticipate possible actions needed to adapt as change occurs over time.

We are fairly adept at defining a range of possible futures and such ensembles of possible futures can provide the ability to anticipate possible futures even under conditions of high uncertainty. Traditional scenario planning has been one such method. Using 3 to 5 possible scenarios of the future, stakeholders and experts compare and contrast these scenarios to better understand possible futures. A major limitation to the traditional approach is human cognition limitations to analyze more than 4 or 5 factors thus limiting the range of uncertainty that can be explore. A new set of methods, here discussed collectively as Advanced Scenario Analysis (ASA), have emerged that overcome this limitation by analyzing a large set of scenarios (potentially thousands) to distill a smaller set of strategic heuristics which are descriptive of the range of scenarios.

Advanced Scenario Analysis Literature

Advanced Scenario Analysis (ASA) has not been well documented in the academic or professional literature. Within the body of literature on scenario planning in

general, there are a limited number of books and articles that describe ASA methods and fewer provide details of the mechanics of these methods. Only a hand full of publications identify ASA methods as a class of methods separate from traditional scenario or strategic planning and why this is significant, none explore the theoretical underpinnings or unique nature of these methods as a class of methods. None provide a critical assessment of the methods as a class. Only a few examples of how these methods have been applied to actual public policy development have been documented and most of this documentation is found in government reports or professional presentations and does not include a critical assessment of the methods or results.

Much of the scenario planning literature focuses more on how scenarios can be created and less on how the can be analyzed. This is primarily because most public processes that use scenario planning methods are seeking a single desired scenario among a few scenarios (less than six) and analysis between the scenarios is based on individual intuition and observation of desirability. The goal is to pick a future and plan to it (predict and plan paradigm). Rarely are the scenarios expressed as uncertainty about the future and used to explore the implications of such futures (foresee and anticipate paradigm). However there is an emerging body of literature that does focus on this later paradigm. This includes: concepts of foresight and anticipation (Eriksson & Weber, 2008; L. S. Fuerth, 2009; David Guston, 2007; Quay, 2009) and its application for public policy development (Quay, 2010), advanced scenario analysis methods such as robustness (S. C. Bankes, et al., 2003; Chakraborty, et al., 2011; Lempert & Schlesinger, 2000b; Roy, 2010), contingency (Chakraborty, et al., 2011; Mendonca, Cunha, Ruff, & Kaivo-oja, 2008; Sykes & Dunham, 1995), sensitivity and patterns (Quay, 2011) and their application to public policy development (Attoh-Okine & Gibbons, 2001;

Chakraborty, et al., 2011; City of Phoenix Planning Department, 1998; City of Phoenix Water Services Department, 2005; Mendonca, et al., 2008; Quay, 1999).

However this literature focuses on individual methods as being part of a general scenario planning process and does not distinguish these "advanced" methods from traditional scenario planning. The methods of traditional scenario planning are inherently limited when applied to highly uncertain and complex problems while Advanced Scenario Analysis (ASA) methods are well suited for such problems. The lack of a definition for this field of scenario planning limits understanding of the methods and application a foresight and anticipation approach to complex and uncertain problems.

Defining Advanced Scenario Analysis

Base on the literature Advanced Scenario Analysis varies from application to application in the specific methods used. However several common characteristics can be defined.

- ASA is not a planning process in itself, rather it is a tool to use within existing planning efforts.
- ASA is based on creating a large number of scenarios representing a range of futures, from several dozen to hundreds. Scenario generation is done using a wide range of traditional methods, varying from expert scenarios to systems modeling. Qualitative and quantitative methods are used to analyze the ensemble of scenarios as a whole, rather than comparing individual scenarios.
- Heuristics that identify patterns in the ensemble of scenarios are developed that describe the ensemble in a whole or in part, essentially focusing on the most important or critical aspects of uncertainty, rather than trying to reduce uncertainty. The heuristics are not normative statements rather are

exploratory statements of the scenario ensemble. Methods used to used to develop these heuristics include risk assessment, factor sensitivity, worst case scenario analysis, critical path, and aggregated descriptive statistics. Such analysis need not be based on quantitative estimates of probability for each scenario.

- These heuristics are used within a traditional planning processes, such as resource planning or regional growth planning, as a guide to anticipate the future and develop strategies for consideration as part of the decision making process. However, these strategies may be different than traditional planning strategies in that they may included contingency plans, robust strategies that fair well across a range of futures, strategies designed for flexible incremental implementation that can be adapted as the future unfolds.

Assessing Advanced Scenario Analysis

One of the major uncertainties of regional growth is the political will of individual decision makers to implement plans for regional growth management. As discussed above, political will is one of the factors of decision making and is highly dynamic subject to changing attitudes of constituencies, economy, public finance, as well as national political movements. Two regional visioning projects, Vision North Texas in Texas and AzOne in Arizona used public participation events modeled around the Urban Land Institute Reality Check method to develop growth strategies. These events utilized different planning methods to develop strategies that represented the political will of the participants for actions to promote and manage growth. These methods ranged from consensus based methods in which participants were asked to come to a consensus on a set of strategic heuristics, strategic methods developed based on expert advice, and

scenario methods that utilized dozens of scenarios of future growth created by small groups of participants.

These methods are each assessing the political will of a group, but for purposes of foresight they each have inherently different results. Consensus methods attempt to find a position that is agreed to by all participants, or at least one that represents an informed consent. Expert methods lead to positions reflective of the ideas of a small number of experts. Advanced Scenario Analysis distills concepts from a wide range of scenarios or opinions. The goal of foresight is to anticipate a wide range of possible futures. Thus when foresight is applied to the uncertainty of political will related to regional visioning, methods that generate heuristics with a wider range of political will would be preferred to those that generate a narrow range of political will. This research affirms that the strategic heuristics developed using ASA methods had a wider range of opinion of usefulness and disagreement than other methods, with consensus methods generating the smallest range of opinion.

Consensus and expert opinion based methods involve a high degree of human judgment. Many consensus opinions represent a normative process. Often such consensus is more a informed consent position, where those opposed may disagree but choose not to verbalize disagreement, either because they feel there level of disagreement is not worth continued argument, or they are intimidated by the majority opinion. Thus consensus judgment can be biased towards the majority opinion and less favorable minority opinions are less likely to be identified. ASA methods are based on an analysis of scenarios that may represent majority and minority opinions. The analysis of these scenarios, and thus opinions, is not normative but rather a more objective qualitative or quantitative description of the scenarios as a whole. A wider range of useful and disagreement is expected as minority opinion may disagree with majority, and majority

may disagree with minority. This certainly must be considered a negative characteristic of the ASA methods if your goal is to achieve consensus on a position. However if foresight is your goal this must be considered a positive characteristic. When society uses a foresight planning paradigm, if foresight is narrowed by judgment bias then anticipation of possible futures is limited, reducing the effectives of foresight and anticipatory planning. If ASA methods can overcome judgmental bias that limits the range of possible futures, then they will help to enhance foresight and anticipatory planning.

Summary

The current literature that provides a basis for the theory and application of Advanced Scenario Analysis is limited. The current literature that provides a theoretical basis for ASA is dispersed among several fields and there is little that provides a definition or theory of ASA in the broader context. The current literature of application focuses either on method of analysis or reporting institutional use, neither provides a critical assessment or governmental context for its use. My research responds to these limitations by providing a general definition for and the basic theory of Advanced Scenario Analysis, a brief discussion of it's governance context for foresight and anticipation, and an empirical assessment of its effectiveness for foresight,.

Case Study Research of Planning and Decision Making

Case study methodology is a well established method for social science research. However, doing case studies of public policy development can be complicated. Rarely are two different policy development projects the same, thus comparing and analyzing them can be difficult. Even when the general approach is the same, such as regional visioning, the variation in stakeholders, physical spatial features, local politics, social and governmental institutions, economics, raw resources (water and land), and

environmental (climate and landscape) can make it difficult to compare two different case studies. Policy development is a value based process with values being defined by the individual beliefs and opinions of those participating in the process. But these values will often not be aligned between two different policy development projects which also complicate comparative analysis. Even when the underlying purpose of the policy development process is the same different approaches to formulating policy can be used. This research developed several approaches to structurally analyze regional visioning and apply this framework to two different cases studies. Though these approaches need further development, two of these approaches have proven noteworthy, measuring the uncertainty of political will and quantitatively defining the structural content of planning strategies.

Political Will

Political action is essential to development public policy and resolve public issues. Political will plays an important role in political action and is consider one of the key precursors to political action occur. However, even given its importance there is little literature that explores this part of political action. In order to apply foresight to political will, a method to measure it to define possible future states is needed. There is a only small amount of literature that has discussed measuring political will (corruption, management, disasters), none of which explores it in regards to urban/regional planning policy. This research fills this gap by introducing and operationalizing a concept for measuring political will of individuals in the context of regional visioning and growth strategy. This method is based on the concept of importance of and commitment to a strategy for individual planners. A scale for usefulness was created to measuring how useful the strategy would be for an individual's political activity, was used as a proxy for importance. Disagreement or agreement to a strategy was used a proxy for commitment.

The method was tested for internal consistency by comparing responses of usefulness and agreement.

This research also explored the basis for different levels of political will. In both case studies perceived truthfulness, recognition, perceived success and relevancy were identified as factors for higher levels of usefulness, thus political will. These are consistent with the literature that suggests political will to act is based on self interest and chances of success.

