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Abstract

Scenario-planning academicians and practitioners have been observing for more than three decades the importance of this method in dealing with environmental uncertainty. However, there has been no valid scale that may help organizational leaders to act in practice. Our review of prior studies identifies some problems related to conceptualization, reliability, and validity of this construct. We address these concerns by developing and validating a measure of scenario planning based on Churchill's paradigm (*Journal of Marketing Research*, 1979, *16*, 64–73). Our data analysis follows from a sample of 133 managers operating in the healthcare field in France. To validate our scale, we used three approaches: first, an exploratory factor analysis; second, an examination of psychometric proprieties of all dimensions; and third, a confirmatory factor analysis. The results of this study indicate that scenario planning is a multidimensional construct composed of three dimensions: information acquisition, knowledge dissemination, and scenario development and strategic choices.

KEYWORDS

Churchill paradigm, reliability, scenario planning, validity

1 | INTRODUCTION

Across the literature, there is universal agreement on the importance of introducing scenario planning among firms (Dortland, Voordijk, & Dewulf, 2014; Meissner & Wulf, 2013; Tapinos, 2012; Visser & Chermack, 2009). This concept is a central topic in the strategy literature and is associated with other topics such as learning (Bootz, 2010; Chermack, 2005; Chermack & Van der Merwe, 2003; Haeffner, Leone, Coons, & Chermack, 2012), innovation (De Smedt, Borch, & Fuller, 2013; Worthington, Collins, & Hitt, 2009), biases and decision quality (Meissner & Wulf, 2013), and changing organizational culture (Korte & Chermack, 2007). Furthermore, scenario planning has generally been found to positively impact performance (Phelps, Chan, & Kapsalis, 2001; Visser & Chermack, 2009).

Despite this increasing emphasis on the benefits of scenario planning for organizations, the inadequacy of theory development hinders managers from acting in practice. Several authors conclude that inattention to construct measurement is a major obstacle to the advancement of scenario planning in practice (Chermack, 2005; Hodgkinson & Healey, 2008; Tapinos, 2013). There is still much debate over exactly what constitutes the concept of scenario planning. An integrative and comprehensive measurement of the concept is still a long way from crystallizing (Chermack, 2005; Tapinos, 2013). In examining the scenario-planning literature, we found only one study that attempted to describe the proposed theory using Dubin's methodology (Chermak, 2005). Despite the importance of that study's conclusions, additional studies are certainly needed to address this gap.

Furthermore, a principal criticism of the scenario-planning literature is that researchers devote more effort to analyzing scenario planning's effects on other variables than to conceptualizing and measuring the concept. In fact, there is a significant lack of operationalization. There are two main causes of this problem. The first is that researchers choose to focus on the different methodologies of scenario planning (Amer, Daim, & Jetter, 2013; Bradfield, Wright, Burt, Cairns, & Van Der Heijden, 2005). The second is that researchers examine relationships among variables that may constitute the concept instead of examining the definitions of the variables themselves (Chermack, 2005).

Based on Churchill's paradigm (1979), our objective is to address these limitations by developing a valid scale of scenario planning. To this end, we provide the theoretical background and the principal operationalization of the concept and follow this with an in-depth presentation of the steps used to develop and validate the scale and the assessment of psychometric proprieties.

In summary, this work is designed to contribute to the scenario-planning literature in different ways. First, the development and the validation of a measurement of scenario planning both enable us to illustrate the ambiguity of the concept. Second, we demonstrate the complete process of the validation of the scale and the definition of its dimensions. Finally, this study responds to the recommendations of researchers who have called for additional studies to better understand scenario-planning theory (Chermack, 2005; Tapinos, 2013).

This paper is structured as follows. The first section presents the conceptual background and the item generation process. The second section outlines the processes of data collection, scale purification, and dimensionality. The last section offers our principal results and a discussion.

