The Effects of Scenario Planning on Participant Decision-Making Style

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This research examines changes in decision-making styles as a result of participation in scenario planning. A quasi-experimental pretest-posttest design and several nonparametric tests were used to analyze data gathered from research participants in a technology firm in the Northeastern United States. Results show that participants tend to transition toward more intuitive-based decision-making styles after participation in scenario planning. Limitations are examined and conclusions are drawn concerning the effects of scenario planning on participation decision-making styles as measured by the General Decision-Making Style Survey.

Much has been written about the difficulties in coping with uncertainty in the business environment, but there is relatively little research concerning how people actually make decisions in this domain, attempting to account for the complexity of the environment. This lack of research is a result of the difficulties in specifying measures of decision-making performance (Driver, 1979; Scott & Bruce, 1994). Although some decisions require a vigilant, analytical information processing style, others call for creativity and novelty. Strategic planning in today's business environment is a phenomenon that demands novelty in thought and is designed to prompt decision makers to think differently about the future. Effective planning in an uncertain environment means divergent thought and creation of imagined alternative future states to examine current business practices and processes (Chermack, 2005; Georgantzas & Acar, 1995; Schoemaker, 1995; van der Heijden, 1997).

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Strategic planning has been repeatedly separated into the two phases of formulation and implementation and essentially reduced to decision making by analysis (Andrews, 1987; Chandler, 1962; Christensen, Andrews, Bower, Hamermesh, & Porter, 1982; Porter, 1985; Selznick, 1957). In this model of traditional planning, the architects of strategy (executives) design an optimal strategy and roll out the doing of strategy to the managers below them. Mintzberg (2005) has opposed this oversimplification of strategy, arguing that strategy is as much craft as analysis, if not more, further positing that effective planning is based on iterative interaction among planners, managers, and various ongoing assessments of organizational progress.

Scenario planning has gained increased attention recently (Bradfield, Wright, Burt, Cairns, & van der Heijden, 2005; Burt & van der Heijden, 2003; Chermack, 2005; Chermack & Swanson, 2008) as an alternative approach to planning that is claimed to embrace uncertainty (Wack, 1985a) and account for the emergent properties of strategy so passionately argued for by Mintzberg (1990, 2005). Scenario planning also encourages innovation, creativity, and ongoing organizational learning (Schwartz, 1991; van der Heijden, 1997, 2005; Wack, 1985b). Such an approach to strategy may have important implications for decision making, and literature (Schwartz, 1991; van der Heijden, 1997, 2005; Wack, 1985b) highlights this potential relationship; however again a lack of research leaves this relationship in the abstract domain.

Helping organizations plan and prepare for the future has historically been a concern of human resource development (HRD) professionals (Swanson, 1994; Torraco & Swanson, 1995). This concern has included identifying future workforce demands (Swanson, 1982), formulating organization strategy that incorporates a strategic role for human resources (Garavan, 2007; Gilley & Maycunich, 2000; Walton, 1999), leading strategic planning efforts (Yorks, 2005) and more recently building strategic capacity through examining strategic options using scenario planning (Chermack, 2004; Torraco & Swanson, 1995).

Increasingly, scenario planning has been positioned in the domain of HRD (Bradfield, 2008; Burt & Chermack, 2008; Chermack & Swanson, 2008; Keough & Shanahan, 2008; Korte, 2008; McLean & Egan, 2008; McWhorter, Lynham, & Porter, 2008; van der Merwe, 2008; Walton, 2008). As HRD professionals grow in their scenario planning expertise, their ability to influence the strategy and overall planning of the organization constitutes a unique opportunity to influence decision making at the highest levels in organizations. The literature on scenario planning has conceptually examined the cognitive barriers to decision making (Bradfield, 2008; Chermack, 2004), but little research has actually explored changes in decision-making capabilities on the basis of planning interventions. This research is perhaps the only assessment of decision making in HRD using a real-time sample of participants who have undergone scenario planning in an applied organizational setting.

Purpose of the Study and Research Question

The purpose of this study was to examine the relationship between scenario planning and participant decision-making styles. More specifically, this study aimed to investigate claims that scenario planning has an effect on participant decision-making styles. The research question that served as the basis of this study was, What are the effects of scenario planning on participant decision-making styles?

Theoretical Framework

Scenario planning is designed to recognize uncertainty in the business environment. This approach to planning promotes construction of multiple plausible future environments in which decision makers can "play" with decisions hypothetically and consider the effects of their decisions. This ability to play is at the heart of how scenario planning fosters creativity and is therefore useful as part of a strategy process. A scenario—which literally means "a written outline of a movie, novel, or stage work giving details of the plot and individual scenes" (*Oxford English Dictionary,* 2004, p. 589)—contains elements related to the deep concerns of the managers who will use them, along with a challenging, plausible, and relevant storyline.

Scenario planning has been defined as "a disciplined methodology for imagining possible futures in which organizational decisions may be played out" (Schoemaker, 1995, p. 25). Schoemaker (1995) defined ten steps of the scenario planning process honed in his days as a co-developer of the process in practice at Royal Dutch Shell:

1. Define the scope of the project.
2. Identify the key stakeholders.
3. Identify trends.
4. Identify and consider the key uncertainties.
5. Construct the initial scenarios.
6. Check initial scenarios for plausibility.
7. Develop learning scenarios.
8. Investigate "blind spots" in the scenarios and further research.
9. Reexamine internal consistencies.
10. Select specific decision scenarios relevant to the organization.

