



Drivers and outcomes of scenario planning: a canonical correlation analysis

Scenario
planning

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Abstract

Purpose – The paper's aim is to report a research study on the mediator and outcome variable sets in scenario planning.

Design/methodology/approach – This is a canonical correlation analysis (CCA)

Findings – Two sets of variables; one as a predictor set that explained a significant amount of variability in the second, or outcome set of variables were found.

Research limitations/implications – The study did not involve random selection or assignment and used perception-based measures.

Practical implications – The findings support scenario planning as a tool to reinforce certain decision styles and learning organization culture.

Originality/value – A critical contribution to scenario planning research, this study brings some order to the variety of variables espoused to be involved in scenario work. Clear outcomes are a learning culture and intuitive/dependent decision styles. The study makes a real contribution to quantitative scenario studies.

Keywords Scenario planning, Strategic learning

Paper type Research paper

Scenario planning is a heavily practiced phenomenon, with a growing body of published conceptual work and research (Ramirez *et al.*, 2008). However, there is inadequate research to make predictions about scenario planning outcomes. A substantial amount of theorizing has been underway, and many authors have promoted various theoretical frameworks that capture important variables in the scenario planning exercise (Bradfield, 2008; Keough and Shanahan, 2008; Phelps *et al.*, 2001; Visser and Chermack, 2009). One particular model has proposed a minimum set of theoretical outcomes of scenario planning, and while some of the proposed relationships have been tested (Chermack, 2004, 2005, 2011), the majority remain to be investigated.

An original scenario planning theory hypothesized a model in which a set of outcomes was mediated by another set of variables (Chermack, 2004, 2005, 2011). The purpose of this research is to evaluate the proposed relationship between these sets of outcomes isolated from scenario planning activity, as it is a purposeful first step in assessing the adequacy of the theorized model. To simplify, this article examines the adequacy of theorized relationships between two sets of scenario planning variables, with one set proposed as drivers and another as outcomes.



Purpose and research question

The purpose of this study was to determine the nature and extent of the relationships between two sets of scenario planning variables. The first set of variables included scenario planning participant communication skills and mental model styles. These were positioned as drivers of scenario planning outcomes because they were hypothesized to explain the outcome variables. The second set of variables included perceptions of learning organization characteristics and decision making styles. These were theorized as the outcome variables. According to foundational scenario planning theory, these sets of variables are related, and the mediator set is positioned as a predictor of the outcome set. In other words, it is hypothesized that participant communication skills and mental model styles can predict participant perceptions of learning organization characteristics and decision making styles. The research question that framed this study was:

RQ1. What is the relationship between two sets of scenario planning variables where set one includes communication skills and mental models, and the other includes decision making and learning organization characteristics?

Linking scenario planning to HRD

De Geus (1988) made a very popular and compelling case for reframing strategy as a learning exercise with scenario planning. His seminal article "Planning as learning" in the *Harvard Business Review* drew attention to the fact that financial modeling as strategic planning had limited utility. Once planning is reframed as a learning process (as in scenario planning), two immediate and logical questions are:

- (1) Who should be involved in the planning/learning exercise?
- (2) Who should facilitate the planning/learning exercise?

Addressing these questions makes the case for linking scenario planning and HRD.

First, when strategic planning is reframed as a learning exercise as in scenario planning, it becomes a change intervention. Much has been written about scenario planning as a change management intervention (Schoemaker, 1992; van der Heijden, 1997, 2005), and even as a culture change intervention (Korte and Chermack 2007). Because organization change is generally not a top-down activity (Burke, 2008; Cummings and Worley, 2008), reframing strategic planning as learning means multiple levels, if not all levels of the organization, must be involved. The HRD skill set with expertise in facilitating learning at multiple levels of the organization is one of few disciplinary content areas that can address the numerous issues raised in a multi-level organization learning effort.

Second, HRD professionals (whom vary by title) have long facilitated individual learning, which has grown to include group, process and organization-wide learning projects (Rummler and Brache 2013; Swanson, 2007; Watkins 1997; McLean, 2008). HRD professionals have expertise in learning intervention design, implementation, delivery, general organization development skills (McLean, 2008), and understanding of adult learning principles to name the foundations (Knowles, Holton and Swanson). Many HRD professionals have substantial careers with specific expertise branching into culture, action research, learning organizations, evaluation, and others. In summary, those with HRD expertise are in unique positions to lead strategy efforts when they are reframed as true learning projects rather than extended budget meetings.

It is also important to acknowledge that scenario planning means different things to different people. In other words, there is no universally agreed on definition of scenario planning. Therefore, to be clear, this article is based on the following definition of scenario planning: “Scenario planning is a process of positing several informed, plausible and imagined alternative future environments in which decisions about the future may be played out, for the purpose of changing current thinking, improving decision making, enhancing human and organization learning and improving performance” (Chermack and Lynham, 2002, p. 376).

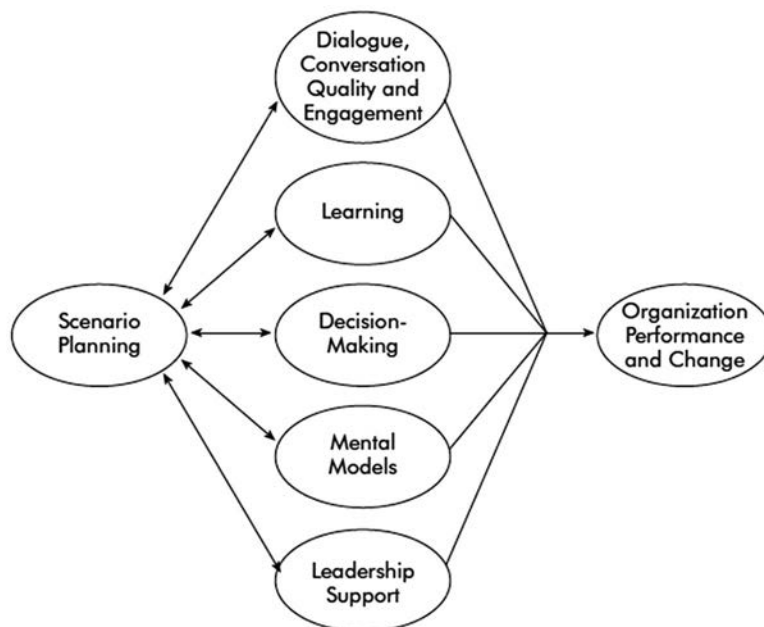
Theoretical framework

A theory of scenario planning (Chermack, 2004, 2005, 2011) sets the theoretical foundation for this study and is presented in Figure 1.