2 | DIMENSIONS OF SCENARIO PLANNING

To develop hypotheses related to the dimensions of scenario planning, we first conducted an extensive review of the conceptual and theoretical literature on scenario planning and strategic foresight (e.g., Bootz, 2010; Bradfield et al., 2005; Bunn & Salo, 1983; Chermack, 2004, 2005; Chermack, Lynham, & Van der Merwe, 2006; Chermack & Van der Merwe, 2003, Chermack, Van der Merwe, & Lynham, 2007; Haeffner et al., 2012; Korte & Chermack, 2007; Malaska, 1985; Malaska, Malmivirta, Meristo, & Hansen, 1984; Phelps et al., 2001; Schoemaker, 1993; Wright, Bradfield, & Cairns, 2013; Wright, Cairns, & Goodwin, 2009). Moreover, we analyzed different approaches to scenario planning, such as intuitive logics, probabilistic modified trends analysis (Bradfield et al., 2005), and the French school of "la prospective" (Godet, 1990). In reviewing these sources, a number of observations can be made, the first of which is the lack of both adequate research on and theoretical development of the scenario-planning concept. This tool has been developed largely by practitioners and, as such, lacks theoretical aspects (Derbyshire, 2016; Goodwin & Wright, 2001). Chermack (2005) comments that the state of theory development is dismal and cannot support the "fast-growing" practice of scenario planning. Bowman (2015) similarly states that "an absence of theoretical belonging has left scenario-based approaches drifting between a multitude of frameworks."

Second, we infer from this review that scenario planning is associated with other theories such as structuration theory (Mackay & Tambeau, 2013), Christensen's theory of disruption and system analysis (Burt, 2007), the social practice theory (Sarpong & Maclean, 2011), and complexity (Derbyshire, 2016; Wilkinson, Kupers, & Mangalagiu, 2013). The other observation is that the literature in this field reveals a large number of scenario development models and approaches. Phadnis, Caplice, Singh, and Sheffi (2014) note that scenario planning encompasses at least three schools of thought, 23 techniques for developing scenarios and 10 approaches to using them.

Furthermore, while indicators of scenario planning have varied widely across approaches, the most cited literature presents scenario planning as a structured and analytical process to create characterization of multiple futures to enable stakeholders to rethink strategic decisions and policies (Bowman, 2015). As such, scenarios are constructed through actors' interpretations of their environment. Sarpong and Maclean (2011) state that scenario planning could be considered as a social practice, where learning from the past, perception of the present, and prediction of the future together enable us to reperceive the organization and its environment. Typically, scenario planning consists of preparatory phase where the purpose is to define a focal issue or decision, to identify key factors and driving forces (Amer et al., 2013); a development phase, where the aim is to construct possible narratives about the future; and a use phase, which consists of the use of scenarios to develop strategies. Moreover, based on the concept of simplixity, Bowman (2015) argues that the complexity of thought combined with the simplicity of action enables us to focus on two aspects of scenario planning: the process and scenario. The former is related to some practices such as sense making, knowledge, and organizational learning. The latter as a result of this process, which that is associated with the development and use of scenarios.

From the organizational theory point of view, scenario planning is also considered to be a learning process. It is heavily influenced by the social interactions between actors and by the culture and the history of the company in terms of planning. According to Chermack and Van der Merwe (2003), this strategic tool has been shown to fulfill the three criteria of organizational learning defined by Senge et al. (1999), which are associated with mapping, challenging, and improving mental models. In addition, scenario planning has also been considered a tool that contributes to learning at two levels: (1) the individual level; and (2) the collective level. At the individual level, scenarios constitute a method of challenging individual mental models and making them more innovative. They offer an efficient source of data that enables individuals to cope with uncertainty and control different situations. At the collective level, scenarios are regarded as tools for strategic conversation that encourage people to discuss relevant aspects of the environment, confront different points of view and align mental models with the external environment (Van der Heijden, 1997, p. 51). The consideration of scenario planning as a form of organizational learning is also based on the analysis of systems and systemic structures (Burt, 2010). This process helps managers to address uncertainty through the recognition and interpretation of external events (Moyer, 1996).

Similarly, Walsh (2005) adopts an evolutionary perspective to emphasize the scenario-planning role in learning. From this perspective, scenario planning is seen as an exploratory learning framework that focuses on how actors process information in order to propose possible responses and strategic options in relation to environment factors. As such, scenario-planning practices involve the identification of issues or drivers of change and the examination of environmental factors in order to reduce the complexity of number of variables and futures. As described by Bowman (2015), one of scenario planning's aims is to simplify the contextual complexities of environment and actors. This aim is achieved through the analysis and creation of narratives in order to reduce epistemic uncertainty to a comprehensive level.

By examining the scenario-planning literature, these practices are related to the preparatory phase (O'Brien & Meadows, 2013). Although this step is described in the literature in various ways, there seems to be agreement regarding its content, which focuses on the identification of key factors and the principal drivers of change (Schoemaker, 1995; Van der Heijden, 1996). O'Brien, Meadows, and Murtland (2007) recommend the use of SWOT analysis to identify the strengths and weaknesses of an organization. The resource-based view may also be used as a framework to evaluate the current and potential resources of the company (Walsh, 2005). This step allows the generation and the development of scenarios. Thus, once trends and uncertainties are identified, scenarios are developed through possible future states (Meissner & Wulf, 2013).