Though variations on Schoemaker's process exist, all incorporate similar, if not identical, elements. No matter the process used, all position the management team as a decision-making unit, and all suggest in some way or another that scenario planning can shift the style in which individuals make decisions, toward a more intuitive, creative, and dependent approach in which teams are prompted to think differently about the organization and the future.

The focus of scenario planning is often thought to be on prediction and preparedness (Schoemaker, 1992), but Wack emphasized that "the most important purpose of scenario planning is to alter the mental models and thereby shift the thinking inside the organization about what might happen in the future in the external environment" (1985a, p. 84). This shifting of mental models is based on seeing the situation in a new light, given information that challenges individual assumptions. For example, Schoemaker (1995) wrote (from Cerf & Navasky, 1984):

> In 1921, when someone suggested that airplanes might sink battleships by dropping bombs on them, U.S. Secretary of War Newton Baker remarked: "That idea is so damned nonsensical and impossible that I'm willing to stand on the bridge of a battleship while that nitwit tries to hit it from the air." Josephus Daniels, Secretary of the U.S. Navy was also incredulous: "Good god! This man should be writing dime novels." Even the prestigious *Scientific American* proclaimed in 1922 that "to affirm that the aeroplane is going to 'revolutionize' naval warfare of the future is to be guilty of the wildest exaggeration" [p. 44].

Another example of the kinds of assumptions that scenario planning tends to reveal is seen in the auto manufacturers in the upper Midwestern United States during the 1970s and 1980s—mainly an assumption that U.S. Americans would not purchase small, fuel-efficient automobiles. The fundamental decision not to entertain the possibilities around this assumption is considered a contributor to significant decline in the U.S. auto industry.

Suffice it to say unexamined theory suggests that decision-making biases and tendencies are part of the mental models of individuals who must make decisions. If this premise can be accepted, and successful scenario planning alters, expands, or reveals these assumptions and biases, then the suggestion follows naturally that engaging in scenario planning should in some way change the patterns by which individuals make decisions. For the purposes of this article, these patterns housed in the mental models of scenario planning participants can be equated with individual decision-making styles.

Theoretical Claims Linking Scenario Planning and Decision Making

The scenario planning literature is rife with claims that the intervention can enhance, reduce error in, generally improve performance in, and alter the style in which participant decision making is conducted (Schwartz, 1991; van der Heijden, 1997, 2005; Wright & Goodwin, 1999). One can see how visiting the future—even if hypothetical—may have advantages. For example, if Newton Baker had allowed himself to seriously consider the progression of technology that would one day evolve into the "smart bombs" that were so prevalently featured on

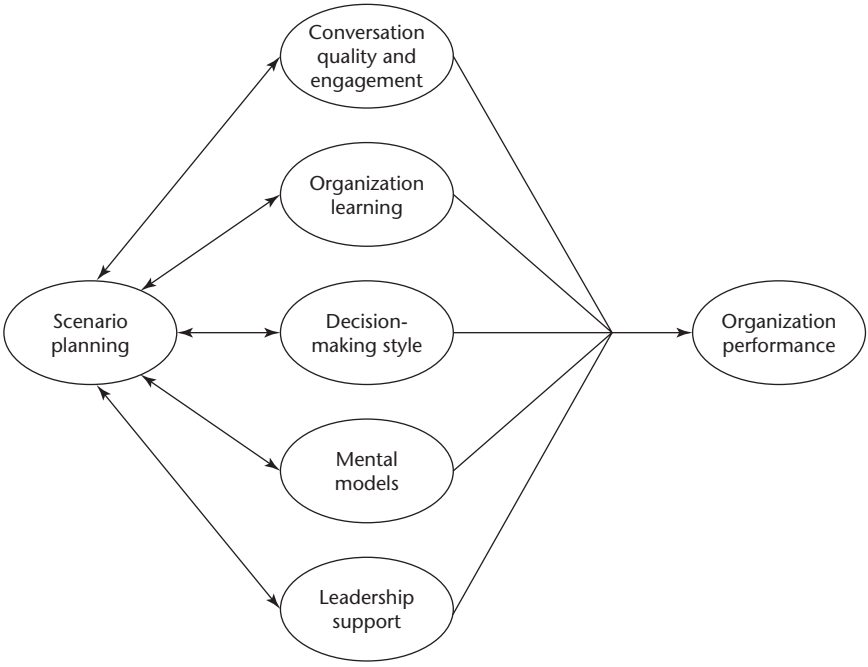
U.S. news channels in 2000, his decision to voluntarily stand exposed on a ship as target practice might have been different. Perhaps more realistically, if U.S. auto manufacturers had really allowed themselves to explore Americans' demand for small, fuel-efficient vehicles, a whole series of decisions might have been different. This could also be an example of hindsight bias; it is difficult to determine.