The proposed elements of the theory are based on extensive literature review (Chermack *et al.*, 2001; Chermack and Lynham, 2002; Georgantzas and Acar, 1995; Ringland, 1998; Schwartz, 1991; van der Heijden, 1997, 2005; Wack 1985a, b). These theoretical domains appear repeatedly in the scenario literature. The use of these domains is intended to describe what the phenomenon of scenario planning is and how it works (Torraco, 1997). Each of these outcome domains is briefly described, and the rationale for pairing them, and arguing them as mediator and outcome variables is provided.

Dialogue, conversation, and communication

The specific work that informs how scenario planning involves dialogue and conversation include Rogers communication theory, Nunnally, Miller, and Wackman’s



Source: Chermack (2011)

Figure 1.
A theory of scenario
planning

communication work, Argyris and Schon's work on advocacy and inquiry, and Lewin's theorizing on group dynamics. Each of these is described below and the link to scenario planning is illustrated.

Rogers' work on communication theory

Carl Rogers posited three conditions for health in relating to other people. These are:

- (1) congruence;
- (2) unconditional positive regard; and
- (3) empathetic understanding.

By congruence Rogers meant "a match or fit between an individuals' feelings and outer display" (Rogers, 1957, p. 97). Unconditional positive regard is simply an attitude that Rogers consciously tried to hold toward people and he found that he experienced deeper levels of trust by doing so (Rogers, 1961; Rogers and Skinner, 1956). Rogers' third condition; empathetic understanding is focused on the benefits of listening. A willingness to explore what it is like to be another person is a skill that Rogers found to bring him closer to those he was trying to help (Rogers, 1961).

Miller, Nunnally, and Wackman's work on communication in families

Nunnally developed a large body of work in the area of communication in interpersonal relationships and among family members (Miller, 1971; Miller *et al.*, 1976, 1979; Miller *et al.*, 1982; Nunnally, 1971; Nunnally and Moy, 1989). These collective works help individuals recognize their own sensations, feelings, intentions and actions in the context of how they relate to others (Miller *et al.*, 1979).

Argyris and Schon's work on advocacy and inquiry

Argyris and Schon (1996) are well-known for their scholarship in balancing advocacy and inquiry in organizations. They are most recognized for differentiating Model I and Model II learning loops. The ability to reflect on one's own behavior is a uniquely human trait and constitutes model II learning. Emphasizing common goals, shared interests, and group efforts to achieve them, these understandings contribute to the idea of reflecting on the learning process. This reflection is known as Model II learning, or double loop learning and contributes to the theoretical underpinnings of scenario planning.

Lewin's work on group dynamics

Lewin's famous *t*-groups were a breakthrough in understanding communication among group members (Lewin, 1951). The key contribution arose when researchers allowed a participant to be present for an analysis of her observed behavior earlier in the day (Lewin, 1948). The participant happened to be a woman and she argued directly with Lewin (1951) about his inaccurate interpretations of things she did. Conversation ensued and a new method of intergroup skills training was born. Certainly, group interactions are critical in scenario planning. The importance of sharing insights, perceptions, and ideas will become clear as this book unfolds.

Mental models

Mental models are “important cornerstones for building knowledge and defining some of the cognitive processes that support change and learning” (Allee, 1997, p. 11). Mental models incorporate our biases, values, learning, experiences and beliefs about how the world works. Research has shown that scenario planning can change participant mental models, promoting a more systemic view of organizational dynamics (Glick, Chermack, Luckel and Gauck, 2011).

Not surprisingly, mental models pose significant measurement challenges. Existing approaches to mental model assessment are highly qualitative and involve transcribing interviews, or complex mind-mapping diagrams. However, a quantitative measure was recently developed (Chermack *et al.*, 2011) that theorizes five mental model styles, namely:

- (1) political mental model style;
- (2) financial mental model style;
- (3) efficiency mental model style;
- (4) social mental model style; and
- (5) systems mental model style.

Political mental model style

While not necessarily politically-driven themselves, holders of this style will view others within the organization as politically motivated with hidden agendas. This view can impede broader trust-building within organizations, especially when the political style of management is autocratic, or a do it my way style. A political mental model style may also be difficult to change because of the perception that someone else is in or has control.

Financial mental model style

An individual holding a financial mental model style views financial performance as the most important goal and views the organization as the means to financial stability. The organization is assessed in terms of its financial performance – net income and a strong balance sheet. A financial mental model style may limit an individual’s ability to fully understand the processes that are important to the organization as a system, and may bias individuals against humanistic aspects of organizational life, such as training, or human resources. Furthermore, mental model styles based strictly on financial performance may reflect short-term thinking that may harm the company in the long run.

Efficiency mental model style

An organization focused on efficiency was the basis of classical management theory, including the work of Frederick Taylor (1919). An efficiency organization tends to be a top-down, management by objective, and a mechanistic system made up of goals and objectives (Morgan, 1997). The emphasis is on the organization as a rational system, operating as efficiently as possible. An efficiency mental model style is focused on simplicity and getting the job done in the most straight-forward means possible. This “no-frills” view of the organization emphasizes cost-cutting, doing things quickly, and doing more with less (Cummings and Worley, 2008).

Social mental model style

“The collaborative spirit of a village or commune often pervades work experience, and there is considerable emphasis on interdependence, shared concerns, and mutual help” (Morgan, 1997, p. 122). An individual with a social mental model style views their organization as a hub of social and networking activity, based on the organization’s culture. Relationships, team building, and other group activities are core to the social style. A sense of belonging and connectedness is extremely important to an individual with a social mental model style.