Quantitative Assessment of Growth Strategy Content

Quantitative methods for classifying the content of public policy heuristics using ontology are being developed for various topical areas such a water management and urban land use regulation. This research introduces a concept for classify regional growth heuristics using factor scores derived from an ontology created from regional growth key words found in the heuristics. A statistically significant structural equation model was built using the heuristic's language from the AzOne project to identify a set of content factors. This was then applied to the AzOne heuristic language to classify the content of the heuristics based on their factor scores. Though the classification factors developed are unique to the AzOne project documents, this approach could be used with any policy document that contains policies or strategies.

Further Research

This research provides a theoretical framework and definition of Advanced Scenario Analysis, as well as an assessment of its effectiveness. However, all three need further refinement as many questions about ASA and its use remain. The following explores briefly some of these remaining questions and the research need to answer them.

The Paradigm of Foresight and Knowing the Future

One could argue that "Foresight" and "Knowing the Future" are opposing planning paradigms. The current prevalent paradigm for planning is that we can know the future. What many would consider opposites, zoning and form based regulations have something in common, they assume that we know what future places will result from their use. We assume that we can know the future magnitude of reduction in carbon emissions that will occur if we have more transit and denser urban areas, or how carbon emission will increase if we have continued sprawl in suburban patterns. We assume that the future of sustainable economies lies with the younger creative generation. We assume locally grown foods are more sustainable than imported food. We also assumed building more freeways would reduce traffic, that home ownership was the key to prosperity, that greed could be regulated, that large institutions were to big to fail, that resources and systems like water supply and the climate were relatively stationary, and that global growth would never end. Human history would suggest that we do not know the future, yet "knowing the future" is the current paradigm. Why is that?

Foresight is based on the premise that we do not know the future. That perhaps we can anticipate range of possible futures, but not which will become the future. Essentially do not assume we know the future. In this light this is a rather radical change in how we think about the future. It implies that we can anticipate that our actions may result in a given set of possible futures, but until the future unfolds we will not know which one prevails. Essentially is suggests that policy is an experiment. Can we accept the concept that policy development (and politics) is an experiment?

If we accepted that policy was an experiment, then we would want to establish an experimental design that frequently measured results, allowing us to draw conclusion about cause and effect, and adjust policies to move towards our goal. This suggests that

policy making is research that entails the rigor od investigation and the politics of decision making. Can we foster collaborative research among academic researchers and policy professionals?

One thing foresight and "knowing the future" have in common is goals, planning, and action. Regardless of whether you kwon the future, or you anticipate a range of futures, one must understand desired states for human existence in order to decide if these are good or bad futures, or what actions are needed to maintain or create desired states if these futures come true. Thus traditional planning processes will still be needed if we embrace a foresight paradigm. Foresight could be used as part of a goal setting process, used to develop contingency actions to achieve goals under different future conditions, or to diagnosis current plans in light of future conditions. How does foresight get integrated into planning and implementation processes?

These are all questions that will need to be explored to understand the viability of foresight, and thus ASA methods, as an approach for public policy development.

Advanced Scenario Analysis

More research is needed to define, assess and advance the use of ASA methods as a tool of foresight. This research explored ASA methods in only one planning context for a specific problem of regional visioning. ASA methods are being utilized in many more planning fields (water, land use, and climate). Two types of further research are needed. 1) More exploration and documentation of the methods of Advanced Scenario Analysis. Each application of ASA occurs in a specific planning context that uses different methods to reflect the unique issues, systems, data, stakeholders, and uncertain factors. Research that indentifies and compares and contrasts these methods is need to further the science and utility of the ASA approach. 2) Each application of an ASA

method is an experiment and more research that assesses the results of such experimentation is needed to critical assess the utility and development of ASA methods.

Planning Case Studies

Political Will:

More research is needed on the role political will plays in political actions, methods of measuring political will, and the factors that affect political will over time. This is particularly true in the area of public urban and regional planning. Methods for assessing political will as part of the political process could be invaluable in crafting plans and successfully managing political action. Research will be needed to link method to assess levels of political will and outcomes from political processes.

Planning Content Classification

More research is needed to develop and refine systems to classify the content of planning documents so qualitative and quantitative analysis of the documents can be preformed. This will be important if we want to understand the impact that content has on organizational and public learning, individual and organizational motivation and political action, and success of implementation and problem solving.

Collaborative research

Research to assess political will, planning content, and ASA methods will require studying actual policy development processes. This cannot be effectively done without collaboration between researchers and policy professional. The research presented in this paper resulted from collaboration between planners conducting the regional visioning processes (of which I was one) and I as a researcher. Such collaboration rarely occurs serendipitously and faces many barriers, including the differences in cultures of research and policy making. More support for such research at both ends of the collaboration is needed.

A Research Agenda

To meet these research needs and questions, the following research and education agenda is proposed.

Case Studies: More embedded case studies of public and private policy efforts that use ASA methods need to be conducted. Though limited there are other examples of policy efforts that have used ASA methods. This includes other regional visioning efforts in Maryland and Tucson, water resource planning in Phoenix and Denver, land resource planning in Phoenix, and climate change adaptation in New York. A case study methodology will need to be developed for each of these projects, but likely could be based on a similar survey approach . Some of these projects, such as the Phoenix desert preserve, have already been implemented and ASA methods could be evaluated as to the role and effectiveness in actual implemented policy. Agencies that could be targeted for funding such research should included the ULI, Lincoln Land Institute, and the National Association of Regional Councils.

Organizational Learning: Foresight and Advanced Scenario Analysis are emerging concepts in response to growing awareness of the uncertainty inherent in issues such as regional growth and climate change. Such new concepts take time to be understood and accepted by professionals and academics as viable tools for public policy. Communications that foster organizational learning will be key to this awareness and acceptance. Articles on the role of foresight and ASA targeted to: 1) peer reviewed journals such as Journal of the American Planning Association, Journal of Planning Literature, Journal of Environmental Planning and Management, and Journal of Regional Science would be an effective way to introduce these concepts to planning academics; and 2) professional journals and magazines such as Planning, Water Resources Journal, and Urban Land would be an effective way to introduce these concepts to water and

planning professionals. Conference presentations at professional conferences such a APA state and national conferences, National Associate of Regional Councils, City Manager's Association, and National League of Cities would be effective at providing a more hands on contact with planning and political professionals. These are all relatively low cost measures (other than time). Other methods that would require funding but may be more effective included the development of a webinar or a dedicated workshop.

Communications among professionals is often better received when it comes from fellow professional associates. Thus it will not only be important for professionals and academic researchers to collaborate on research and implementation (see Collaborative Research), but it will also be important for them to collaborate on these communication strategies as well. Involving professionals in authoring articles and making presentations will not only enhance organizational learning it will create a growing commitment to ASA as a concept which will facilitate transfer to other areas of planning, such as transportation and economic development planning where the uncertainties of social systems are just know being understood.

Summary

Foresight and anticipatory approaches to planning is an emerging field which is well suited to help with planning that involves highly uncertain natural and social systems such as climate and regional growth. These systems are highly complex systems with dozens of uncertain factors. Using scenarios is one method to explore the uncertain future of these factors, but large sets of scenarios will require new methods to do so. This research found that for two case studies of regional visioning, Advanced Scenario Analysis methods were better at defining a range of uncertainty associated with uncertain factors than other traditional methods such as consensus, expert opinion and traditional scenario planning methods. This result provides a basis to encourage the continued use

of ASA methods. However, the use of these methods is just emerging and their potential application is much broader than the focused planning context of this research. Each application of ASA is an experiment and further research is needed to continue assessing the method to affirm its utility and to refine the methods of ASA. Finally, research and education is needed to further the acceptance and use of ASA within public processes. Many questions about foresight as a paradigm and how it is integrated into different planning processes remain to be addressed before the utility of ASA methods can be established. However, this research provides insight into ASA methods, defines researcher techniques to assess them, and suggests their use is appropriate for strengthening the resilience of social institutions.

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APPENDIX A

POTENTIAL ASA CASE STUDIES

Maryland Reality Check	
Public Policy Issue	Regional Growth and Local Plans
Uncertainty	Rate and location of population and employment growth, Local Land Use Plans, regional transportation plans, political will
Complexity	Multiple systems, transportation, land use, employment with interdependent factors; multiple local government jurisdictions
Scenario Generation	Multiple groups formed desirable scenarios based on fixed growth rates.
ASA Method	Aggregated scenario and assumption testing.
Evidence of Success	Not Year
People Involved	Growth-watchers, city and county legislators, policy professionals
Vision North Texas	
Public Policy Issue	Regional Growth for North Texas Region
Uncertainty	Rate and location of population and employment growth, change in Local Land Use Plans, Regional Transportation Plans, political will
Complexity	Multiple systems, transportation, land use, employment with interdependent factors; multiple local government jurisdictions
Scenario Generation	Expert scenarios developed by multiple work groups based on agreed principles for each group.
ASA Method	Factor sensitivity
Evidence of Success	Not yet clear
People Involved	Karen Walz : Key organizer, Growth-watchers, city and county legislators, policy professionals
Description	Started in 2005 and continues as of 2011. Organized as a public private partnership between North Central Texas Council of Governments, University of Texas at Artlington, and the North Texas Chapter of ULI. Management was done through contract with a local consultant. Governance was through a Visioning Committee that has over 40 members and various technical committees. Funding was fairly extensive with over a hundred public and private sponsors. The project relied on hundreds of volunteers. As a partner the local COG's participation was extensive. The project held dozens of meetings, varying from large regional meetings with hundreds of participants to small meeting with individual institutions with ten or fewer participants. One regional meeting, two sub regional meetings, and 5 meetings with special interest groups conducted the reality check exercise. Three scenarios of regional growth were developed by the local COG. They produced four primary reports documenting their efforts, and several technical reports .