All of the claims in the literature, however, are merely that: claims. None have been explored beyond anecdotes of successful scenario planning activities. Examples of successful practice can provoke insight, but it is important to acknowledge that there has been little if any systematic empirical research aimed at examining or making generalized statements about the effects of scenario planning. Some theory on the matter has been articulated more clearly in recent publications (Chermack, 2005; van der Heijden, 1997). Georgantzas and Acar (1995) spent considerable time on the general decision-making literature in their publication *Scenario-Driven Planning* and concluded that decision-making styles could theoretically be altered through participation in scenario planning. A complex paper by Wright and Goodwin (1999) further specified the espoused relationship between scenario planning and decision making. Van der Heijden (1997, 2005), and then van der Heijden, Burt, Bradfield, and Cairns (2002) made theoretical assertions in line with the logical, theoretical link between the phenomena, including a statement about a link between decision-making patterns and styles and how scenario planning can alter them, but none offer clear theoretical propositions, empirical indicators, or hypotheses about the connection between the phenomena. Ringland (1998) also made claims of the link between scenario planning and decision-making style but has not clarified the context, details, or specifics of those claims.

Chermack's theoretical model (2005) of scenario planning (see Figure 1) is the only publication to explicitly include decision making as a critical component of the scenario planning intervention and is complete with theoretical propositions and hypotheses. The difficulties encountered by Chermack were in measurement. Chermack's research (2005) did not specify a particular empirical indicator for measuring decision-making performance.

Figure 1 represents decision making as a driver of organizational performance; it accommodates the claims of Chermack (2005), Georgantzas and Acar (1995), van der Heijden (1997, 2005), van der Heijden et al. (2002), and Wright and Goodwin (1999), among others. The key in this representation of the link between scenario planning and decision making is the positioning of the latter as a critical point between scenario planning and organization performance. It should be further noted that even though there are larger questions about the nature and effectiveness of scenario planning in general (as can be seen in Figure 1), this study is evaluating only one component of scenario planning that is common among many authors in the literature. In short, the model presented in Figure 1 is actually a program of research, intended to be carried out over many years of investigation, and this study serves to add research to one small portion of the model.

Figure 1. A Theoretical Model of Scenario Planning (Based on Chermack, 2005)



Decision-Making Style: An Overview and Hypotheses

Given the difficulties in developing empirical indicators for specific and situational decision-making performance, decision-making style has emerged as a way of studying *patterns* in decision-making performance (Woodman, Sawyer, & Griffin, 1993). Decision-making style has been defined as "a habitual pattern individuals use in decision-making" (Driver, 1979). Alternatively, decision-making style is a characteristic mode of responding in decision-making situations (Harren, 1979). Rather than focusing on a specific situation, considering decision-making style allows examination of general patterns, tendencies, or approaches to decision making and may be a more appropriate approach given a context in which a series of decisions is required.

Scott and Bruce (1994) developed a measure of decision-making style and as an outcome of their item development process verified four initial decision styles: (1) rational decision-making style, "characterized by a thorough search for and logical evaluation of alternatives" (p. 820); (2) intuitive decision-making, "being data-sensitive and focusing on an intuitive sense of 'rightness' about decisions is more likely to be open to alternatives in problem formulation" (p. 823); (3) dependent decision-making style, "characterized by a search for advice and

direction from others" (p. 820); and (4) avoidant decision-making style, "characterized by attempts to avoid decision-making" (p. 820). After an intricate validation process, a fifth decision-making style emerged containing items related to spontaneity. Spontaneous decision makers have "a sense of immediacy and a desire to get through the decision-making process as soon as possible" (p. 823). The resulting instrument was titled the General Decision-Making Style Survey (GDMS).

The GDMS is intended to measure participant decision-making tendencies. Scott and Bruce (1994) further recognized that a decision maker may rely on more than a single style but is unlikely to draw from opposing styles. In summary, there is a single overarching research question for this study, namely, What are the effects of scenario planning on decision-making style? There are five hypotheses identified here that serve as the basis for answering the research question.

Rational Decision-Making Style. Rational decision making is the cornerstone of MBA education. It focuses on breaking issues into component pieces (Mintzberg, 2005). Aimed at separating most any managerial issue into analysis and implementation, rational decision makers focus on creating a sense of order and structure to deal with information. Rational decision makers also usually attempt to establish a procedure for choosing options that can be applied and reapplied to any situation and generally assume that available information is accurate and reliable (Mintzberg, 2005). Also prevalent in this approach to decision making is an underlying assumption that there is a single, optimal solution and the task of the decision maker is to find it (van der Heijden, 1997). Critiques of this approach to decision making have centered on its assumptions of perfect information and a stable, relatively nonpolitical environment: "It is suggested that the rational decision-maker's focus on logic, order and systematic analysis limits the boundaries on problem formulation" (Scott & Bruce, 1994, p. 823). The first hypothesis for investigation in this study was with regard to rational decision-making style:

HYPOTHESIS 1: *Individuals who engage in scenario planning will tend to use a less rational decision-making style.*

Hypothesis 1 features a negative directional relationship because scenario planning is intended to encourage approaching any strategic situation with new insights (Wack, 1985a). Scenario planning is based on an assumption that there are multiple possible "answers" to the strategy question (Chermack, 2005; van der Heijden, 1997, 2005), and that information will never be complete, completely accurate, or completely reliable (Schoemaker, 2001).