Systems mental model style

Within a systems-based organization the ability to learn and change may be based on the idea of double-loop learning. This learning depends on an individual’s ability to frame and then reframe, or to change the way in which you think about or view a concept or idea (Senge, 1990; Swanson and Holton, 2009). This learning requires the abilities of employees to understand “the paradigms, metaphors, mind-sets, or mental models that underpin how the organization operates” (Morgan, 1997, p. 92). Most critical is the ability to change ones’ mental model in order to view the future of an organization through a new lens (Morgan, 1997).

Rationale for pairing the drivers of scenario planning outcomes

The basis of scenario planning is in dialogue and conversation about strategic issues decision makers are facing (Chermack, 2011; Georgantzias and Acar, 1995; Schwartz, 1991; van der Heijden, 1997, 2005; Wack, 1985a). Most authors agree that successful cases of scenario planning feature serious commitment of time and energy to the project (Chermack, 2011; Georgantzias and Acar, 1995; Schwartz, 1991; van der Heijden, 1997, 2005; Wack, 1985a), and it is the time dedicated to conversations and exploring organizational issues that yields results. Many authors argue that this is the primary reason why scenario planning cannot be facilitated via current technological methods – many subtle aspects of a live, interactive conversation are lost on video chat meetings, such as body language, side bar conversations, interruptions, and other nuances of human communication (Chermack, 2011; Georgantzias and Acar, 1995; Schwartz, 1991; van der Heijden, 1997, 2005; Wack, 1985a). While these may be viewed as distractors to conversations, they certainly carry meaning, and sorting out the meaning of these communication subtleties is absolutely critical to the purpose of the conversation: changing mental models.

Many authors and management scholars have argued that strategy is an issue of perception (Mintzberg, 2005; Schoemaker, 1992; Schwartz, 1997). When considering the importance of perceptions, it is easy to see the importance of anticipating what a competitor will do, or for that matter, even another business unit within the same organization. Mental models have been established as the ultimate heuristic for making decisions and taking action because they are based on individual experiences. Mental models are not easily changed, and it may require powerful learning experiences, “aha” moments, or other kinds of transformational interactions to accomplish a shift in mental models and embedded belief systems.

Communicating with others, understanding different ways of perceiving the same situation has been shown as one such learning experience (Chermack, 2011), and the theory of scenario planning, as well as the logic for pairing conversation skills and

mental models as antecedent scenario planning outcomes is based on a simple idea that having conversations changes participants mental models of the situation at hand.

Learning organization characteristics

“Although people initiate change on their own as a result of their learning, organizations must create facilitative structures to support and capture learning in order to move toward their missions” (Yang *et al.*, 2004, p. 41). This study builds on that knowledge and uses the same logic to continue the use of the DLOQ, which has been rigorously tested for validity and reliability, as one measure of scenario planning effectiveness (Yang *et al.*, 2004; Marsick and Watkins, 1999).

The seven dimensions of learning organization characteristics

The DLOQ measures characteristics of learning organizations on seven dimensions:

- (1) continuous learning;
- (2) dialogue and inquiry;
- (3) collaboration and team learning;
- (4) embedded systems;
- (5) empowerment;
- (6) system connections; and
- (7) leadership.

Continuous learning refers to opportunities for growth that are provided through the job, such as on-going education. Dialogue and inquiry refers to the extent to which the organization supports employees to express their views whether they be questioning, giving feedback or experimenting. A learning organization encourages collaboration and team learning by creating work expectations and culture around learning together. Embedded systems refer to both high and low technological systems that are integrated into work and allow employees to share learning. Empowerment refers to the perception that employees are involved in setting the agenda, take ownership in decision making and are accountable to the collective vision. System connections refer to the respondent’s perception of how well employees see the impact of their contributions as well as how well the organization incorporates outside views. Lastly, leadership refers to how the respondent feels the organization rewards people who use learning strategically for business results.

The DLOQ evaluates how effective the organization is at providing the resources for individuals to acquire knowledge, at providing a safe space for individuals to share knowledge, and at providing avenues for the dissemination of knowledge through individual organization members.

Decision making

Decision making is a complicated phenomenon to study. Psychologists tend to study particular decision making performance, based on specific tests. These are measurements of single tasks and instances of decision making. While these tests are useful, they do not easily translate to the variety of decisions that are required in business organizations.

To tackle this issue, Scott and Bruce (1994) developed a measure of decision making style. Their research identified five decision making styles. These were:

- (1) Rational decision making style “characterized by a thorough search for and logical evaluation of alternatives” (Scott and Bruce, 1994, 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” (Scott and Bruce, 1994, p. 823).
- (3) Dependent decision making style “characterized by a search for advice and direction from others” (Scott and Bruce, 1994, p. 820).
- (4) Avoidant decision making style “characterized by attempts to avoid decision making” (Scott and Bruce, 1994, p. 820).
- (5) Spontaneous decision making style characterized by “a sense of immediacy and a desire to get through the decision making process as soon as possible (Scott and Bruce, 1994, p. 823).

Rational decision making style

Rational decision making is the cornerstone of MBA education, and focuses on breaking issues into component pieces (Mintzberg, 2005). Rational decision makers also usually attempt to establish a procedure for choosing options that can be applied and re-applied to any situation and generally assume that available information is accurate and reliable (Mintzberg, 2005). An underlying assumption here is 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 non-political environment. “It is suggested that the rational decision maker’s focus on logic, order and systematic analysis limits the boundaries on problem formulation” (Scott and Bruce, 1994, p. 823).

Intuitive decision making style

Intuitive decision making style is characterized by individual efforts based on data-based hunches. 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). Intuitive decision makers are reflective and are concerned with patterns while incorporating emotional biases into their processing of the decision situation (MacCrimmon and Wehrung, 1990).

Dependent decision making style

Dependent decision making is characterized by a need for the aid of other people in the decision situation. Some individuals prefer to seek the council of others and often struggle to a point of paralysis without the available council of trusted colleagues (McKenney and 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 and Bruce, 1994, p. 822).

Avoidant decision making style

Avoidant decision makers simply do not 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 and Bruce, 1994, p. 822). The fourth hypothesis for this study was as follows.