Correspondingly, in explaining the origins of approaches to scenarios, Bradfield et al. (2005) identify two centers: the US center and the French center. They conclude that scenario development is considered a principal component of the scenario-planning process.

Finally, scenario planning is used to support business development and strategic choices. Burt and Van der Heijden (2008) identify three aims of scenario planning: sense making, norm creating, and strategic choice. This method provides an opportunity to enrich "the portfolio of possible strategic initiatives" (Van der Heijden, 2004, p. 158) that leads to the discovery of opportunities in the business environment and to actions. Hines and Bishop (2006) agree that scenario planning offers multiple contingency plans that enable decision makers to cope with uncertainty. In fact, the link between scenario planning and strategy development is approached from two different perspectives. The first approach refers to testing the organization's current strategy under each scenario (Van der Heijden, 2005). The second approach suggests the discovery of new options based on scenario development. It is recommended that frameworks be mobilized and that analytical approaches such as competitor analysis (Hadfield, 1991) and core competences analysis be employed (Van der Heijden, 2005) to generate new options and strategic choices.

3 | METHODOLOGY

3.1 | Sample and procedures

The initial domain specification step is based on the literature review. The items in our scale were generated using studies related to scenario planning (Amer et al., 2013; Bradfield et al., 2005; O'Brien & Meadows, 2013; Schoemaker, 1995) and strategic foresight (Bootz, 2010; Godet, 2000).

Given the diverse perspectives of these dimensions and the multiple definitions of scenario planning, our literature review was completed using a qualitative study with a focus group. The objective of the focus group was to clarify the theoretical construct by exploring the significance of scenario planning for managers and the practices used in their companies to develop this method of planning.

According to the Churchill paradigm (1979), the specification of the construct domain employs a two-step approach: first, the literature search; and second, qualitative studies. This step may include experience surveys, interviews, and focus groups. Thus, to develop better

measures, we conducted a focus group with managers in the healthcare sector in France. Efforts were made to discuss the dimensions of scenario planning. We formed four groups that included both senior and junior managers. For each group, we designated a key informant. His role was to encourage his colleagues to participate in discussions and to collect information. Debates concerned the scenario-planning concept and activities related to this tool in the respective companies.

On the basis of these two stages, we developed 25 items that characterized the dimensions of the scenario-planning construct. All of them were measured via a Likert seven-point scale (1 = completely disagree and 7 = fully agree).

We then sent these items to a panel of 50 researchers who had recognized expertise on scenario-planning topics. Academicians were asked to rate the consistency of each item with the scenario-planning construct and to recommend any additional items that could enrich our scale. Finally, we submitted items with high ratings to our respondents.

Ultimately, 21 items were included in our questionnaire. Each item was measured using a seven-point Likert-typical scale, where 1 represents "totally disagree" and 7 "totally agree." Respondents were asked to rate their firm's emphasis on the following indicators: organizational learning, scenario development, and strategic choices (Table 1).

We randomly chose 981 potential respondents working in the healthcare field. Respondents held key positions in their organizations and had determinant roles in defining strategy and overall decision making. First, the healthcare field is currently confronting radical changes. Organizations are forced to address issues as such competition among healthcare providers, demographic changes, medical and technological developments, and policy changes. The business environment of the healthcare sector has become increasingly competitive and uncertain (Dortland et al., 2014). Consequently, strategic foresight activities—such as scenario planning—have been widely applied in this industry to achieve flexibility and address changes (Blanken, 2008; Rechel, Wright, Edwards, Dowdeswell, & McKee, 2009). Furthermore, the healthcare sector is considered to be a suitable industry segment in which to study strategy issues (Boyd & Reuning-Elliot, 1998).