Intuitive Decision-Making Style. Intuitive decision-making style is characterized by individual efforts from data-based hunches; it is usually a strategy employed by people with extensive experience in a given field or environment. Often the result of past experiences, intuitive approaches to decision making

are truly understood only by the individual and are, by definition, unexplainable. Intuition is defined as "the ability to understand something immediately, without the need for conscious reasoning" (*Oxford English Dictionary,* 2004, p. 403). This approach can therefore be thought of as contradictory to the rational school, which is based on learning from past experiences and favoring the value of history over systematic analysis. Intuitive decision makers are reflective and concerned with patterns while incorporating emotional biases into their processing of the decision situation (MacCrimmon & Wehrung, 1990). Qualitative research by Burke and Miller (1999) confirms the base of experience, emotion, and cognition for making intuitive judgments as "an increasingly viable approach in today's business environment" (p. 91); "The intuitive decision-maker, being data-sensitive and focusing on an intuitive sense of 'rightness' about decisions is more likely to be open to alternatives in problem formulation" (Scott & Bruce, 1994, p. 823). The second hypothesis for investigation in this study was as follows:

HYPOTHESIS 2: *Individuals who engage in scenario planning will tend to use a more intuitive decision-making style.*

A positive directional relationship is featured in Hypothesis 2 because scenario planning is intended as a tool for fostering intuition and creativity (Schoemaker, 2001). In fact, scenario planning is based on the assumption that only novel insights about the organization in its environment will be enough to spark genuine interest in the planning process among managers. Indeed, the key advantage in using scenario planning is in writing challenging scenarios that help managers view a situation in a new way. This requires creativity and intuition, both aimed at shifting the thinking inside the organization.

Dependent Decision-Making Style. Dependent decision making is characterized by a need for the aid of other people in the decision situation. Delphi is an example of dependent decision making. The Delphi technique requires the contributions of experts, but it is usually deemed appropriate given certain contextual elements (Schwartz, 1991). However, some individuals prefer to seek the council of others and often struggle, to the point of paralysis, without the available council of trusted colleagues (McKenney & Keen, 1974): "An external orientation, or the belief that one's fate is not self-controlled, is likely to be associated with dependent decision-making, where responsibility for decisions are projected onto others" (Scott & Bruce, 1994, p. 822). Dependent decision making is certainly a common phenomenon in organizations and highlights issues related to conflict and preferences (Bazerman, Tenbrunsel, & Wade-Benzoni, 1998). Thus the third hypothesis under investigation:

HYPOTHESIS 3: *Individuals who engage in scenario planning will tend to use a more dependent decision-making style.*

Hypothesis 3 exhibits a positive association because scenario planning is based on the assumption that the group is the decision-making unit. The whole point of scenario planning is to introduce novelty into the strategic decision-making activities of the organization (Wack, 1985b) by including a diverse set of people in the planning team. In order to do so, "remarkable people" (van der Heijden, 1997, p. 49)—individuals outside the organization who are unfamiliar with the industry—are often used to promote new thinking on old topics. Further, the group process component of scenario planning allows group members to express and share their views. It is through this conversational exchange that decision makers can realistically consider and understand perspectives different from their own.

Avoidant Decision-Making Style. Avoidant decision makers simply don't want to make decisions. Characterized by the use of strategies to work around decision making completely, avoidant decision-making style may result "from a lack of confidence in one's decision-making ability, similar to the external's believe in lack of control over life events" (Scott & Bruce, 1994, p. 822). The fourth hypothesis for this study was:

HYPOTHESIS 4: *Individuals who engage in scenario planning will tend to use a less avoidant decision-making style.*

Spontaneous Decision-Making Style. Spontaneous decision-making style emerged as a fifth category during factor analysis procedures for the instrument containing the previous four decision-making styles. This approach to decision making was identified as "missing from the literature" (Scott & Bruce, 1994, p. 819), and thus there is little published support that describes the nuances of people relying on this decision-making style. In assessing their research participants, however, Scott and Bruce (1994) observed that "a spontaneous decision-maker has a sense of immediacy" (p. 823) and is usually impatient with the decision-making process. Here is the fifth and final hypothesis for this study related to spontaneous decision-making style:

HYPOTHESIS 5: *Individuals who engage in scenario planning will tend to use a less spontaneous decision-making style.*

Method

The sections that follow describe the sample, instrument, data collection, and analysis procedures.

Sample. Participants in this study were eighty-four managers, senior managers, and executives in a technology firm in the Eastern United States. Participants were selected first on the basis of their organization participating in a scenario planning project. Participants in the project were invited to participate in this study and joined voluntarily. Forty-one participants in the scenario

planning project volunteered to be involved in this research and became the intervention group. An additional feature of the research design was to obtain a comparison group; thus additional input was sought from participants not involved in the scenario planning effort. Again, participants were selected only on willingness to participate in this research study; forty-three participants volunteered to serve in the comparison group. Forty-one participants in the intervention group completed both pretests and posttests; forty-three participants in the comparison group completed both. There were no data missing in any of the returned surveys.

The only demographic data gathered for the participants in this study were education level and length of time in the organization. This was an effort to examine the level of similarity between the intervention and comparison groups; there was no random assignment. Sample characteristics on these data are presented in Table 1. Even though the intervention and comparison groups are similar, there is evidence that the intervention group members have generally been with the organization for a longer period of time. Given that scenario planning is an intervention that demands the participation of senior executives and high-level managers, it is logical that the two groups would differ slightly in this way. Another issue arises in considering how representative this sample is of the intended population (planners in U.S. companies), but not enough demographic data were collected to offer such a judgment.