Spontaneous decision making style

Spontaneous decision making style emerged as a fifth category during factor analysis procedures in Scott and Bruce’s research. This approach to decision making was identified as “missing from the literature” (Scott and Bruce, 1994), 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, p. 832) observed that: “a spontaneous decision maker has a sense of immediacy” and is usually impatient with the decision making process. Data were strong enough to identify this as a discrete approach to decision making.

Rationale for pairing outcomes of scenario planning

A fundamental assumption of the scenario literature, and the theory proposed (Chermack, 2011) is that if organization members come to believe that their organization leaders truly support learning and development, provide opportunities for growth, and continuously monitor the internal and external environments, they will shift their decision styles (Chermack, 2011; Georgantzis and Acar, 1995; Schwartz, 1991; van der Heijden, 1997, 2005; Wack, 1985a). In other words, the perception of a supporting learning environment can drive decision making patterns that ultimately reinforce the learning organization characteristics (Chermack, 2011; Schwartz, 1991; van der Heijden, 2005; Wack, 1985a).

The theory of scenario planning (see Figure 1) is built on the assumption and hypothesis that influencing the ways in which individuals regard their organizations is a key path to influencing how they make decisions. In other words, the entire discipline of organization culture is formulated on an assumption that individuals must first be able to re-perceive their organizations in order to make the behavioral changes necessary to constitute genuine and sustained change, no matter what the basis, or content of the change may involve.

It is further theorized that through conversation, communication, and dialogue, mental models can be changed. In the context of scenario planning, the major purposes of changing mental models can be seen as opening up perceptions, transitioning toward a learning organization, and as a result, decisions can encompass a wider range of thought. In other words, decisions are based on a more full understanding of the implications, both internal and external to the organizations. This chain of influence (that conversation drives mental model change, which in turn moves the organization toward open learning, and therefore, different, more inclusive decision making) is conceptualized at length in many scenario writings (Chermack, 2011; Georgantzis and Acar, 1995; Schwartz, 1991; van der Heijden, 1997, 2005, Wack, 1985a). However, it was not clearly articulated until a theory of scenario planning was published, and certainly has not yet been empirically investigated. The proposed model sets up communication

Summary

The theoretical framework established here has briefly reviewed and summarized the relevant theories that are the foundation of this research study. In other words, the logic has been clarified that establishes the relationships between these two sets of variables. Indeed, there are several variables and sub-constructs at play in this study and to simplify, the goal of the research is simply to determine what specific relationships exist within two sets of scenario planning variables. The first set of variables can be thought of as drivers of the second set of variables, which we have described as outcomes. Our theoretical framework has provided the necessary and relevant background material to understand the research design and analysis.

Method

The following sections describe the participant sample, instruments and analyses used to answer the research question.

Sample

The sample for this study comes from a data set collected as part of an ongoing process of scenario planning evaluation. Pretest data from a total of 129 employees from eight organizations were used. Demographic data were collected for all but 32.56 percent of the sample. Over half of the employees that provided demographic data indicated that they worked for a for-profit organization (55.2 percent), were female (64.4 percent), and worked in the western region of the US (60.9 percent). See Table I for additional demographic data.

Instruments

Each of the instruments used for measuring the constructs examined in this research require further elaboration. Each instrument is described briefly.

Learning organization characteristics. The 21-item version of the Dimensions of the Learning Organization Questionnaire (DLOQ; Yang *et al.*, 2004) was used to assess employee perceptions of learning organization characteristics. The DLOQ provides seven measures of learning organization characteristics:

- (1) continuous learning;
- (2) dialogue and inquiry;
- (3) team learning;
- (4) empowerment;
- (5) system connection;
- (6) embedded system; and
- (7) leadership development.

Items were self-rated on a five-point Likert type scale with response categories ranging from “never” to “always”.

Demographic	Percentage
Male	35.6
<i>Position</i>	
Line worker	18.3
Middle manager	36.8
Senior manager	27.6
Executive	17.2
<i>Years with organization</i>	
0-2	40.2
3-5	28.7
6-10	18.4
> 10	12.6
<i>Geographic region</i>	
Northeast	18.3
Midwest	4.6
South	16.1
West	60.9
<i>Type of organization</i>	
For profit	56.3
Non profit	36.8
Private	1.1
<i>Annual revenue of organization</i>	
1-10 million	35.6
11-50 million	31.0
51-500 million	27.6
> 500 million	5.7
<i>Number of employees in organization</i>	
< 100	28.7
100-500	33.3
501-1,000	29.9
> 1,000	8.0

Table I.
Demographic data
reported

Decision making styles. The General Decision Making Style Survey (GDMS; Scott and Bruce, 1994) was used to assess decision making styles. The GDMS is a 25 item survey that provides five measures of decision making style tendencies:

- (1) avoidant;
- (2) dependent;
- (3) intuitive;
- (4) rational; and
- (5) spontaneous.

Items were self-rated on a five-point Likert type scale with response categories ranging from *never* to *always*.

Conversation quality and engagement skills. The Conversation Quality and Engagement Checklist (CQEC) was used to assess participant communication skills.

The instrument contains 20 items which were divided into two groups. The first ten items were designed to measure Type 1 skills, or individual conversation patterns and skills, and the second ten items were to measure Type 2 skills, or the ways in which individuals communicate with others. Items were self-rated on a five-point Likert type scale with response categories ranging from “never” to “always”.

Mental model styles. The Mental Model Style Survey (MMSS; Chermack *et al.*, 2011) was used to assess mental model styles. The MMS is a 25 item survey that provides five measures of mental model styles:

- (1) efficiency;
- (2) financial;
- (3) political;
- (4) social; and
- (5) system.

Items were self-rated on a five-point Likert type scale with response categories ranging from “never” to “always”.

Analyses

To determine the degree to which communication skills and mental model styles explained variance in learning organization characteristics and decision making styles, a canonical correlation analysis (CCA) was conducted. Canonical correlation analysis (CCA) is a multivariate method (Thompson, 1984) that explores the relationships between two variable sets, where each set contains variables that are theoretically linked (Nimon and Reio, 2011). It is generally considered a more appropriate technique than separately regressing multiple dependent variables on the same set of independent variables (Thompson, 1984). Not only does CCA avoid the inflation of Type I error rate associated with conducting several multiple regressions, CCA honors the ecological validity of research that considers multiple outcomes and causes (Thompson, 2000). CCA is the standard data analysis approach when attempting to understand and analyze relationships across two different, but potentially related sets of variables.