Respondents were identified using different databases and professional networks. Chief executive officers and

TABLE 1 List of items used to measure scenario planning

SP1	In our organization, we collect and use the information generated during organizational changes
SP2	Employees' interaction and participation to gather information about possible changes are encouraged
SP3	We constantly evaluate the need to adapt to the business environment
SP4	The members of the organization use formal and informal means to find out about the most recent events regarding the market or the environment
SP5	We systematically examine and update our opinion about the business environment
SP6	We explicitly go outside of our organization to seek for new ideas
SP7	New ideas and approaches on work performance are experimented continuously
SP8	There is a consolidated and resourceful R&D policy
SP9	We always acquire knowledge from outside sources
SP10	We acquire knowledge from external sources and our main competitors
SP11	We can quickly distribute knowledge in our firm
SP12	We define the issue of concern and process and we set the scenario timescale
SP13	We determine the driving forces by working first individually and then as a group
SP14	We define results while presenting the two extremes and contradictions
SP 15	We define the impact/uncertainty matrix and determine the key scenario factors
SP16	We scope the scenarios by building the set of broad descriptors for them
SP17	Scenarios developed are internally consistent and plausible
SP18	Developed scenarios make a connection between past events, present and future
SP19	We offer strategic choices based on scenarios developed
SP20	We confront these strategic choices with the different possible futures
SP21	These strategic choices are transferred into an action plan

directors were used as key informants because they have comprehensive knowledge of firms' policies, strategies, and strategic orientations (Weerawardena, O'Cass, & Julian, 2006). To increase the response rate, each respondent received a personal email describing the research and urging him to participate in our study. Each member received a questionnaire titled "scenario planning practice in French companies" with questions related to the practices of scenario planning, such as learning, scenario development, and strategy development.

One month after the first mailing, the questionnaire was re-sent to all respondents to ensure a high response rate. In total, only 136 questionnaires were returned, of which 133 were considered valid, representing a response rate of 13.55% (Table 2). Thus a large proportion of our sample (86.13%) did not return the questionnaire. Among these nonrespondents, the primary reason was that the respondent was not a scenario-planning practitioner; the second reason was related to the characteristics of the organization.

The final sample, therefore, includes managers operating in small and medium-sized companies (77.4%) and large companies (22.6%). Their operations are principally related to the management of nursing homes, specialized clinics, and care and hospitalization in France.

3.2 | Statistical analysis of the scale

The assessment of our measure is based on three steps: an exploratory factor analysis (EFA), a confirmatory factor analysis (CFA), and an examination of the psychometric properties of the measure.

We followed the steps of the exploratory factor analysis (EFA) to create components summarizing the items and to validate the constructs. The use of EFA has two objectives: (1) to test the multidimensionality of the concept; and (2) to purify the questionnaire items that deteriorate the factor structure. Based on the Kaiser rule (1958), it is recommended to select the number of factors for which the eigenvalue is greater than or equal to 1 (Table 2). In fact, according to Churchill (1979), when factor analysis is conducted before the purification steps, there is a tendency to produce more dimensions than those identified by the literature review and qualitative study. This fact is due to the "garbage items which do not have the common core but which produce additional dimensions in the factor analysis."

Table 3 shows the eigenvalues and the proportion of variance explained by the main factors. Thus five factors emerged from the analysis, each with an eigenvalue above one. These values generally represent the total proportion of variance returned by the common factors. These factors explain only 56.876% of total variance. This result confirms that the initial factor structure is not clear. Thus new iterations must be conducted to improve the structural factors and facilitate the interpretation of the factorial axes and treatment of items that affect the quality of the scale (Table 4). The aim is to determinate whether any items need to be dropped from our analysis.

To purify our measurement scale, we used two empirical criteria: we removed the items whose factorial contribution was above 0.4 on several factors and items whose factorial contribution was less than 0.5. Based on these criteria, we dropped items SP12 ("We define the issue of concern and the process, and we set the scenario timescale") and SP16 ("We scope the scenarios by building a set of broad descriptors for them"). A second iteration was performed on the remaining items (removing items SP12 and SP16). Following this step, we removed item SP17 ("Scenarios developed are internally consistent and plausible"). The third iteration was conducted without taking into account item SP17. We dropped items SP13 ("We determine the driving forces by working first individually and then as a group") and SP14 ("We define the cluster outcomes by presenting the two extremes").

A final iteration was conducted with varimax rotation. This iteration procedure was stopped because we had a clear structure. Three factors emerged from this analysis (Table 5).