A further note here is that, of course, we would have liked to have more comprehensive demographic data about the participants. However, the group of individuals with whom we worked had limited time available to provide

Table 1. Two Demographic Characteristics of the Comparison and Intervention Groups

	Comparison Group		*Intervention Group*	
	n	*%*	*n*	*%*
Education level				
High school diploma	13	30.23	5	12.20
Bachelor's degree	22	51.16	24	58.54
Master's degree	7	16.27	10	24.39
Doctoral degree	1	2.33	2	4.88
Total	43	100	41	100
Time in the organization				
0–5 years	12	27.91	4	9.75
6–10 years	23	53.49	25	60.98
11–15 years	8	18.60	11	26.82
16+ years	0	0	1	2.44
Total	43	100	41	100

data at all, and in many ways we imposed on their time and were privy to sensitive data regarding the organization and its strategic position. To state things plainly, we intuited that we were pushing the limits of what the participants were willing to give to our research project, and as a result we made a judgment that having complete pretests and posttests, along with the proper IRB documentation, was more important than comprehensive demographic data. We note this as one common challenge in applied research projects, and we have identified this as a significant limitation to our research study.

Instrument. The instrument used in this study was the General Decision-Making Style (GDMS) Survey, developed by Scott and Bruce (1994) and further evaluated by Loo (2000) and Thunholm (2004). The General Decision-Making Style Survey is a twenty-five-item survey that affords a measure of decision-making style tendency based on five independent styles: (1) rational, (2) intuitive, (3) dependent, (4) avoidant, and (5) spontaneous. Sample items from the survey are "I avoid making important decisions until the pressure is on" and "I use the advice of other people in making my important decisions." Items are self-rated on a five-point Likert-type scale with response categories ranging from strongly disagree to strongly agree.

Initial Instrument Validity. Scott and Bruce (1994) have performed a thorough analysis aimed at assessing the validity and reliability of their initial survey scores. Initial exploratory factor analysis results indicated the presence of five discrete factors that have formed the basis of the General Decision-Making Style Survey. To examine the various forms of validity, further analysis was conducted, including assessment of content, concurrent, and construct validity.

Initial Content Validity. From an extensive review of the literature and decision-making theory, the items were written and then examined by several independent researchers with expertise in decision making. The scale has been judged to have face and content validity by those experts and refined where necessary.

Initial Concurrent Validity Analysis. Analyses of variance were performed during the initial instrument validation with three samples: (1) military officers ($n = 250$), (2) MBA students ($n = 84$), and (3) undergraduate students ($n = 229$). The three samples were significantly different on rational, intuitive, and dependent decision-making style, but not significantly different on avoidant or spontaneous decision-making style. Correlations suggested the existence of five discrete factors even though significant differences were found among the groups.

Initial Construct Validity Assessment. Correlations were computed during the initial survey development among all the scales for all of the samples.

Significant correlations between control orientation and the decision-making style scales support the proposition that decision-making style is reflective of individual cognitive style. In addition, the correlations found among the subscales of the GDMS support the notion that the decision-making styles are not mutually exclusive, and that individuals do not rely on a single style.

The findings of this study indicate that individuals use a combination of styles in making important decisions (Scott & Bruce, 1994).

Additional studies (Loo, 2000; Thunholm, 2004) have been conducted since Scott and Bruce's original developmental research (1994). These studies have confirmed the five-factor structure of the GDMS and have generally added to the validity and reliability robustness of the instrument. The major suggestion for furthering the acceptability and use of this instrument has been to study its validity and reliability across cultures, because varying cultures have their own norms and tendencies in decision making.

Initial Reliability Analysis. During instrument development and initial validation, coefficient alpha scores were all over .79, indicating reasonably reliable data (Scott & Bruce, 1994)—particularly given the early stage of instrument development. There were significant differences among groups in the concurrent validity analysis; the pattern of correlations also lent further support to the conceptual independence among the five factors.

Data Collection. Approximately two weeks prior to the start of a scenario planning effort, participants were asked to assess their own decision-making styles using the GDMS survey developed by Scott and Bruce (1994). Participants were asked to complete the same survey again at the conclusion of the scenario planning effort, approximately three months later. Data were input into the Statistical Package for the Social Sciences (SPSS), Version 15.0 for Windows.

Analyses. Analyses conducted included calculating the coefficient alpha for reliability estimates, and a confirmatory factor analysis (CFA) for assessing the validity of measurement scores using four estimates of measurement score validity (goodness-of-fit index, GFI; adjusted goodness-of-fit index, AGFI; normed fit index, NFI; and standardized root mean square, SRMR).

Because the study was based on a classic quasi-experimental design using pretests and posttests with intervention and group groups, the researchers pursued Russ-Eft and Hoover's suggestion (2005) and considered ANCOVA as an analytic strategy. However, both the covariates (pretest) and dependent variables (posttests) were found to be nonnormal (Kolmogorov-Smirnov Z's = 1.647 − 2.676, $p < .001$). Because analysis of variance procedures is generally robust if distributions are symmetric, the researchers further examined the data to determine what caused the departures from normality. The researchers found that the majority of the study's variables were skewed ($p < .05$). Therefore the data were analyzed for outliers. Because eliminating the data from all participants whose scores were numerically distant from their respective groups would have resulted in decreasing the sample size by 23 percent, the researchers elected to analyze the data with nonparametric procedures.