Proper inferences regarding statistical significance tests resulting from CCA depend on multivariate normality (Tabachnick and Fidell, 2011). For this study, multivariate normality was assessed by plotting Mahalanobis D^2 against chi-square in keeping with Thompson (1990). The resulting plot revealed an approximately linear relationship with only small departures from multivariate normality. The data were considered sufficiently multivariate normal to proceed (see Bray and Maxwell, 1985).

The canonical model tested consistent of six dependent variables and seven independent variables. The independent variable set consisted of two measures of communication skill (i.e. level 1 and level 2) and five mental model style measures (i.e. efficiency, financial, political, social, and systems). The dependent variable set consisted of an aggregated measure of learning organization perceptions and five decision making style measures (i.e. avoidant, dependent, intuitive, rational, and spontaneous). Rather than including disaggregated measures of learning organization perceptions (e.g. continuous learning, team learning), we aggregated the 7 dimensions of the DLOQ to form an overall perception of learning organization characteristics. We

preferred a more parsimonious model, because as noted by Thompson (2006, p. 419), “true findings are more likely to replicate” and a “more parsimonious explanation is more likely to be true”.

Results were interpreted using squared canonical correlations (R_c^2), standardized function and structure coefficients as in Sherry and Henson (2004). Additionally, canonical commonality analysis (Thompson and Miller, 1985) was employed to more fully interpret noteworthy canonical effects. As indicated in Nimon *et al.* (2010, p. 719), “canonical commonality analysis provides a level of interpretation of canonical effects that cannot be revealed by only examining function and structure coefficients”. Readers unfamiliar with canonical correlation or canonical commonality are respectively referred to Sherry and Henson (2000) and Nimon and Reio (2011).

Results

Table II presents the descriptive statistics of the study’s measures. All of the study’s measures resulted in coefficients alphas that exceeded 0.70 with most of the measures exceeding 0.80. In the case of the dependent decision making style, one item was deleted in order to achieve an adequate level of reliability (see Henson, 2001).

The canonical model that resulted from simultaneously regressing perceptions of learning characteristics and mental mode styles on communication skills and decision making styles yielded six canonical functions with R_c^2 s of 0.632, 0.514, 0.171, 0.117, 0.061, and 0.002 for each successive function. Collectively, the full model across all functions was statistically significant using the Wilk’s $\lambda = 0.1228$ criterion, $F(42, 547.54) = 7.35$, $p < 0.001$. “Because Wilk’s λ represents the variance unexplained by the model, $1 - \lambda$ yields the full model effect size in an r^2 metric” (Sherry and Henson, 2005, p. 48). Across the set of six canonical functions, the r^2 type effect size was 0.8772, which indicates that the full model identified 87.72 percent of shared variance between the two variable sets.

Functions 1 and 2 accounted for almost all of the variance explained (i.e. 72.02 percent + 21.57 percent = 93.59 percent) and respectively explained 63.17 percent and 18.92 percent of the original observed variance across the variable sets. The remaining functions only accounted for 6.41 percent of the variance explained and respectively explained 3.06 percent, 1.74 percent, 0.80 percent, and 0.03 percent of the original observed variance across the variable sets. Therefore, only the canonical results for the first two functions were considered noteworthy for further interpretation.

Table III presents the standardized canonical function coefficients, structure coefficients (r_s), squared structure coefficients (r_s^2), and commularity coefficients (h^2) for Functions 1 and 2, in keeping with Sherry and Henson (2005)’s recommendations. Table I also presents the unique and common effects for each variable as suggested by Nimon and Reio (2011).

Unique and common effects are metrics that result from conducting a canonical commonality analysis. Unique effects represent the amount of variance in a given canonical variate that is unique to an observed variable from the other canonical set and common effects identify the amount of variance in a given canonical variate that is common to groups of observed variables from the other canonical set (Nimon *et al.*, 2010). Note that summing the unique and common effects for a given variable (i.e. Total) yield the r^2 between the variable and its canonical variate, and therefore can be used to compute squared structure coefficients (i.e. $r_s^2 = \text{Unique} + \text{Common} / R_c^2$).

Table II.
Descriptive statistics for
study measures

Measure	M	SD	1	2	3	4	5	6	7	8	9	10	11	12	13
Learning	3.84	0.71	0.89												
Avoidant	1.77	0.65	-0.02	0.89											
Dependent	2.75	0.73	0.27	0.09	0.75										
Intuitive	2.86	0.88	0.36	-0.09	0.39	0.89									
Rationale	4.00	0.58	0.24	0.11	0.96	0.40	0.82								
Spontaneous	2.02	0.70	0.23	-0.04	-0.01	-0.14	0.00	0.91							
Level 1	3.49	0.60	0.14	0.45	0.17	0.29	0.20	-0.34	0.88						
Level 2	3.23	0.66	0.28	0.41	0.01	0.09	0.02	0.38	0.31	0.90					
Efficiency	3.26	0.57	0.46	-0.15	0.32	0.51	0.34	0.16	0.10	0.37	0.71				
Financial	3.05	0.83	0.30	0.05	0.30	0.21	0.26	0.10	-0.09	0.06	0.25	0.85			
Political	2.41	0.68	-0.28	-0.08	-0.32	-0.35	-0.32	0.15	-0.30	-0.12	-0.34	0.08	0.81		
Social	2.82	0.75	-0.08	0.48	-0.03	-0.08	-0.06	0.22	0.31	0.48	-0.04	-0.01	0.00	0.84	
Systems	3.53	0.78	0.53	0.05	0.41	0.51	0.38	-0.05	0.34	0.21	0.43	0.30	-0.50	0.11	0.86

Notes: Learning is an aggregated measure of learning organization characteristics. Avoidant, dependent, intuitive, rationale, and spontaneous are types of decision making styles. Level 1 and Level 2 are levels of communication skills. Efficiency, financial, political, social, and systems are types of mental model styles