Phoenix Desert Preserve	
Public Policy Issue	Strategy for acquisition of desert open space for North Phoenix
Uncertainty	Urban Growth Rate, Method of acquisition, Funding amount, political will
Complexity	Two systems, private sector land development and public sector open space land acquisition. Multiple techniques for land acquisition, multiple source of funds, both of which are dependent on growth rates.
Scenario Generation	Market based model of land acquisition for growth and open space. Risk analysis for goal failure based on probability of scenarios.
ASA Method	Factor sensitivity, aggregated goal risk analysis
Evidence of Success	Change in desert preserve goals, Voter approval of sales tax referendum.
People Involved	Jim Burke – Organizer, professional technical and management staff, executive staff, City Council, special interest groups
Phoenix Water Resource Plan	
Public Policy Issue	Water Resource Planning and Drought
Uncertainty	Future Climate pattern, future growth rate and patterns, future behavior of customers towards water use, regulatory restrictions, institutional behavior, political will.
Complexity	Multiple sources of water: surface, ground, and reclaimed water; over lapping regional water agencies, demand behavior of customers, interdisciplinary (water resources, land use planning, engineering).
Scenario Generation	Growth fore cast model used to create 7 land use scenarios, water budget model.
ASA Method	Factor sensitivity and worst case timeline.
Evidence of Success	City Council adoption of the Plan
People Involved	Professionals, Regional agencies, special interest groups, City Council

AzOne Reality Check	
Public Policy Issue	Growth Strategies for the Greater Phoenix Region
Uncertainty	Future growth rate and patterns, Future local land use policies, future private and public support for transportation funding .
Complexity	Multiple systems, transportation, land use, employment with interdependent factors; multiple local government jurisdictions
Scenario Generation	Multiple groups formed desirable scenarios based on fixed growth rates, used ASA methods to develop two summary scenarios.
ASA Method	Aggregated scenario analysis.
Evidence of Success	
People Involved	Growth-watchers, city and county legislators, policy professionals, development community
Description	AzOne started organizing in 2007. Organized and managed by the local ULI council. Held two events, both conducted reality check exercises. Funding was limited. The Maricopa Association of Governments provided some technical assistance. Governance consisted of leadership committee and a research committee. Sponsorship was primarily from 2 dozen private sector institutions related to growth. The project relied on several dozen volunteers. There was no government sponsorship. In year two National ULI provided a staff person part time to help draft a "Centers" report. In 2011 the AzOne effort was dropped as a project by the state ULI chapter. They produced three reports.

APPENDIX B

PHOENIX STAKEHOLDER SURVEY

Date

Dear

Recently AzOne, a collaborative effort of over 20 public, private, and civic entities has been conducted workshops to explore the opinions and attitudes about regional growth and growth management in the Greater Phoenix region. Researchers at Arizona State University, one of the collaborators with AzOne, is preparing a case study of the results of the AzOne workshops and publications. Previously ASU assisted the ULI in conducting pre and post attitude surveys of these events in which you may possibly have participated. Now a research team under the direction of Professor David Pijawka in the School of Geographical Sciences and Urban Planning at Arizona State University is inviting you to participate in a survey to assess opinions about some of the growth concepts that have been developed from the results of the AzOne events. Participation in this survey is fully voluntary and you must be 21 years of age or older to participate. If at any time during the survey you which to decline to participate you can simply stop filling out the survey and any responses completed will not be saved. If there is any individual question you which to decline to answer, you can simple skip the question and no response for that answer will be saved,

All information obtained in this study is strictly confidential and researchers at ASU analyzing survey results will not know who filled out each survey. No names or identifying attributes will appear in the final analysis. Data from this study may be used in reports, presentations and publications, but all results will be reported in the aggregate and will not identify you or discuss the results of any individual survey.

Based on our pretest, the survey takes approximately 15 minutes to complete. We realize that this is a considerable amount of time and ask for your patience. Each response to this survey is valuable. We hope the internet format will be convenient for you and reduce the amount of paperwork required. However, if you would prefer to fill out a paper survey one can be provided by contacting Bill Edwards at (480) 965-2177 or by email at bill.edwards@asu.edu.
The link below will take you to the internet survey, filling out the survey will be considered your consent to participate.

LINK

If you have any questions concerning the research study, please contact the research team at: David Pijawka@asu.edu. If you have any questions about your rights as a subject/participant in this research, or if you feel you have been placed at risk, you can contact the Chair of the Human Subjects Institutional Review Board, through the ASU Office of Research Integrity and Assurance, at (480) 965-6788.

Sincerely,

David Pijawka

NOTE: This survey does not represent the final design or pagination of the web based survey format.

In May of 2008 and in Sept of 2009 Moving AzOne, a project of the Phoenix Chapter of the Urban Land Institute, invited people from the Maricopa/Pinal counties to consider how they would like the region to grow over the coming decades. Those attending were divided into 20 to 30 groups of 10 to 15 people. Each group defined a scenario of what they would like region's future to be by developing growth principles and showing were and how growth could occur on a map of the region based on these principles.

Did you participate in either of these events?

☐ Yes ☐ No

Did you help plan or evaluate the results from either of these events?

☐ Yes ☐ No

Did you read any of the reports that described the results from either of these events?

☐ Yes ☐ No

From the list below, please select which description best describes your primary role in the process of decision making about regional growth policies.

	Role Description
☐	I am a business person whose business interests will be affected by the public decision making processes affecting regional growth.
☐	I am employed to represent the interests of or advise an institution or organization other than a government agency in regards to the public decision making processes affecting regional growth
☐	I am a government employee involved in providing support to the public decision making processes affecting regional growth.
☐	I am an elected or appointed public official with the responsibility of making a policy decisions affecting regional growth.
☐	I am a resident whose personal rights or personal interests will be affected by the public decision making processes affecting regional growth.

From the list below, please select all the organizations for which you are a member.

☐	Non-Profit Agency -providing services within a not for profit business model.
☐	Business/ Corporation - providing services or producing products within a for profit model
☐	Special Interest Group(s) - representing the common interest of the individual members of the group.
☐	University or Research Institution
☐	Local Government - Towns, Cities, or Counties
☐	State Government
☐	Federal Government

NOTE: This survey does not represent the final design or pagination of the web based survey format. Not all the heuristics listed below will be included on every survey, a method of randomly selecting 20 heuristics for each survey will be used. Five sets of surveys, each with at least 4 ASA heuristics will be randomly delivered.

The following statements are some of the growth principles developed by these groups and observations about the scenarios of desired regional futures each group created. For each of these growth principles and observations, please indicate how useful the principle or observation has been or will be to the process of making decisions about the future for the greater Phoenix region and your community. If you do not agree with a particular growth concept, in addition to rating its usefulness please also check the Do Not Agree box.

Growth Concept or Observation	Extremely useful	Quite a bit useful	A little useful	Very slightly or not at all useful	Do Not Agree
Establish a multi-modal transportation network that provides connectivity to employment, housing and urban cores.	☐	☐		☐	☐
Conserve open space as a cornerstone of the region.	☐	☐		☐	☐
Maximize the efficiency of transportation networks to encourage future growth in areas that are already developed and reduce sprawl.	☐	☐		☐	☐
Protect our quality of life by emphasizing arts, recreation, safe and livable neighborhoods, and education.	☐	☐		☐	☐
Create a diversity of housing options understanding the importance of affordability.	☐	☐		☐	☐
Preserve open space as a cornerstone of the region.	☐	☐		☐	☐
Support the current investment in infrastructure by encouraging growth along existing transportation corridors.	☐	☐		☐	☐
Connect existing and new employment, housing and urban areas with multi-modal transportation options including freeways, light rail, commuter rail and bus rapid transit.	☐	☐		☐	☐
Create new core urban centers and infill currently developed areas allowing compact, higher density development including mixed-use buildings.	☐	☐		☐	☐
Locate housing near jobs to create employment corridors.	☐	☐		☐	☐
Protect quality of life by emphasizing safe and livable neighborhoods, education, recreation and arts.	☐	☐		☐	☐
Conserve natural resources; create sustainable communities.	☐	☐		☐	☐

Provide a diversity of housing options understanding the importance of affordability.	☐	☐		☐	☐
Significant investment in new transportation infrastructure will be needed to keep up with the expected growth	☐	☐		☐	☐
70% of the group scenarios added an estimated $20 billion or more of transportation infrastructure, with an average investment of over $25 billion.	☐	☐		☐	☐
That much infrastructure investment would require an average estimated sales tax increase of 1.3	☐	☐		☐	☐
More investment in public transit	☐	☐		☐	☐
Money for new transportation infrastructure was invested by the group scenarios in a mix of freeways and mass transit.	☐	☐		☐	☐
The group scenarios placed less than 30% of the new transportation infrastructure miles as freeways, with the other 70% coming in the form of light rail, commuter rail and bus rapid transit.	☐	☐		☐	☐
New rail corridors	☐	☐		☐	☐
80% of the group scenarios included a new commuter rail corridor between Phoenix and Tucson.	☐	☐		☐	☐
67% of the group scenarios showed commuter rail linking Wickenburg, Surprise and Buckeye to Metro Phoenix.	☐	☐		☐	☐
Some group scenarios included rail service through the East Valley into Pinal County linking Superstition Vistas, Florence, Coolidge, Eloy and Tucson.	☐	☐		☐	☐
More than half of the group scenarios provided passenger service to Maricopa and Casa Grande.	☐	☐		☐	☐
New freeway corridors	☐	☐		☐	☐
70% of the groups including at least 100 miles of new freeways	☐	☐		☐	☐
Some group scenarios included in the East a corridor connecting the Santan Freeway to new freeways in Pinal County serving superstition Vistas, and the communities south along the proposed Picacho Vista Freeway to I-10 near Eloy	☐	☐		☐	☐