4 | RELIABILITY AND INTERNAL CONSISTENCY

This analysis is performed for each factor of scenario planning. The aim was to test the homogeneity of the subscales and the ability of a set of items to represent the construct. Therefore, items must correlate and be internally consistent. Reliability is tested through the following criteria: correlation between the item and the

TABLE 2 Survey response

		Frequency	Percent	Valid percent	Cumulative percent
Valid	General managers	101	75.9	75.9	75.9
	Middle managers	27	20.3	20.3	96.2
	Other	5	3.8	3.8	100.0
	Total	133	100.0	100.0	

TABLE 3 Proportion of variance explained

	Initial eigenvalues			Extraction sums of squared loadings		
Factor	Total	% of variance	% cumulative	Total	% of variance	% cumulative
1	6.634	31.590	31.590	6.240	29.716	29.716
2	2.974	14.163	45.753	2.572	12.249	41.965
3	1.868	8.896	54.650	1.484	7.068	49.034
4	1.482	7.055	61.705	1.005	4.787	53.820
5	1.026	4.888	66.592	0.642	3.055	56.876
6	0.905	4.310	70.903			
7	0.833	3.968	74.871			
8	0.727	3.460	78.331			
9	0.642	3.056	81.387			
10	0.581	2.765	84.152			
11	0.516	2.459	86.611			
12	0.473	2.253	88.864			
13	0.436	2.074	90.938			
14	0.359	1.709	92.646			
15	0.314	1.493	94.140			
16	0.271	1.289	95.428			
17	0.255	1.215	96.644			
18	0.227	1.083	97.726			
19	0.183	0.872	98.598			
20	0.155	0.736	99.335			
21	0.140	0.665	100.000			

Note. Extraction method: principal component analysis.

construct; the average correlation between items; and Cronbach's alpha.

Table 6 reports the means, standard deviations, and correlations for all variables, and alphas if the item was deleted. All scores are significant. Furthermore, reliability for information acquisition, knowledge dissemination, scenario development, and strategic choices exceeds the 0.7 recommended by Nunnally (1978) for exploratory research. Thus, with such high values for all indicators, the reliability of the scale is sufficient.

5 | CONSTRUCT VALIDATION

Our theoretical model is based on the three factors that emerged from the exploratory factor analysis (EFA). This structure consists of 15 items divided into three dimensions: information acquisition, knowledge acquisition and dissemination, and development of scenarios and strategic choices. The last step of the analysis consists of confirmatory factor analysis using AMOS 18 software. Validity is tested through the goodness of fit of our model to the collected empirical data ($N = 133$). In fact, we rely on a comparison of five theoretical models (Doll, Xia, & Torkzadeh, 1994). The first model hypothesizes a null model with 15 items uncorrelated and without latent variables. The second model hypothesizes one first-order factor (scenario planning). The third model hypothesizes that the three factors (information acquisition, knowledge dissemination, and scenario development and strategic choices) are uncorrelated. Model four considers that the three factors are correlated with each other. The fifth model hypothesizes three first-order factors and one second-order factor.

This study uses the maximum likelihood (ML) method to describe alternative models and test the fit of each model to the sample data. The goodness-of-fit indexes are summarized in Table 7.

5.1 | Criteria of comparing model–data fit

Our interpretation of results is based on the incremental fit index (i.e., ratio of chi-square to degrees of freedom and normed fit index (NFI)). Furthermore, we used

TABLE 4 Factor matrix

	Factor				
	1	**2**	**3**	**4**	**5**
SP1	0.567				
SP2	0.581				
SP3	0.663				
SP4	0.756				
SP5	0.630				
SP6	0.691				
SP7	0.670				
SP8	0.556				
SP9	0.621				
SP10	0.636				
SP11	0.561				
SP12	**0.473**	**−0.027**	**0.283**	**0.460**	**−0.069**
SP13				0.472	
SP14	0.413				
SP15	0.480				
SP16	**0.399**	**0.361**	**0.164**	**−0.022**	**−0.075**
SP17	0.419				
SP18	0.485	0.654			
SP19	0.405	0.713			
SP20	0.441	0.569			
SP21	0.427	0.603			

Note. Extraction method: principal axis factor analysis. Five factors extracted; seven iterations required.

indexes of goodness of fit such as chi-square, goodness-of-fit index (GFI), root mean square residual (RMSEA), and the comparative fit index (CFI).

The chi-square test reflects the ability of the model to reproduce the sample variance–covariance matrix. It is affected by the sample size and by multivariate normality (Bollen, 1989; Doll et al., 1994). Concerning the GFI and AGFI, scores between 0.8 and 0.89 are considered reasonable; scores higher than 0.9 are associated with a good fit of the model. Scores of RMSEA below 0.05 are considered significant. Based on different indexes, model 4 (three correlated factors) and model 5 (second order) provide a reasonable fit to the data.