Variable	Function 1				Function 2							
	Coef. ^c	<i>r_s</i>	<i>r_s²</i> (%)	<i>r_s</i>	Coef. ^c	<i>r_s</i>	<i>r_s²</i> (%)	<i>r_s</i>	C	T	U	<i>h²</i> (%)
Learning organization	0.49	<i>68</i>	46.24	0.12	0.18	0.29	-0.18	-0.41	0.08	0.09	0.01	<i>63.05</i>
Avoidant	-0.28	-0.31	9.61	0.03	0.03	0.06	-0.52	-0.70	0.15	0.25	0.10	<i>58.61</i>
Dependent	0.37	<i>0.63</i>	39.69	0.07	0.18	0.25	0.08	-0.16	0.01	0.01	0.00	<i>42.25</i>
Intuitive	0.40	<i>0.77</i>	59.29	0.07	0.30	0.37	-0.16	-0.20	0.01	0.02	0.01	<i>63.29</i>
Rationale	-0.25	-0.16	2.56	0.03	-0.01	0.02	-0.59	-0.42	-0.05	0.09	0.14	<i>20.20</i>
Spontaneous	-0.07	0.13	1.69	0.00	0.01	0.01	-0.49	-0.58	0.10	0.18	0.08	<i>35.33</i>
<i>R_c</i>			63.18					51.37				
Level 1	-0.26	-0.07	0.49	0.02	-0.02	0.00	-0.73	-0.91	0.26	0.43	0.17	<i>83.30</i>
Level 2	0.40	<i>0.69</i>	47.61	0.06	0.24	0.30	0.14	-0.28	0.04	0.04	0.00	<i>55.45</i>
Efficiency	0.06	0.40	16.00	0.00	0.10	0.10	-0.07	-0.15	0.01	0.01	0.00	<i>18.25</i>
Financial	-0.02	-0.49	24.01	0.00	0.15	0.15	0.10	0.25	0.03	0.03	0.00	<i>30.26</i>
Political	-0.30	-0.37	13.69	0.04	0.05	0.09	-0.32	-0.71	0.22	0.26	0.04	<i>64.10</i>
Social	0.47	<i>0.75</i>	56.25	0.08	0.28	0.36	-0.20	-0.43	0.08	0.09	0.02	<i>74.74</i>
System	0.30	<i>0.70</i>	54.14	0.03	0.28	0.31	-0.05	-0.38	0.08	0.08	0.00	<i>68.58</i>

Notes: Structure coefficients (*r_s*) greater than |0.45| are italicized. Communality coefficients (*h²*) greater than 45 percent are italicized. Coef = standardized canonical function coefficient; Rc = canonical correlation coefficient; rs2 = squared structure coefficient = Total/R2c; U = variable's unique effect. C = Σvariable's common effects. T = Unique + Common = r2variable, othervariate.

Table III. Canonical solution for communication skills and mental model styles explaining perceptions of learning organization characteristics and decision making styles for Functions 1 and 2

Function 1

This section describes the results of analysis for Function 1 for the research study. This Function positioned communication skills and mental model styles as drivers of learning organization characteristics and decision making styles. The primary relationships of the analysis in terms of variance explained are highlighted.

Criterion set: perceptions of learning organization characteristics and decision making styles. The relevant criterion variables for Function 1 were primarily “learning organization”, “dependent”, and “intuitive”. Most of the variance in the criterion variate was explained by “intuitive” (59.29 percent), followed by “learning organization” (46.24 percent), and “dependent” (39.69 percent). The standardized canonical function coefficients indicate that the largest contributions to the criterion canonical equation were respectively made by “learning organization” (0.49), “intuitive” (0.40), and “dependent” (0.37). Although “learning organization” shared less total variance with the criterion canonical variate than “intuitive, learning organization”’s contribution to the canonical equation was higher because it contributed more unique variance than “intuitive” (0.12 vs 0.07).

Predictor set: communication skills and mental model styles. The relevant predictor variables for Function 1 were primarily “level 2”, “efficiency”, “financial”, “social”, and “system”. Most of the variance in the predictor variate was explained by *social* (56.25 percent), followed by “system” (54.14 percent), “level 2” (47.51 percent), “financial” (24.01 percent), and “efficiency” (16.00 percent). The standardized canonical function coefficients indicate that the largest contributions to the predictor canonical equation were respectively made by “social” (0.47), “level 2” (0.40), and “system” (0.30). Although level 2 shared less total variance with the predictor canonical variate than systems, level 2’s contribution to the canonical equation was higher because it contributed more unique variance than “system” (0.06 vs 0.03). Note that despite “financial” and “efficiency” sharing a substantial amount of variance with the predictor canonical variate, their contributions to the regression equation were attenuated as they contributed virtually no unique variance to the predictor canonical variate.

Function 2

This section describes the results of analysis for Function 2 for the research study. This Function also positioned communication skills and mental model styles as drivers of learning organization characteristics and decision making styles. The secondary relationships of the analysis in terms of variance explained are highlighted.

Criterion set: perceptions of learning organization and decision making styles. The relevant criterion variables for Function 2 were primarily “avoidant”, “rationale”, and “spontaneous”. Most of the variance in the criterion variate was explained by “avoidant” (49.00 percent) followed by “spontaneous” (33.64 percent) and “rationale” (17.64 percent). The standardized canonical function coefficients indicate that the largest contributions to the criterion canonical equation were respectively made by “rationale” (−0.59), “avoidant” (−0.52), and “spontaneous” (−0.49). Although “rationale” shared less total variance with the criterion canonical variate than “avoidant” and “spontaneous”, “rationale”’s, contribution to the canonical equation was higher because it contributed more unique variance than “avoidant” and “spontaneous” (0.14 vs 0.10 vs 0.08).