In considering nonparametric approaches to ANCOVA, the researchers initially drew from McSweeney and Porter's guidance (1971). Pretest and posttest data were ranked independently, and parametric ANCOVAs were carried out on the rank data. The resulting analyses indicated that pretest was not a

significant covariate for any of the five decision-making styles. Only in the case of intuition was the pretest covariate statistically significant ($p = .001$). However, even in that case it contributed to just 5.4 percent of the variance in intuition posttest score ranks.

Given the skewness and the lack of relationship between pretest and posttest scores, the researchers tested medians to analyze differences between measurement occasion (pretest, posttest) and group (intervention, comparison). Because there were only two levels of measurement occasion, median tests were conducted on the differences between posttest and pretest scores. The median tests compared how many values each group had above or below the grand median for both combined. If the medians are the same, the resulting contingency table should show no statistical difference (Conover, 1999).

To interpret significant interactions between measurement occasion and group, tests of simple effects were conducted. This analytic approach models Maxwell and Delaney's procedures (2003) for analyzing repeated measures data from a pretest-posttest design using parametric procedures (that is, ANOVA). Consistent with Conover's suggestions (1999), median tests served as the analyses for the simple effects. Four simple effects were tested: (1) the two groups' pretest medians, (2) the two groups' posttest medians, (3) the intervention group's pretest and posttest medians, and (4) the comparison group's pretest and posttest medians. For these analyses, alpha was maintained at .05 following Winer's guidelines (as cited in Huck & McLean, 1975).

Effect sizes for the median tests were reported using Cramer's V (V). In the case of a median test, V is equal to the square root of the resultant chi-square value divided by n (Gravetter & Wallnau, 2006). Cohen (1973) suggested the following general guidelines for interpreting Cramer's V with one degree of freedom: small (.10–.29), medium (.30–.49), and large (>.50). Confidence intervals for V were calculated using these formulas derived from Smithson (2003):

$$V_L = \sqrt{(\Delta_L + 1)/N} \tag{1}$$

$$V_U = \sqrt{(\Delta_U + 1)/N} \tag{2}$$

where Δ_L and Δ_U are the respective lower and upper limits for a 95 percent confidence interval on the chi-square statistic, and N is the number of observations.

Results

The next sections describe the results obtained from our analysis.

Reliability. We assessed internal consistency for each decision-making style by calculating coefficient alpha. In the case of the avoidant scale, one item was found to have a corrected item-total correlation lower then .20; the item

was deleted and coefficient alpha was recalculated. The final coefficient alphas for the variables under study were .956 (rationale), .909 (intuitive), .921 (dependent), .919 (avoidant), and .893 (spontaneous).

Validity. We also conducted a confirmatory factor analysis to assess how well the data from the resulting twenty-four items fit the five-scale model. Because our data did not meet the requirement of multivariate normality, we employed the Scale-free Least Squares method, which does not rest on any distributional assumption and works with small sample sizes. Results of commonly used fit indices indicated that the model fit the data reasonably well. Goodness-of-fit index (GFI; .96), adjusted goodness-of-fit index (AGFI; .95), and normed fit index (NFI; .95) met the recommended criterion value of .95 for good fit, as defined by Schumacker and Lomax (2004). Standardized root mean square (SRMR; .086) was just over the recommended level of .08 for adequate fit, as defined by Brown (2006).

Five sets of median tests were conducted for the five decision-making style scores. For each measure, parallel analyses were conducted to test the (1) interaction effect between group (that is, intervention and comparison) and measurement occasion (pretest and posttest); (2) simple effects of group at each measurement occasion; and (3) simple effects of measurement occasion at each group. Tables 2 and 3 present descriptive statistics and the results of the style score analyses.

Hypothesis 1: Rational Decision-Making Style Results. The median delta between posttest and pretest scores was statistically and practically significantly lower for the intervention group ($Mdn = -1.20$) than the comparison group ($Mdn = .40$; $\chi^2 = 25.271$, $p < .001$, $V = .548$). The simple effects of group at measurement occasion indicate the interaction effect was due in large part to the difference between the two groups' posttest scores ($V = .864$), which was mitigated by the difference in the two groups' pretest scores ($V = .225$). The simple effects of measurement occasion at group indicate that intervention appeared to play a significant role ($V < .490$) in decreasing the intervention group's scores, whereas time appeared to make no significant difference ($V = .124$) in the comparison group's scores.

Table 2. Medians for Decision-Making Styles by Condition

	Intervention (n = 41)			*Comparison (n = 43)*		
Decision-Making Style	*Pretest*	*Posttest*	*Delta*	*Pretest*	*Posttest*	*Delta*
Rational	2.60	1.40	−1.20	4.20	4.40	.40
Intuitive	2.80	4.40	1.40	2.20	2.00	−.20
Dependent	3.00	4.00	1.25	2.50	2.25	−.25
Avoidant	4.20	1.80	−2.40	2.80	1.80	−1.40
Spontaneous	4.40	1.80	−2.40	3.00	2.00	−1.20