Some group scenarios included In the West a new freeway corridor connecting the planned Loop 303 freeway in Goodyear through the Hidden Valley to provide the linkage to Maricopa and Casa Grande	□	□		□	□
Some group scenarios included a new freeway corridor that runs north and south through the Hassayampa Valley connecting Wickenburg to I-10.	□	□		□	□
Some group scenarios included new corridors for multi-modal use combining a freeway and high capacity transit service within the same corridor	□	□		□	□
Development focused around transportation corridors	□	□		□	□
New development intensities were generally placed along existing and new transportation corridors to provide efficiency of investment in transportation and to provide the ridership necessary to ensure financial feasibility of the new infrastructure.	□	□		□	□
Housing and job growth in the existing core areas was supported in some group scenarios by a number of light rail or other high capacity transit service that linked the activity centers within the core. This included enhanced service along I-17 and Loop	□	□		□	□
More compact and diverse housing mix	□	□		□	□
Group discussions included the concept of stacking Legos to represent smaller lot sizes and more attached housing products such as town homes, apartments and condominiums.	□	□		□	□
Even with more compact housing development, the group scenarios required significant amounts of land to accommodate new development.	□	□		□	□
The stacking of Legos points to a diversity of housing types, which furthers housing affordability and seeks to meet shifting market demand.	□	□		□	□
Mixed-use communities with jobs and housing in the same community	□	□		□	□
Housing and employment were placed in close proximity, distributing jobs throughout communities to reduce commute times.	□	□		□	□
Housing focused around transportation corridors	□	□		□	□

Every group scenario placed new housing along existing and new transportation corridors.	□	□		□	□
The most intense housing was placed closest to transportation corridors.	□	□		□	□
Intense housing close to transportation corridors promotes efficiency of transportation investment and provides the high capacity infrastructure needed to serve more compact neighborhoods.	□	□		□	□
Recognize the significant amount of open space that is already under preservation	□	□		□	□
Many participants expressed surprise at the amount of land in Central Arizona that is already managed by virtue of its federal ownership.	□	□		□	□
Approximately 3.7 million acres, or 49% percent of the area on the map was depicted as ?managed open space,? of which 3.1 million acres are federally owned.	□	□		□	□
Preserve additional open space	□	□		□	□
Despite the large amount of managed open space, each group added more open space to the map.	□	□		□	□
Some general themes emerged, such as open space closer to and within urban areas, green corridors placed along rivers and washes, and trails along transportation corridors.	□	□		□	□
Larger open space areas generally formed linkages between existing managed areas, filled in gaps in public ownership of existing open space, and preserved higher elevation slopes.	□	□		□	□
Understanding the amount of growth that is anticipated increases the importance placed on open space	□	□		□	□
Every group scenario added open space preservation as a Guiding Principle-the only principle listed by every group.	□	□		□	□
This change was probably due to the sheer magnitude of the growth that participants were forced to accommodate on the maps and the significant pressures for more open space that will result from this expected growth.	□	□		□	□
Recognize significant existing constraints on where growth may occur	□	□		□	□

Participants were surprised by the amount of land that was not available for development as 58% of the land is protected federal land, Tribal lands, and similar areas.	☐	☐		☐	☐
Growth west of the White Tank Mountains and south and east to strengthen the Sun Corridor connection to Tucson	☐	☐		☐	☐
A large number of group scenarios created growth west of the White Tank Mountains and near Buckeye.	☐	☐		☐	☐
A large number of group scenarios created growth along the growth corridor south and east towards Tucson.	☐	☐		☐	☐
New town centers rather than infill or redevelopment	☐	☐		☐	☐
Few group scenarios placed the vast majority of new growth in existing developed areas like Downtown Phoenix.	☐	☐		☐	☐
Most groups created new, vibrant places in compact patterns along transportation corridors.	☐	☐		☐	☐
Group scenarios placed 75% of new housing development outside the 101/202 loop and less than 4% in the core business district of Phoenix.	☐	☐		☐	☐
On average group scenarios placed 1/3 of new housing development in Pinal County.	☐	☐		☐	☐
Understand the critical importance of State Trust Lands to the future of Central Arizona	☐	☐		☐	☐
Trust Lands form a substantial portion of the available developable land in close proximity to existing urban areas in Central Arizona.	☐	☐		☐	☐
The primary source of revenue for the Public School Trust Fund is the sale and lease of urban Trust Lands for housing and commercial development.	☐	☐		☐	☐
How well the Central Arizona region functions, what it looks like, what kinds of communities exist, and where people live, work, and play will be dramatically affected by whether and how development occurs on Trust Lands.	☐	☐		☐	☐
It is clear that the future of Central Arizona is inextricably linked to the future of these lands.	☐	☐		☐	☐
A large portion of growth will likely be accommodated on Trust Lands	☐	☐		☐	☐

36% of new housing was placed on State Trust Lands	☐	☐		☐	☐
No group scenario placed less than 14% of housing on Trust Lands and some placed as much as half on Trust Lands.	☐	☐		☐	☐
Trust Lands provide a remarkable opportunity to help shape the future of the region	☐	☐		☐	☐
The group scenarios placed on average a new population of approximately 440,000 people and 122,000 jobs on Superstition Vistas, a proposed 275 sq.mi. area east of Apache Junction.	☐	☐		☐	☐
Our region would benefit from using this area as a demonstration project to envision, plan and test the type of growth we desire for the future of Central Arizona.	☐	☐		☐	☐
A polycentric region with a variety of employment centers of different sizes	☐	☐		☐	☐
Most group scenarios included a hierarchy of employment centers, ranging from existing downtown areas like Phoenix, Mesa, Tempe and Scottsdale, to local employment areas like Buckeye, Maricopa, Casa Grande, Florence, Surprise, Goodyear, and the Superstit	☐	☐		☐	☐
Jobs close to housing throughout the region	☐	☐		☐	☐
Most group scenarios dispersed the employment centers throughout the region, bringing jobs close to where people live to reduce commute distances and provide nearby workforce for employers.	☐	☐		☐	☐
Most group scenarios dispersed the employment centers throughout the region.	☐	☐		☐	☐
Jobs focused around major transportation corridors	☐	☐		☐	☐
On average, over 50% of new employment was placed within two miles of a major transportation corridor.	☐	☐		☐	☐
Group scenarios invested on average $25 billion in new transportation infrastructure with more on public transit (70%) such as light rail, commuter rail, and bus rapid transit	☐	☐		☐	☐

80% of group scenarios created a new commuter rail corridor between Phoenix & Tucson and 67% showed a new commuter rail linking Wickenburg, Surprise and Buckeye to Phoenix	□	□		□	□
2 Million People Were Placed On Trust Land	□	□		□	□
50% Of New Jobs Were Placed Within Two Miles Of A Major Transportation Corridor	□	□		□	□

Please indicate which of the following concepts do you think will be the more useful for the process of making decisions about the future of your community in regards to the positive and negative Aspects of regional growth?

Concept A: Every group added open space preservation as a guiding principle- the only principle listed by every group.

Concept B: Understanding the amount of growth that is anticipated increases the importance placed on open space.

Concept A Concept B Neither/Both

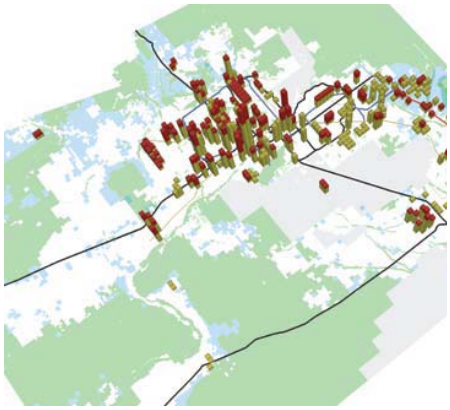
If you selected A or B, please indicate how you agree with the following statements about the concept you selected above as being more useful.

	Strongly Agree	Agree	Disagree	Strongly Disagre e
I believe the strategic concept is truthful.				
I recognize the strategic concept.				
I understand the strategic concept better than the other concept.				
The strategic concept is simple.				
The strategic concept is complex.				
The strategic concept challenges traditional thinking.				
The strategic concept is innovative				
The strategic concept is fair.				
The strategic concept will lead to an equitable resolution of an issue.				
The strategic concept is				

relevant to the issues of growth important to me.				
I can imagine this strategic concept being successful.				

The follow describes two scenarios. Please look these over and proceed to the question below.....

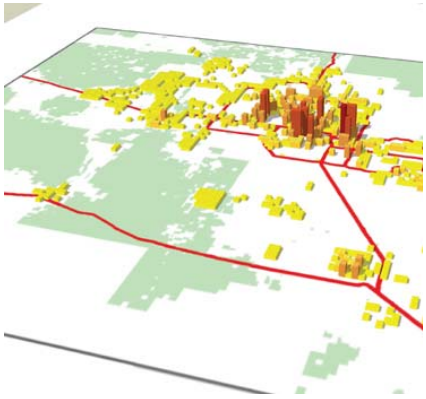
Scenario A



Scenario Features

- Compact and mixed-use development.
- Massive investment in Downtown Phoenix and existing cities.
- Looks to create a true vibrant downtown lifestyle that would balance opportunities for employment, living, recreation, culture, education, leisure, commerce and community service.
- Less pressure to expand development outside the existing parameter of the Phoenix metropolitan area.
- More pressure to balance transportation

Scenario B



Scenario Features

- focuses slightly more homes and business on less land overall
- moderate increases in the number of homes and businesses in a few key activity centers
- construction of approximately 390 miles of new freeways, light rail, and other mass transit facilities
- slightly more compact pattern of growth in the region

Please indicate which of these two scenarios do you think will be the more useful for the process making decisions about the future of your community in regards to the positive and negative Aspects of regional growth?