Predictor set: communication skills and mental model styles. The relevant predictor variables for Function 2 were primarily “level 1” and “political”. Most of the variance in

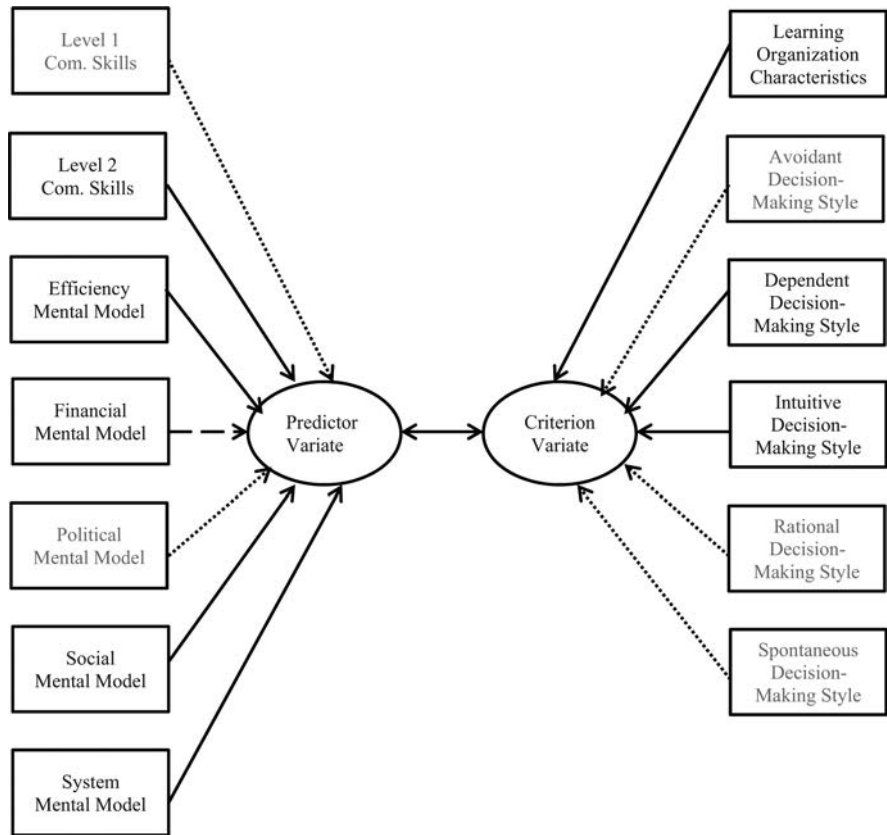
the predictor variate was explained by “level 1” (82.81 percent), followed by “political” (50.41 percent). The order of magnitude of the standardized canonical function coefficients was congruent with the order of magnitude of the structure coefficients. The standardized canonical function coefficients indicates that the largest contributions to the predictor canonical equation were respectively made by “level 1” (−0.91) and “political” (−0.71).

Discussion

Based on the findings of this study, we conclude that how employees communicate and form mental models about the organization explain their perceptions of learning organization characteristics and decision making styles. At a more granular level, we found that employees’ level 2 communication skills and the efficiency, financial, social, and system mental models they form about the organization strongly related to their perceptions of learning organization characteristics and their preference to make decisions based on intuition and input from others (i.e. dependent) (see Figure 1). We also found that employees’ level 1 communication skills and the political mental model they formed about the organization strongly related to their perceived preference to use avoidance, rational, and spontaneous decision making styles (see Figure 2).

The data indicates that if a participant’s interpersonal communication skills, efficiency, financial, social, and system model models can be changed, then their perceptions of learning organization characteristics, and the degree to which they adopt dependent and intuitive decision making styles will also change. Theory supporting this conclusion is prevalent throughout the organizational learning (Chermack, 2011; Georgantzias and Acar, 1995; Schwartz, 1991; van der Heijden, 1997, 2005, Wack, 1985a), organizational culture (Schein, 2010), and scenario planning literatures (Schwartz, 1991; van der Heijden, 1997, 2005). For example, Schein has found repeatedly that perceptions of the organization tend to influence an individuals’ tendency to buy-in to the organizational culture or not (Schein, 2010). Overall, we may interpret the findings in Function 1 to suggest that the model found in Figure 1 tends to reinforce a humanistic, team-driven, collaborative, learning approach to organizational activity. Interestingly, the data showed that the relationship between financial mental model and learning organization and dependent and intuitive decision making styles is a negative one. That is, according to the data, the stronger the financial mental model, the weaker the perceptions of learning organization characteristics, dependent, and intuitive decision making styles will tend to be.

The model found in Function 2 clarifies that individual communication skills and political mental models can explain the tendency to use avoidant, rational, and spontaneous decision making styles. In other words, the data indicates that if an individuals’ personal communication skills and political mental model can be changed, it will affect the degree to which they adopt avoidant, rational, or spontaneous decision making styles (see Figure 3). Theory and existing research supporting this finding are found in traditional approaches to hierarchical management. For example, Taylor’s (1919) scientific management is a classic example of a management style that reflects the characteristics found in Function 2. MBA curriculum is another more modern version of the analytic, reductionist approach that is prevalent in today’s organizations, and highly criticized (Bennis and O’Toole, 2005; Ghoshal, 2005; Kuchinke, 2007). Function 2 reinforces the traditional, mechanistic, individualistic, and analytic