Table 3. Analysis of Five Decision-Making Style Scores

Test	*n*	*Mdn*	*Chi*	*p*	*V (95% CI)*
Rational					
Interaction between group and occasion	84	−.200	25.271	<.001	.548 (.352, .770)
Group at pretest	84	4.000	4.240	.039	.225 (.000, .452)
Group at posttest	84	2.200	62.645	<.001	.864 (.659, .999)
Measurement occasion at intervention group	41	2.000	19.700	<.001	.490 (.295, .715)
Measurement occasion at comparison group	43	4.400	1.324	.250	.124 (.000, .352)
Intuitive					
Interaction between group and occasion	84	.200	29.739	<.001	.595 (.396, .816)
Group at pretest	84	2.400	3.812	.051	.213 (.000, .441)
Group at posttest	84	4.000	35.287	<.001	.648 (.448, .869)
Measurement occasion at intervention group	41	4.000	28.368	<.001	.588 (.388, .812)
Measurement occasion at comparison group	43	2.000	2.290	.130	.163 (.000, .390)
Dependent					
Interaction between group and occasion	84	.000	9.296	.002	.333 (161, .557)
Group at pretest	84	2.500	5.743	.017	.261(.117, .488)
Group at posttest	84	3.250	48.790	<.001	.762 (.559, .982)
Measurement occasion at intervention group	41	4.000	.052	.820	.025 (.000, .247)
Measurement occasion at comparison group	43	2.250	1.689	.194	.140 (.000, .140)
Avoidant					
Interaction between group and occasion	84	−2.200	25.492	<.001	.551 (.354, .771)
Group at pretest	84	4.000	21.271	<.001	.503 (.309, .725)
Group at posttest	84	1.800	.271	.603	.057 (.000, .289)
Measurement occasion at intervention group	41	3.500	63.200	<.001	.878 (.671, .999)
Measurement occasion at comparison group	43	2.000	16.873	<.001	.443 (.663, .443)
Spontaneous					
Interaction between group and occasion	84	−2.200	19.416	<.001	.481 (.288,. 703)
Group at pretest	84	4.200	5.810	.016	.263 (.118,. 489)
Group at posttest	84	1.800	7.172	.007	.292 (.134, .518)
Measurement occasion at intervention group	41	2.600	74.239	<.001	.952 (.743, .999)
Measurement occasion at comparison group	43	2.100	22.512	<.001	.512 (.319, .731)

Hypothesis 2: Intuitive Decision-Making Style Results. The median delta between posttest and pretest scores was statistically and practically significantly higher for the intervention group ($Mdn = 1.40$) than the comparison group ($Mdn = -.20$; $\chi^2 = 29.739$, $p < .001$, $V = .595$). The simple effects of group at measurement occasion indicate the interaction effect was due in large part to the difference between the two groups' posttest scores ($V = .648$), which was somewhat mitigated by the difference in the two groups' pretest scores ($V = .213$). The simple effects of measurement occasion at group indicate that intervention appeared to play a significant role ($V = .558$) in increasing intervention group scores, whereas time appeared to make little difference ($V = .163$) in the comparison group's scores.

Hypothesis 3: Dependent Decision-Making Style Results. The median delta between posttest and pretest scores was statistically and practically significantly higher for the intervention group ($Mdn = 1.00$) than the comparison group ($Mdn = -.60$; $\chi^2 = 9.296$, $p = .002$, $V = .333$). The simple effects of group at measurement occasion indicate that the interaction effect was due in large part to the difference between the two groups' posttest scores ($V = .762$), which was partially mitigated by the difference in the two groups' pretest scores ($V = .261$). The simple effects of measurement occasion at group indicate that intervention appeared to play an insignificant role ($V = .025$) in increasing intervention group scores. Similarly, time appeared to play an insignificant role ($V = .140$) in the comparison group's scores.

Hypothesis 4: Avoidant Decision-Making Style Results. The median delta between posttest and pretest scores was statistically and practically significantly lower for the intervention group ($Mdn = -2.40$) than the comparison group ($Mdn = -1.40$; $\chi^2 = 25.492$, $p < .001$, $V = .551$). The simple effects of group at measurement occasion indicate that the interaction effect was due almost exclusively to the difference between the two groups' pretest scores ($V = .503$). The simple effects of measurement occasion at group indicate that intervention may have played a role ($V = .878$) in decreasing intervention group scores. However, measurement occasion may also have been a factor, given that time appeared to play a significant role ($V = .443$) in decreasing the comparison group's scores.

Hypothesis 5: Spontaneous Decision-Making Style Results. The median delta between posttest and pretest scores was statistically and practically significantly lower for the intervention group ($Mdn = -2.40$) than the comparison group ($Mdn = -1.20$; $\chi^2 = 19.416$, $p < .001$, $V = .481$). The simple effects of group at measurement occasion indicate that the interaction effect was due in large part to the difference between the two groups' posttest scores ($V = .292$) as well as the difference in the two groups' pretest scores ($V = .263$). The simple effects of measurement occasion at group indicate that intervention may have played a role ($V = .952$) in decreasing intervention group scores. However, measurement occasion may also have played a factor, given that time appeared to play a significant role ($V = .512$) in decreasing the comparison group's scores.

Limitations

There are four key limitations that should be considered in interpreting this research: use of perception-based data, the possibility of nonequivalent groups, the social desirability of responses, and potential pretest influence on posttest scores. These limitations also set the stage for further research including other questions that might be asked about decision making as it relates to scenario planning, as well as efforts to establish randomized groups in future efforts. Each limitation is discussed here, followed by suggestions for refining future research on the topic.