Scenario A Scenario B Neither/Both

If you selected A or B, please indicate how you agree with the following statements about the scenario you selected above as being more useful.

	Strongly Agree	Agree	Disagree	Strongly Disagree
Challenges traditional thinking.				
Is innovative				
Is fair.				
Is more detailed				
Is easier to understand				
Addresses Important Issues				

APPENDIX C

DALLAS STAKEHOLDER SURVEY

Survey of Opinions about Regional Growth in North Texas

Dear colleague,

Vision North Texas (www.visionnorthtexas.org), a partnership between the Urban Land Institute North Texas District Council, the North Central Texas Council of Governments, and the University of Texas at Arlington, supported by over 45 local governments, and several dozen businesses, has conducted several events over the last 3 years to help people envision how the Dallas-Fort Worth region should grow over the next few decades. At these events attendees identified their preferred principles of how the region should grow. Also Vision North Texas created four scenarios of alternative growth patterns (Infill, Polycentric, and Rail) to compare with North Texas Council of Governments forecast of possible future growth of the region (NCTCOG baseline forecast). Finally through a series of workshops people were given the opportunity to show on maps of the region how they thought the region should grow, creating dozens of different regional growth scenarios (Workshop scenarios). Based on these events and scenarios Vision North Texas has produced several reports that include statements of regional growth concepts and principles.

A research team under the direction of Professor David Pijawka and Ray Quay in the School of Geographical Sciences and Urban Planning at Arizona State University is inviting you to participate in a survey to assess opinions about some of these growth concepts and principles that have been developed from the results of the Vision North Texas events.
Participation in this survey is fully voluntary and you must be 21 years of age or older to participate. If at any time during the survey you wish to decline to participate you can simply stop filling out the survey and any responses completed will not be saved. If there is any individual question you wish to decline to answer, you can simply skip the question and no response for that answer will be saved.

All information obtained in this study is strictly confidential and researchers at ASU analyzing survey results will not know who filled out each survey. No names or identifying attributes will appear in the final analysis. Data from this study may be used in reports, presentations and publications, but all results will be reported in the aggregate and will not identify you or discuss the results of any individual survey.
Based on our pretest, the survey takes approximately 15 minutes to complete. We realize that this is a considerable amount of time and ask for your patience. Each response to this survey is valuable. We hope the Internet format will be convenient for you and reduce the amount of paperwork required. However, if you would prefer to fill out a paper survey one can be provided by contacting Bill Edwards at (480) 965-2177 or by email at bill.edwards@asu.edu.

If you have any questions about your rights as a participant in this research, or if you feel you have been placed at risk, you can contact the Chair of the Human Subjects Institutional Review Board, through the ASU Research Compliance Office, at (480) 9656788.

Between 2005 and 2010 Vision North Texas conducted several events where they asked people from North Texas to explore how they think the region should grow over the next several decades. They used stakeholder input from each meeting to create a series of reports that summarized the results of each event.

Q1. Did you participate in any of these events?
- ○ Yes
- ○ No

Q2. Did you help plan or evaluate the results from any of these events?
- ○ Yes
- ○ No

Q3. Did you read any of the reports that described the results from these events?
- ○ Yes
- ○ No

Q4. From the list below, please select which description **best describes** your primary role in the process of decision making about regional growth policies.
- ○ I am a business person whose business interests will be affected by the public decision making processes affecting regional growth.
- ○ I am employed to represent the interests of or advise an institution, organization, or a government agency in regards to the public decision making processes affecting regional growth
- ○ I am a government employee involved in providing support to the public decision making processes affecting regional growth.
- ○ I am an elected or appointed public official with the responsibility of making a policy decisions affecting regional growth.
- ○ I am a resident whose personal rights or personal interests will be affected by the public decision making processes affecting regional growth.

Q5. From the list below, please **select all** the organizations of which you are a member.
- ☐ Non-Profit Agency -providing services within a not for profit business model.
- ☐ Business/ Corporation - providing services or producing products within a for profit model
- ☐ Special Interest Group(s) - representing the common interest of the individual members of the group.
- ○ University or Research Institution
- ○ Local Government Agency - Towns, Cities, or Counties
- ○ State Government Agency
- ○ Federal Government Agency

The following are statements about the growth principles and observations of the different growth scenarios developed by various groups during the Vision North Texas events, or developed by experts based on stakeholder input from these events. For each of these growth principles and observations, please indicate how useful the principle or observation has been or will be to the process of making decisions about the future of North Texas region and your community.

If you do not agree with a particular growth concept, in addition to rating its usefulness please also check the Do Not Agree box.

Growth Concept	Extremely useful	Quite a bit useful	A little useful	Very slightly or not at all useful	Do not agree with concept
A strong emphasis on networks for non-auto mobility options; The use of alternative energy sources, LEED building and conservation to reduce the region's energy consumption needs.	○	○	○	○	☐
In order to preserve environmental assets, the southeast region will develop by creating growth opportunities in nodes and corridors fed by public transportation and by encouraging high density in mixed use settings.	○	○	○	○	☐
Some sub-regional workshop scenarios had most of the new development located close to the Fort Worth and Dallas downtowns.	◉	○	○	○	☐
Use tools such as the transfer of development rights (TDR) to protect natural areas while enabling property owners to benefit from previously-approved development intensity.	○	○	○	○	☐
Protect and enhance existing ecosystems.	○	○	○	○	☐
An investment framework that emphasizes mobility choices within and between centers, including trails/paths, public transportation (bus, streetcar, light rail and commuter rail) and routes for travel by car.	○	○	○	○	☐
A Polycentric Scenario would reduce the hours residents spend stuck in traffic by 32.5% and would require 71.5% fewer lane miles to meet their needs.	○	○	○	◉	☐
A region that maximizes the benefit received from the extensive investment taxpayers and property owners have made in the region's existing infrastructure and development pattern.	○	○	○	○	☐
Provide trail connections that people can use for recreation and travel between desired destinations.	○	○	○	○	☐
A region with an initial identification of natural assets and open spaces that create a 'green infrastructure' for the region and that are protected and enhanced.	◉	○	○	○	☐
Emphasize public infrastructure design, materials and locations that reduce the region's carbon footprint.	○	○	○	○	☐

Previous Next

Please indicate which of the following concepts you think will be the more useful for the process of making decisions about the future of your community in regards to the positive and negative aspects of regional growth?

Concept A: A region with an initial identification of natural assets and open spaces that create a 'green infrastructure' for the region and that are protected and enhanced.

Concept B: A Polycentric Scenario would reduce the hours residents spend stuck in traffic by 32.5% and would require 71.5% fewer lane miles to meet their needs.

- Concept A
- Concept B
- Both Concepts
- Neither

If you selected A or B, please indicate how you agree with the following statements about the concept you selected above as being more useful.

	Strongly Agree	Agree	Disagree	Strongly Disagree
I believe the strategic concept is truthful.				
I recognize the strategic concept.				
I understand the strategic concept better than the other concept.				
The strategic concept is simple.				
The strategic concept is complex.				
The strategic concept challenges traditional thinking.				
The strategic concept is innovative				
The strategic concept is fair.				
The strategic concept will lead to an equitable resolution of an issue.				
The strategic concept is relevant to the issues of growth important to me.				
I can imagine this strategic concept being successful.				

In these **last two pages** we are asking you to consider two sets of scenarios. You can view these by clicking on Option 1 or Option 2 below. Selecting an option will open a window that contains some information about each scenario group. Please take some time now to review each group, then return to this survey and answer the question below. It may be helpful to print the documents for easy reference.

For each option below, you have a choice between "PDF" or "HTML" files. Although both contain the same material, our preference would be for everyone to view the PDF files.

Option 1 (PDF format) | Option 2 (PDF format)

Option 1 (HTML format) | Option 2 (HTML format)

Q38. After you have reviewed the two groups of scenarios, indicate which of the two scenario groups do you think will be the more useful for the process making decisions about the future of your community in regards to the positive and negative aspects of regional growth?