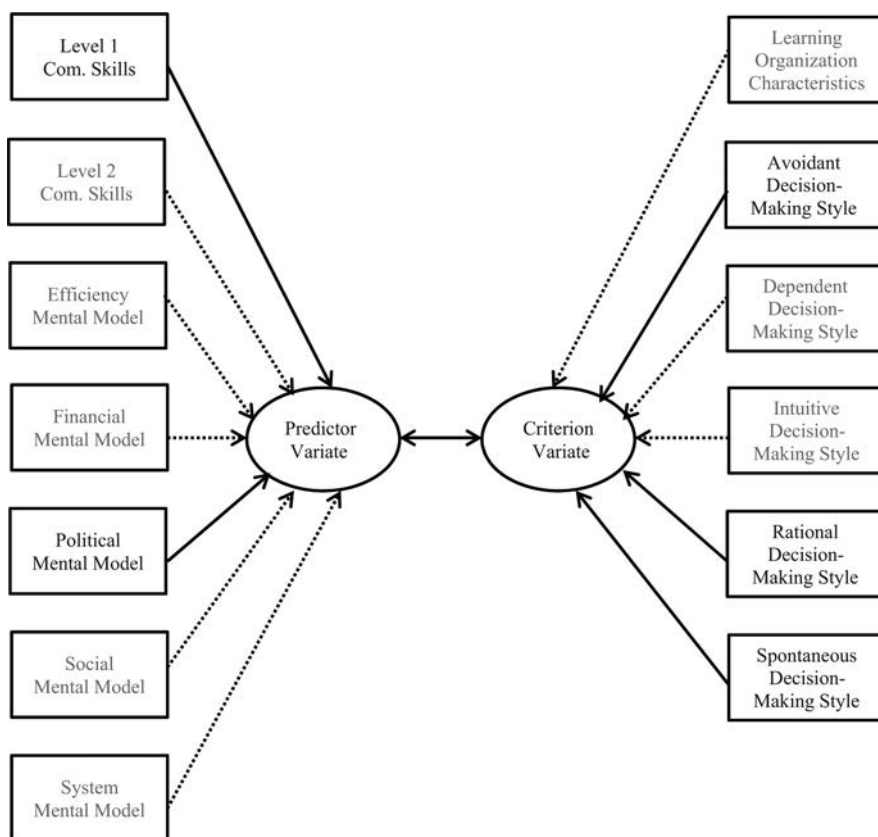


Notes: Solid lines represent relevant positive relationships from observed variables to canonical variate. Dashed line represents relevant negative relationship from observed variable to canonical variate. Dotted lines represent non-relevant relationships from observed variables to canonical variate

Figure 2.
Canoncal Function 1

approach to organizational activity. An important point of reiteration here is the meaning of the term “rational” as a decision making style. “Rational” here does not mean logical, or based on fact, rather the term as a decision making style is intended to indicate the perception that a single “correct” answer exists.

In summary, this research has uncovered two discreet approaches to organizational activity. In the context of HRD, we might call these the HRD-oriented approach, and the MBA-oriented approach. To return to the research question and provide an answer, this study has found two clear sets of relationships between the proposed drivers and outcomes of scenario planning. Data indicate that there are two sets of related constructs embedded in the proposed scenario planning assessment tools. Those sets of constructs have confirmed that the learning organization, dependent decision making, and intuitive decision making tend to be related constructs, and interpersonal communication skills, social mental models, and systems mental models tend to be related constructs. However, these relationships were uncovered by analyzing a data



Notes: Solid lines represent relevant positive relationships from observed variables to canonical variate. Dotted lines represent non-relevant relationships from observed variables to canonical variate

Figure 3.
Canonical Function 2

set without the scenario planning intervention. Therefore the major question that remains is if the scenario planning intervention will reinforce these sets of relationships or alter them in some way.

Implications for HRD theory, research, and practice

This research has implications for HRD theory, research, and practice. Each is described here with intention of outlining further work in all three domains.

Implications for HRD theory

First, this research confirms some aspects of the proposed theory of scenario planning, however, more meaningful evidence will be found when these sets of constructs are tested before and after the scenario intervention. The construct relationships found in this study confirm several long claimed relationships in the scenario planning literature, but evidence has been lacking. There are clear implications for re-considering some aspects of the theory of scenario planning, such as the role of

leadership. For example, certain styles of leadership will clearly be more effective in facilitating dependent group decision making, and those detailed characteristics must be theorized further.

Implications for HRD research

A very clear next step is to test these sets of constructs with pretest and posttest data. Comparing the two data sets would have implications for the role of scenario planning in reinforcing or changing these related constructs. If the relationships change, it would be possible to see how, and in what direction. If they are reinforced, a next step is to understand why. In both situations there is a case for follow-up qualitative research with scenario planning participants to understand the experience, and if, how, and when these constructs may have changed for the individual participants.

Implications for HRD practice

The implications for practice include a potential proposition that scenario planning will reinforce dependent and intuitive decision making, and support learning organization characteristics. Thus, consultants working in scenario planning may have more confidence in scenario planning as a strategic learning tool, because there is accumulating evidence of its effects. However, such confidence is preliminary – to clarify, our research suggests this may be the case, but further evidence is required. Other practical considerations include increasing data-drive awareness that communication skills and dialogue are critical to the scenario planning process, if it is to be considered a learning organization intervention.

Limitations

There are three main limitations to this study. They are:

- (1) no claims of causation;
- (2) common method variance; and
- (3) perception-based measures.

Each is described briefly.

No claims of causation

The data analyzed in this study were collected at the same time with no experimental controls. As such, we can make no claims of causality. While it is clear that employee perceptions of learning organization characteristics and their decision making styles are related to their communication styles and the mental models they form about their organization, we can only use theory to suggest that communication skills and mental models predict learning organization perceptions and decision making styles.

Common method variance

The data analyzed in this study were collected from surveys where participants responded to all survey items in single sitting. As such, common method variance may threaten the validity of the data analyzed (see Burton-Jones, 2009). Although the administration of the surveys followed many of the procedures outlined in Reio (2010), it is possible that collecting data from a single set of sources (i.e. self-reports) with no

time lag between the measurement of the drivers and outcomes led to inflated correlations among the variable sets.

Perception-based measures

This study is working with perception-based data, which is less reliable in general than objective, observable measures of the same constructs. It is unclear whether the relationships found in this research would hold up using objective measures, and that provides clear direction for future research. An immediate next step is to identify the objective measures that indicate the same constructs as the surveys used in this research.

Future research and conclusions

Two clear and immediate future research projects are direct outcomes of this study:

- (1) To identify objective measures of the constructs and attempt to make conclusions about observed behavioral changes, rather than perception changes.
- (2) To determine if scenario planning affects the relationships found in the study.

The first study involving the identification of objective measures of these constructs is more difficult. One promising approach is to use the critical outcome technique to assess whether self-reported changes are also observed by participants' colleagues. Forming a true mixed methods study, the design would obviously involve using the surveys outlined in this article, coupled with interviews of selected participants and their surrounding reports.

The second study would use the same approach as in the present article, but would include a post-test measure after the scenario planning intervention. This design would yield pre- and post- data with which to examine Functions 1 and 2 and if they change over the course of the scenario work.

In summary, this study has specified two clear sets of relationships between proposed drivers and outcomes of scenario planning. The research question sought to contribute a better understanding of these relationships and results have yielded new knowledge for scenario planning researchers and practitioners, as well as two very specific studies on which to build for future research.

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