Perception-Based Measures. This study is based on measures of decision-making style, and even though there is evidence that the resultant data were valid and reliable, the data reflect individual perceptions. The larger question is still how and if decision-making style is linked to any objective measure of organization performance. Stated simply, this study is working with perception-based data, which are less reliable in general than objective, observable measures of decision-making style and performance. It is unclear whether decision making can be linked to financial performance, although this connection seems logical and obvious. Perhaps more appropriately, this problem could be reframed to include the notion of "duality of error" (Rochlin, 1998), which informs us that there are consequences of taking certain decisions and there are also consequences related to not taking other specific decisions. In short, decision making is certainly a complex phenomenon; there is no agreement on how to measure, assess, and evaluate decision-making performance. Decision-making style is one among many potential ways of investigating this phenomenon.

The Possibility of Non-Equivalent Groups. There are issues related to the similarity of the intervention and comparison groups. Because there was no random assignment of the participants into these groups in this study, there is a possibility that "differences on the pretest are attributable to some unexplored factor and are not simply by chance" (Howell, 2002, p. 637). Similarly, there is "no basis for expecting the two groups to have the same mean on the posttest in the absence of a real treatment effect" (p. 637). Limited demographic data are supplied in an effort to establish comparability of the groups, but there are other factors on which the participants in the group may differ that have not been accounted for in this study. For example, demographic data in this study did not include prior experience with scenario planning in either group. It is feasible that prior exposure to scenario planning may predispose participants to a particular decision-making style.

Social Desirability of Responses. Self-report measures are susceptible to bias and social desirability and thus possibly yield invalid data. This is always a possibility when using self-report data, but research by Loo (2000) using a measure of susceptibility to faking found that "the GDMS is generally not susceptible to faking, a concern when using self-report measures" (p. 904). It will

be useful in future studies to continue exploring the possibility of faking, or susceptibility to socially desirable responses, but the purposes and scope of this study did not include such an analysis.

Pretest Influence. Given the results for Hypotheses 4 and 5 and that both intervention and comparison group scores changed significantly from time 1 to time 2, there is a possibility that the pretest influenced participant responses on the posttest. However, in correlating the rank order of the avoidant and spontaneous pretest scores to posttest scores for participants in the comparison group, we found the results practically and statistically insignificant for both measures ($r_s = -.185$, $p = .236$; $r_s = -.088$, $p = .575$). Despite the lack of linear relationship, it seems feasible that taking the pretest could have sensitized participants to the posttest, which may have triggered a socially desirable response. This situation is further plausible if participants in the comparison group happened to communicate with participants in the intervention group. Future studies should attempt to address such possible confounding of data by considering the use of intervention and comparison groups from different organizations, although this strategy would introduce other potential sources of variation.

In short, applied research in the social sciences conducted in complex organizations is filled with potential sources of error. Researchers must therefore constantly struggle with decisions about maximizing the validity of study design, while recognizing that the social context is simply not comparable with controlled research environments available in other disciplines.

Conclusions

This study presents preliminary evidence that scenario planning has an effect on participant decision-making style. More specifically, scenario planning decreased rational decision making and increased intuitive decision making. Scenario planning had no effect on dependent decision making. Scenario planning decreased avoidant decision making (however, the finding is mitigated because the comparison group also experienced a negative effect, albeit not as large as for the intervention group) and, finally, decreased spontaneous decision making (again, the finding is mitigated; the comparison group also experienced a negative effect, albeit not as large as for the intervention group).

The results of this study show that people who rely on rational decision-making styles (the idea that there is one "right" answer) will tend to reduce their reliance on that particular decision-making style as a result of participation in scenario planning. These results support many of the conceptual arguments prevalent in the literature. Scenario planning is thought to promote systems thinking (Schwartz, 1991; Senge, Kleiner, Roberts, Ross, & Smith,

1994), and this study supports these assertions. Further, evidence of participants reducing their reliance on predictive, linear, and logical assumptions in the decision-making process suggests that participants are in fact seeing the situation differently.

Examination of the data presented here reveals that people who tend to rely on rational decision-making styles will tend to shift toward intuitive decision-making styles as a result of participation in scenario planning. An increase in intuitive decision-making style suggests that participants begin to draw more from their history and experience when considering decisions as a result of scenario planning participation. Finally, scenario planning appears to reduce individual reliance on avoidant and spontaneous decision-making styles, but the extent to which we can state this as a generality is very limited. Further study is required. The results confirm the participatory nature of scenario planning and suggest that participants who are not normally engaged in decision-making processes might find a more useful and appealing way to participate in decision-making processes through scenario planning.

Overall, claims that scenario planning produces a shift in participant decision-making styles—particularly that they become more intuitive—is supported by this research. Further, theoretical propositions (such as those by Chermack, 2004, 2005) that decision making is an important component of the scenario planning intervention are also supported by the results of this study. Further research with larger sample sizes, and if possible using random assignment, would lend particularly credible additional data to support or refute the findings of this study.

Finally, as HRD professionals (researchers and practitioners alike) grow in their scenario planning expertise, and thereby their ability to influence, support, and shape organizational strategy, research such as that provided in this study can be used as support for claims that scenario planning can actually change how people make decisions. Further, from a practical perspective, this research sheds light on how those decision-making preferences actually do change during the scenario planning process. In short, this research can be used as a calling card for backing up some of the espoused outcomes of scenario planning, and it also serves as a foundation for further research on how and in what ways decision making changes as a result of participation in scenario planning activities.

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