○ Option 1 ○ Option 2 ○ Neither

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APPENDIX D

AZ ONE HEURISTICS BY METHOD AND CLASS WITH SOURCE

AzOne Heuristics

METHODS
Consensus – CON Expert Opinion – EXO Traditional Scenario Planning - TSP
Advanced Scenario Analysis - ASA

TOPIC
Transportation – TRN Density – DEN Urban Form/Growth – UFG Quality of Life – QLF Economic – ECO Environmental – ENV

ID	CODE	HEURISTIC	TOPIC	METHOD
1	01TRNCON	Establish a multi-modal transportation network that provides connectivity to employment, housing and urban cores.	TRN	CON
2	02QLFCON	Conserve open space as a cornerstone of the region.	QLF	CON
3	03TRNCON	Maximize the efficiency of transportation networks to encourage future growth in areas that are already developed and reduce sprawl.	TRN	CON
4	04QLFCON	Protect our quality of life by emphasizing arts, recreation, safe and livable neighborhoods, and education.	QLF	CON
5	05QLFCON	Create a diversity of housing options understanding the importance of affordability.	QLF	CON
6	06QLFCON	Preserve open space as a cornerstone of the region.	QLF	CON
7	07UFGCON	Support the current investment in infrastructure by encouraging growth along existing transportation corridors.	UFG	CON
8	08UFGCON	Connect existing and new employment, housing and urban areas with multi-modal transportation options including freeways, light rail, commuter rail and bus rapid transit.	UFG	CON
9	09UFGCON	Create new core urban centers and infill currently developed areas allowing compact, higher density development including mixed-use buildings.	UFG	CON
10	10UFGCON	Locate housing near jobs to create employment corridors.	UFG	CON
11	11QLFCON	Protect quality of life by emphasizing safe and livable neighborhoods, education, recreation and arts.	QLF	CON

ID	CODE	HEURISTIC	TOPIC	METHOD
12	12QLFCON	Conserve natural resources; create sustainable communities.	QLF	CON
13	13QLFCON	Provide a diversity of housing options understanding the importance of affordability.	QLF	CON
14	14TRNEXO	Significant investment in new transportation infrastructure will be needed to keep up with the expected growth	TRN	EXO
15	15TRNASA	70% of the group scenarios added an estimated $20 billion or more of transportation infrastructure, with an average investment of over $25 billion.	TRN	ASA
16	16ECOEXO	That much infrastructure investment would require an average estimated sales tax increase of 1.3	ECO	EXO
17	17TRNTSP	More investment in public transit	TRN	TSP
18	18TRNTSP	Money for new transportation infrastructure was invested by the group scenarios in a mix of freeways and mass transit.	TRN	TSP
19	19TRNASA	The group scenarios placed less than 30% of the new transportation infrastructure miles as freeways, with the other 70% coming in the form of light rail, commuter rail and bus rapid transit.	TRN	ASA
20	20TRNTSP	New rail corridors	TRN	TSP
21	21TRNASA	80% of the group scenarios included a new commuter rail corridor between Phoenix and Tucson.	TRN	ASA
22	22TRNASA	67% of the group scenarios showed commuter rail linking Wickenburg, Surprise and Buckeye to Metro Phoenix.	TRN	ASA
23	23TRNTSP	Some group scenarios included rail service through the East Valley into Pinal County linking Superstition Vistas, Florence, Coolidge, Eloy and Tucson.	TRN	TSP
24	24TRNASA	More than half of the group scenarios provided passenger service to Maricopa and Casa Grande.	TRN	ASA
25	25TRNTSP	New freeway corridors	TRN	TSP
26	26TRNASA	70% of the groups including at least 100 miles of new freeways	TRN	ASA

ID	CODE	HEURISTIC	TOPIC	METHOD
27	27TRNTSP	Some group scenarios included in the East a corridor connecting the Santan Freeway to new freeways in Pinal County serving superstition Vistas, and the communities south along the proposed Picacho Vista Freeway to I-10 near Eloy	TRN	TSP
28	28TRNTSP	Some group scenarios included In the West a new freeway corridor connecting the planned Loop 303 freeway in Goodyear through the Hidden Valley to provide the linkage to Maricopa and Casa Grande	TRN	TSP
29	29TRNTSP	Some group scenarios included a new freeway corridor that runs north and south through the Hassayampa Valley connecting Wickenburg to I-10.	TRN	TSP
30	30TRNTSP	Some group scenarios included new corridors for multi-modal use combining a freeway and high capacity transit service within the same corridor	TRN	TSP
31	31UFGTSP	Development focused around transportation corridors	UFG	TSP
32	32UFGEXO	New development intensities were generally placed along existing and new transportation corridors to provide efficiency of investment in transportation and to provide the ridership necessary to ensure financial feasibility of the new infrastructure.	UFG	EXO
33	33UFGTSP	Housing and job growth in the existing core areas was supported in some group scenarios by a number of light rail or other high capacity transit service that linked the activity centers within the core. This included enhanced service along I-17 and Loop	UFG	TSP
34	34UFGTSP	More compact and diverse housing mix	UFG	TSP
35	35UFGEXO	Group discussions included the concept of stacking Legos to represent smaller lot sizes and more attached housing products such as town homes, apartments and condominiums.	UFG	EXO

ID	CODE	HEURISTIC	TOPIC	METHOD
36	36UFGEXO	Even with more compact housing development, the group scenarios required significant amounts of land to accommodate new development.	UFG	EXO
37	37UFGEXO	The stacking of Legos points to a diversity of housing types, which furthers housing affordability and seeks to meet shifting market demand.	UFG	EXO
38	38UFGEXO	Mixed-use communities with jobs and housing in the same community	UFG	EXO
39	39UFGEXO	Housing and employment were placed in close proximity, distributing jobs throughout communities to reduce commute times.	UFG	EXO
40	40UFGEXO	Housing focused around transportation corridors	UFG	EXO
41	41UFGASA	Every group scenario placed new housing along existing and new transportation corridors.	UFG	ASA
42	42UFGTSP	The most intense housing was placed closest to transportation corridors.	UFG	TSP
43	43UFGEXO	Intense housing close to transportation corridors promotes efficiency of transportation investment and provides the high capacity infrastructure needed to serve more compact neighborhoods.	UFG	EXO
44	44UFGEXO	Recognize the significant amount of open space that is already under preservation	UFG	EXO
45	45UFGEXO	Many participants expressed surprise at the amount of land in Central Arizona that is already managed by virtue of its federal ownership.	UFG	EXO
46	46UFGEXO	Approximately 3.7 million acres, or 49% percent of the area on the map was depicted as ?managed open space,? of which 3.1 million acres are federally owned.	UFG	EXO
47	47QLFCON	Preserve additional open space	QLF	CON
48	48UFGASA	Despite the large amount of managed open space, each group added more open space to the map.	UFG	ASA
49	49UFGTSP	Some general themes emerged, such as open space closer to and within urban areas, green corridors placed along rivers and washes, and trails along transportation corridors.	UFG	TSP

ID	CODE	HEURISTIC	TOPIC	METHOD
50	50UFGTSP	Larger open space areas generally formed linkages between existing managed areas, filled in gaps in public ownership of existing open space, and preserved higher elevation slopes.	UFG	TSP
51	51UFGEXO	Understanding the amount of growth that is anticipated increases the importance placed on open space	UFG	EXO
52	52QLFASA	Every group scenario added open space preservation as a Guiding Principle-the only principle listed by every group.	QLF	ASA
53	53UFGEXO	This change was probably due to the sheer magnitude of the growth that participants were forced to accommodate on the maps and the significant pressures for more open space that will result from this expected growth.	UFG	EXO
54	54UFGEXO	Recognize significant existing constraints on where growth may occur	UFG	EXO
55	55UFGEXO	Participants were surprised by the amount of land that was not available for development as 58% of the land is protected federal land, Tribal lands, and similar areas.	UFG	EXO
56	56UFGEXO	Growth west of the White Tank Mountains and south and east to strengthen the Sun Corridor connection to Tucson	UFG	EXO
57	57UFGTSP	A large number of group scenarios created growth west of the White Tank Mountains and near Buckeye.	UFG	TSP
58	58UFGTSP	A large number of group scenarios created growth along the growth corridor south and east towards Tucson.	UFG	TSP
59	59UFGEXO	New town centers rather than infill or redevelopment	UFG	EXO
60	60UFGASA	Few group scenarios placed the vast majority of new growth in existing developed areas like Downtown Phoenix.	UFG	ASA
61	61UFGTSP	Most groups created new, vibrant places in compact patterns along transportation corridors.	UFG	TSP

ID	CODE	HEURISTIC	TOPIC	METHOD
62	62UFGASA	Group scenarios placed 75% of new housing development outside the 101/202 loop and less than 4% in the core business district of Phoenix.	UFG	ASA
63	63UFGASA	On average group scenarios placed 1/3 of new housing development in Pinal County.	UFG	ASA
64	64UFGEXO	Understand the critical importance of State Trust Lands to the future of Central Arizona	UFG	EXO
65	65UFGEXO	Trust Lands form a substantial portion of the available developable land in close proximity to existing urban areas in Central Arizona.	UFG	EXO
66	66ECOEXO	The primary source of revenue for the Public School Trust Fund is the sale and lease of urban Trust Lands for housing and commercial development.	ECO	EXO
67	67UFGEXO	How well the Central Arizona region functions, what it looks like, what kinds of communities exist, and where people live, work, and play will be dramatically affected by whether and how development occurs on Trust Lands.	UFG	EXO
68	68UFGEXO	It is clear that the future of Central Arizona is inextricably linked to the future of these lands.	UFG	EXO
69	69UFGEXO	A large portion of growth will likely be accommodated on Trust Lands	UFG	EXO
70	70UFGASA	36% of new housing was placed on State Trust Lands	UFG	ASA
71	71UFGASA	No group scenario placed less than 14% of housing on Trust Lands and some placed as much as half on Trust Lands.	UFG	ASA
72	72UFGEXO	Trust Lands provide a remarkable opportunity to help shape the future of the region	UFG	EXO
73	73UFGASA	The group scenarios placed on average a new population of approximately 440,000 people and 122,000 jobs on Superstition Vistas, a proposed 275 sq.mi. area east of Apache Junction.	UFG	ASA

ID	CODE	HEURISTIC	TOPIC	METHOD
74	74UFGEXO	Our region would benefit from using this area as a demonstration project to envision, plan and test the type of growth we desire for the future of Central Arizona.	UFG	EXO
75	75UFGTSP	A polycentric region with a variety of employment centers of different sizes	UFG	TSP
76	76UFGTSP	Most group scenarios included a hierarchy of employment centers, ranging from existing downtown areas like Phoenix, Mesa, Tempe and Scottsdale, to local employment areas like Buckeye, Maricopa, Casa Grande, Florence, Surprise, Goodyear, and the Superstit	UFG	TSP
77	77UFGEXO	Jobs close to housing throughout the region	UFG	EXO
78	78UFGEXO	Most group scenarios dispersed the employment centers throughout the region, bringing jobs close to where people live to reduce commute distances and provide nearby workforce for employers.	UFG	EXO
79	79UFGTSP	Most group scenarios dispersed the employment centers throughout the region.	UFG	TSP
80	80UFGEXO	Jobs focused around major transportation corridors	UFG	EXO
81	81UFGASA	On average, over 50% of new employment was placed within two miles of a major transportation corridor.	UFG	ASA
82	82TRNASA	Group scenarios invested on average $25 billion in new transportation infrastructure with more on public transit (70%) such as light rail, commuter rail, and bus rapid transit	TRN	ASA
83	83TRNASA	80% of group scenarios created a new commuter rail corridor between Phoenix & Tucson and 67% showed a new commuter rail linking Wickenburg, Surprise and Buckeye to Phoenix	TRN	ASA
84	84UFGASA	2 Million People Were Placed On Trust Land	UFG	ASA
85	85UFGASA	50% Of New Jobs Were Placed Within Two Miles Of A Major Transportation Corridor	UFG	ASA

AzOne Reporting Documents Used as Source for Heuristics

Document Name	Description
Az One Reality Check First Event - Pre Exercise Guiding Principles	Principles created from the tables discussion prior to the exercise at the First Reality Check Event
Az One Reality Check First Event - Post Exercise Guiding Principles	Principles created from the tables discussion after the exercise at the First Reality Check Event
Az One Reality Check First Event - First Report	Summary report of the first event released after the event
Az One Reality Check First Event - Second Report	Revised summary and analysis of the first event results released at the second event
Az One Reality Check Second Event Presentation	Power point presentation of the initial results summary at the close of the second event

APPENDIX E

VISION NORTH TEXAS HEURISTICS BY METHOD AND CLASS WITH SOURCE

Vision North Texas Heuristics

METHODS
Consensus – CON Expert Opinion – EXO Expert Guided Scenario - EGS
Traditional Scenario Planning - TSP Advanced Scenario Analysis - ASA Advanced Expert Scenario - AES -

TOPIC
Transportation – TRN Density – DEN Urban Form/Growth – UFG Quality of Life – QLF Economic – ECO Environmental – ENV

ID	CODE	HEURISTIC	TOPIC	METHOD
1	01UFGEXO	Provide a variety and balance of development options and land use types in communities throughout the region.	UFG	EXO
2	02UFGEXO	Foster redevelopment of infill areas with existing infrastructure and promote the orderly and efficient provision of new infrastructure.	UFG	EXO
3	03UFGEXO	Create more neighborhoods with pedestrian oriented features, streetscapes, and public spaces	UFG	EXO
4	04ECOEXO	Sustain and facilitate a range of housing opportunities and choices for residents of multiple age groups and economic levels.	ECO	EXO
5	05UFGEXO	Create mixed use and transit oriented developments that serve as centers of neighborhood and community activity.	UFG	EXO
6	06ENVEXO	Protect sensitive environmental areas, preserve natural stream corridors, and create developments that minimize impact to natural features.	ENV	EXO
7	07QLFEXO	Strengthen community identity through use compatible, quality architecture and landscape designs and preservation of significant historic structures.	QLF	EXO
8	08TRNEXO	Develop land uses, building sites, and transportation infrastructure that enhances the efficient movement of people, goods, and services.	TRN	EXO
9	09ENVEXO	Provide functional, adaptable, and sustainable building site designs that use water, energy, and material resources effectively and efficiently.	ENV	EXO

ID	CODE	HEURISTIC	TOPIC	METHOD
10	10UFGEXO	Adopt Comprehensive Plans and ordinances that support Development Excellence and involve citizens and stakeholders in all aspects of the planning process.	UFG	EXO
11	11UFGASP	Among the workshop scenarios, Dallas County's share of future growth ranges from just under 15% to almost 45% with all scenarios envisioning a larger share of growth in this central county than under North Central Texas COG's 2030 Forecast.	UFG	ASA
12	12UFGEGS	Create mixed use developments that are centers of neighborhoods and community activities and serve as hubs of non-automobile transportation systems.	UFG	EGS
13	13ENVEGS	Protect, retain or enhance the region's important natural assets (including its air, water, land and forests) and integrate these natural features and systems into the character of the region's communities and the experiences of its residents.	ENV	EGS
14	14QLFEGS	Strengthen the identities of the region's diverse communities through preservation of significant historic structures and natural assets, creation of new landmarks and gathering spaces, use of compatible architectural and landscape design.	QLF	EGS
15	15TRNEGS	Invest in transportation systems, facilities and operations that provide multi-modal choices for the efficient and sustainable movement of people, goods, and services.	TRN	EGS
16	16ENVEGS	Design buildings, sites, communities and regional systems to use water, energy, and renewable resources responsibly, effectively and efficiently, and to retain non-renewable resources for the use of future generations.	ENV	EGS
17	17QLFEGS	Provide opportunities for all North Texans to have access to the schools, people and technology they need for success in learning throughout their lives.	QLF	EGS

ID	CODE	HEURISTIC	TOPIC	METHOD
18	18QLFEGS	Identify and support functional, sustainable infrastructure and institutions that offer North Texans access to affordable, nutritious foods, opportunities for physical activity, and access to wellness and primary care services.	QLF	EGS
19	19UFGEGS	Achieve the region's vision by adoption of compatible comprehensive plans and ordinances for cities and consistent investment plans for regional systems; involve citizens and stakeholders in all aspects of these planning processes.	UFG	EGS
20	20UFGAES	A region where people have more choices about how they connect to the places where they live, work and play and many human-scale mixed use centers located throughout North Texas.	UFG	AES
21	21TRNAES	An investment framework that emphasizes mobility choices within and between centers, including trails/paths, public transportation (bus, streetcar, light rail and commuter rail) and routes for travel by car.	TRN	AES
22	22UFGAES	A region that maximizes the benefit received from the extensive investment taxpayers and property owners have made in the region's existing infrastructure and development pattern.	UFG	AES
23	23UFGAES	A region where growth through 2030 is mostly contained in areas where urban-scale infrastructure already exists, emphasizing infill, revitalization and maintenance of existing communities.	UFG	AES
24	24UFGAES	A region with different sorts of communities and centers, built on the traditional character of regional communities but designed to meet the needs of the region's future markets.	UFG	AES

ID	CODE	HEURISTIC	TOPIC	METHOD
25	25UFGAES	A region that instead of focusing on quantities (of new population or of facility capacity), focuses on qualities – the features, places and experiences that make one community stand out from another and that encourage residents to develop strong and las	UFG	AES
26	26UFGAES	A region with different sorts of communities and centers, built on the traditional character of regional communities, designed to meet the needs of the region's future markets but with a focus on qualities – the features, places and experiences that make	UFG	AES
27	27UFGAES	A region that supports reinvestment and development in downtown Dallas, downtown Fort Worth and in the downtowns of other communities around the region, providing regional support for the efforts many of these communities have underway.	UFG	AES
38	38UFGTSP	The limits of natural resources, particularly water, shaped many workshop scenarios	UFG	TSP
39	39UFGCON	The general issues that ranked highest for most workshop scenarios were water quality and quantity, transportation, air quality, quality of life, infrastructure and economic development.	UFG	CON
40	40UFGTSP	Some workshop scenarios had most of the new development located close to the Fort Worth and Dallas downtowns.	UFG	TSP
41	41UFGTSP	Some workshop scenarios planned linear development patterns, some along transit lines and others along major highways.	UFG	TSP
42	42UFGTSP	Some workshop scenarios reflected the concept of concentrating development in centers separated by low density development and open space.	UFG	TSP
43	43UFGTSP	Some workshop scenarios emphasized centers around transit stations while others focused on adding new mixed-use development in the cores of the existing cities in the outer parts of the region.	UFG	TSP

ID	CODE	HEURISTIC	TOPIC	METHOD
44	44ECOASP	Dallas County, where 55%the region's jobs were located in 2000, continues to be the largest employment center under all workshop scenarios.	ECO	ASA
45	45UFGASP	All workshop scenarios show Dallas County's share of regional employment growth being less than the 55% it was in 2000 , so Dallas County's share of regional employment declines over time.	UFG	ASA
46	46TRNTSP	The Rail Scenario dramatically increases the number of trips on transit.	TRN	TSP
47	47TRNTSP	A Polycentric Scenario would increase transit travel more than an Infill Scenario.	TRN	TSP
48	48TRNTSP	A Polycentric Scenario would reduce the hours residents spend stuck in traffic by 32.5% and would require 71.5% fewer lane miles to meet their needs.	TRN	TSP
49	49UFGTSP	All workshop scenarios located more of the region's growth in the two central city downtowns than the North Central Texas COG's 2030 Forecast does.	UFG	TSP
50	50UFGTSP	All three scenarios, rail, infill, and polycentric place more new housiing in the two Core Cities.	UFG	TSP
51	51UFGTSP	All three scenarios, rail, infill, and polycentric locate less housing in the outlying Cities and the Towns than does the North Central Texas COG's 2030 Forecast.	UFG	TSP
52	52ECOTSP	All four scenarios (Forecast, Rail, Infill, and Polycentric) locate the largest share of new jobs in the Core Cities but three scenarios (Rail, Infill and Polycentric) continue to emphasize revitalization by locating a higher share of jobs in the First T	ECO	TSP
53	53ENVTSP	All three scenarios (Rail, Infill and Polycentric) reduce the emissions linked to air pollution.	ENV	TSP
54	54UFGASP	Most of the workshop scenarios improve the jobs-hosing balance of the region.	UFG	ASA

ID	CODE	HEURISTIC	TOPIC	METHOD
55	55UFGASP	Ten of the 19 workshop scenarios add jobs and households in balanced proportions for 3 to 5 of the region's counties.	UFG	ASA
56	56UFGTSP	In the North Central Texas COG's 2030 Forecast, 20% of new jobs and almost 10% of new households are within ¼ mile of a transit station in the 2025 Mobility Plan. The Rail Scenario locates 35% of new jobs and almost 48% of new households in this vicinity	UFG	TSP
57	57ENVTSP	73% of new households in the North Central Texas COG's 2030 Forecast are located in open space or agricultural areas. In contrast, this share drops to 60% for the Infill Scenario, 50% for Rail Scenario and 37% for Polycentric Scenario, suggesting more p	ENV	TSP
58	58UFGCON	In order to preserve environmental assets, the southeast region will develop by creating growth opportunities in nodes and corridors fed by public transportation and by encouraging high density in mixed use settings.	UFG	CON
59	59UFGEGS	Meet the needs of changing markets by providing a mix of development options and land use types in communities throughout the region.	UFG	EGS
60	60UFGEGS	Promote reinvestment and redevelopment in areas with existing infrastructure, ensure that new infrastructure supports orderly and sustainable growth, and provide coordinated regional systems of natural and built infrastructure.	UFG	EGS
61	61TRNEGS	Create and connect pedestrian-(and bicyclist) oriented neighborhoods, centers and places throughout the region.	TRN	EGS
62	62ECOEGS	Sustain and facilitate a range of housing opportunities and choices that meet the needs of residents of all economic levels and at all stages of life.	ECO	EGS

ID	CODE	HEURISTIC	TOPIC	METHOD
63	63ENVCON	Provide trail connections that people can use for recreation and travel between desired destinations.	ENV	CON
64	64ENVCON	Foster new opportunities for recreation, access and parks.	ENV	CON
65	65ENVCON	Protect and enhance existing ecosystems.	ENV	CON
66	66ENVCON	Restore vital ecosystems.	ENV	CON
67	67ENVCON	Preserve the assets that define "character of place" for the region and its communities.	ENV	CON
68	68ENVCON	Protect water quality and promote natural storm water management.	ENV	CON
69	69ENVCON	Sustain the region's watersheds, waterways and water resources.	ENV	CON
70	70ENVCON	Use natural and land assets to improve public health.	ENV	CON
71	71ENVAES	A region with an initial identification of natural assets and open spaces that create a 'green infrastructure' for the region and that are protected and enhanced.	ENV	AES
72	72ENVAES	An emphasis on the inclusion of natural areas in the development pattern in all parts of the region.	ENV	AES
73	73ENVAES	Use tools such as the transfer of development rights (TDR) to protect natural areas while enabling property owners to benefit from previously-approved development intensity.	ENV	AES
74	74ENVAES	Support for green jobs – economic development based on the regions's natural assets, continuing agricultural uses and ecotourism.	ENV	AES
75	75ENVAES	A region based on a network of green infrastructure to serve the region's needs for parks, trail connections and storm water management.	ENV	AES
76	76ENVAES	A strong emphasis on networks for non-auto mobility options; The use of alternative energy sources, LEED building and conservation to reduce the region's energy consumption needs.	ENV	AES
77	77ENVAES	Emphasize water conservation and demand reduction above current levels as a strategy to meet the region's water supply needs.	ENV	AES

ID	CODE	HEURISTIC	TOPIC	METHOD
78	78ENVAES	Emphasize public infrastructure design, materials and locations that reduce the region's carbon footprint.	ENV	AES

Vision North Texas Reporting Documents Used as Source for Heuristics

Document Name	Description	Source Date
Pre Phase 1 Growth Principles	Vision North Texas Phase One Report - Principles of Development Excellence section	12/1/2005
Phase 1 Report	Vision North Texas Phase One Report	12/1/2005
Phase 2 Report	Vision Texas Phase 2 Report - Date based on pdf file properties - Summary of some of the sub-regional workshops, only individual data, no aggregation	12/5/2007
Phase 3 Report - Sub-regional	Regional Choices for North Texas - Sub-regional Analysis	11/15/2008
Phase 4 Report - Guiding Principles	North Texas 2050 Report - Guiding Principles Section	3/10/2010
Leadership Summit	Vision North Texas Leadership Summit	9/20/2006
Phase 4 Report - Scenarios	North Texas 2050 Report - Sections on Alternative Scenarios	3/10/2010
Alternative Futures Report	North Texas Alternative Futures Scenario Descriptions	8/21/2009
Phase 3 Report - Key Pad	Regional Choices for North Texas - Key Pad Issue Polling	11/15/2008
Phase 3 Report - Scenario Analysis	Regional Choices for North Texas - Scenario Analysis	11/15/2008
Greenprint Project Framework	Vision North Texas - Greenprint Project 2007 Results Report - Framework design	10/23/2008

APPENDIX F

AZONE INTERVIEW QUESTIONS

1. What was your role to date in the Az One regional visioning project?
2. What were the key public policy issue (s) that initiated the regional visioning project.
3. What were the key social, political, economic, and environmental factors important driving these issues?
4. What was the initial goal(s) of the regional visioning project?
5. Why was the reality check exercise chosen to be a part of the regional visioning project?
6. What did the project leadership hope to accomplish with the reality check exercise?
7. Do you think this was accomplished by the first Reality Check event?
8. Where there any other results of the first Reality Check Event?
9. Where any of these results unanticipated?

Over the next few months after the Reality Check event, some further qualitative and quantitative analysis was done using results from the first Reality Check exercise and in September of 2008 a report was produced and distributed.

10. What did the project leadership hope to accomplish with this report?
11. Do you think this was accomplished by this report?
12. Where there any other results from this report?
13. Where any of these results unanticipated?

APPENDIX G

VISION NORTH TEXAS INTERVIEW QUESTIONS

1. What was your role to date in the Az One regional visioning project?
2. What were the key public policy issue (s) that initiated the regional visioning project.
3. What were the key social, political, economic, and environmental factors important driving these issues?
4. What was the initial goal(s) of the regional visioning project?
5. The VNT partnership is rather diverse, (ULI, NCTCOG, UTA) how did this partnership come about?
6. In April of 2005 VNT held its first regional visioning event.
7. Why was the ULI's reality check LEGO exercise chosen to be included in the initial regional visioning event (April 2005)?
8. What did the project leadership hope to accomplish with the LEGO reality check exercise?
9. Do you think this was accomplished?
10. At this initial event, after the LEGO exercise two other scenarios were presented, along with an analysis of these scenarios compared to NCTCOG's 2030 Forecast
11. What did the project leadership hope to accomplish introducing these two scenarios and the analysis of each?
12. In general, what do you think was accomplished by the first event?
13. Late in 2005 the VNT leadership decided to proceed with a Phase II of the project which was implemented over roughly the next 18 months. There was a leadership summit, a few mini-LEGO workshops, four subregional LEGO workshops, and some research, including the regional form study and the greenprinting project.
14. What did the leadership hope to accomplish with this phase?
15. At the Sept 2006 Leadership Summit the concept of Community Form (Core InnerTeir, Outer Tier) was introduced along with an analysis of comprehensive plans by community and Community Form.
16. What did the leadership hope to accomplish with this analysis?
17. Also at the Sept 2006 Leadership Summit a new scenario was introduced, the polycentric scenario, which was developed as a hybrid based on the LEGO scenarios created by participants of the first workshop in 2005. Using some metrics this hybrid scenarios was compared to the previous scenarios and NCTCOG's 2030 forecast.
18. What did the leadership hope to accomplish by introducing this new scenario and the comparative analysis?
19. Most of the Sept 2006 Leadership summit was focused on discussion groups discussing regional issues.
20. What did the leadership hope to accomplish from this event and the publication of the results afterward.

21. Starting in early 2007 and over the next 18 months four subregional LEGO exercises were conducted.
22. Why did the leadership organize these workshops?
23. Was there anything different about these compared to the original regional lego exercise other than they were subregional?
24. What do you think was accomplished from these workshops?
25. One of the efforts initiated in this second phase was the greenprinting project.
26. Why was this project initiated?
27. How did the partnership with TPL come about?
28. In June of 2007 Phase III was initiated, with a goal of establishing a shared regional vision. This was one of the questions posed in Phase II

APPENDIX H

SOCIAL BEHAVIORAL APPLICATION HUMAN SUBJECTS APPROVAL

ASU ARIZONA STATE UNIVERSITY
RESEARCH AND ECONOMIC AFFAIRS

Office of Research Integrity and Assurance

To:	David Pijawka ARCH
From:	Mark Roosa, Chair Soc Beh IRB
Date:	02/05/2010
Committee Action:	**Exemption Granted**
IRB Action Date:	02/05/2010
IRB Protocol #:	0907004147
Study Title:	Reality Check Preference Surveys

The above-referenced protocol is considered exempt after review by the Institutional Review Board pursuant to Federal regulations, 45 CFR Part 46.101(b)(2) .

This part of the federal regulations requires that the information be recorded by investigators in such a manner that subjects cannot be identified, directly or through identifiers linked to the subjects. It is necessary that the information obtained not be such that if disclosed outside the research, it could reasonably place the subjects at risk of criminal or civil liability, or be damaging to the subjects' financial standing, employability, or reputation.

You should retain a copy of this letter for your records.