In fact, model 4 (correlated factors) shows reasonable fit as indicated by these indexes: $\chi^2 = 263.411$; χ^2/d.f. = 2.608; GFI = 0.801; AGFI = 0.732; NFI = 0.790; CFI = 0.857, RMSEA = 0.11. However, before proceeding with the analysis of the validity and reliability of the factors of this model, we conclude that some changes must be made to improve it (Wolfle & Ethington, 1986). The AMOS software proposes modifications to improve the quality of the model fit. Any change greater than 4 indicates a significant reduction in chi-square value. The additional link estimation should be conditional on a theoretical justification. In our case, we retain the covariance relationship between measurement error e22 <—> e23, e23 <—> e25 and e12 <—> 24. Theses covariance links allow a reduction in the value of chi-square. From a theoretical point of view, this change can be made because the two measurement errors belong to items of the same construct.

Certainly, these covariance links improve the model fit to data but are against reflexive model-building principles. Thus, in the reflexive models, the covariance between the measuring errors must be equal to 0 to determine the convergent validity of a model (Danes & Mann, 1984). To do so, we will remove the items that have a high correlation between their measurement errors (Figure 1).

After verifying the quality adjustment of model 4, we will proceed in the same way to the measurement of model 5 (second order). In fact, the second order model shows a reasonable data fit as indicated by some indexes ($\chi^2 = 263.414$; χ^2/d.f. = 2.582; GFI = 0.801; AGFI = 0.734; NFI = 0.790, CFI = 0.858, RMSEA = 0.109). To improve the model fit to data, we have added links between measurement errors (e21 ↔ 22), (e23 ↔ 25), and (e12 ↔ e24). Then, we removed the items responsible for any deviation to respect the principles of a reflective model, where covariance links should be equal to zero. The results obtained from this purification process are shown in Figure 2.

The results suggest that these two models are satisfactory and fit the data. To decide which model to choose, we use the target coefficient index (TCI). Using the first-order model as the target model, the target coefficient is the ratio of the chi-square of the first order to the square of the second order. In our case, a coefficient of 0.997 indicates that 91% of the three first-order factors is explained by the second-order model (Marsh & Hocevar, 1985). As a result, we consider that the second-order model better fits the data.

5.2 | Reliability and construct validation

Reliability indicates whether all the items of a scale measure the same latent variable. Composite reliability is assessed through the examination of the Rho Jöreskog coefficient (Jöreskog, 1971), where the value must be greater than 0.6 and the average variance extracted (AVE) ≥ 0.5. All measures are found to be significant (Table 8).

Construct validity determines to what extent a measurement behaves in the same way as the target concept (Begoña Lloria & Moreno-Luzon, 2014). Messick (1989)

TABLE 5 Rotated component matrix

	Factor		
	Knowledge dissemination	**Scenario development and strategic choices**	**Information acquisition**
SP1 (SP_INFO1)			**0.653**
SP2 (SP_INFO2)			**0.800**
SP3 (SP_INFO3)			**0.794**
SP4 (SP_INFO4)			**0.642**
SP5 (SP_INFO5)			**0.579**
SP6 (SP_KNOW1)	0.718		
SP7 (SP_KNOW2)	0.759		
SP8 (SP_KNOW3)	0.601		
SP9 (SP_KNOW4)	0.762		
SP10(SP_KNOW5)	0.725		
SP11 (SP_KNOW6)	0.639		
SP15 (SP_SCSTRA1)		0.568	
SP18 (SP_SCSTRA2)		0.803	
SP19 (SP_SCSTRA3)		0.861	
SP20 (SP_SCSTRA4)		0.673	
SP21(SP_SCSTRA5)		0.749	
Eigenvalue	5.894	2.802	1.663
Percentage of variance explained	36.838	17.514	10.395

Note. Extraction method: principal component analysis. Rotation method: varimax with Kaiser normalization (five iterations).

considers construct validity as "as an integrated evaluative judgment of the degree to which empirical evidence and theoretical rationales support the adequacy and appropriateness of inferences and actions based on test scores." It can be verified through convergent validity and discriminant validity. First, convergent validity is verified through the correlation between instruments measuring the same construct. It is recommended to measure the *t*-tests of the factors loading (Anderson & Gerbing, 1988). Table 9 shows the critical ratio (CR) of items. The CR test is greater than 1.96 in all cases and is significant for $p < 0.05$. It is also assessed through the examination of average variance extracted (VME), where values greater than 0.5 are considered as significant (Table 8).

Discriminant validity concerns the relation of each dimension to other concepts. In other words, a confirmation of discriminant validity shows that concepts are unrelated and are not highly correlated with others (Fornell & Larcker, 1981). We assessed this validity by comparing the square root of VME with correlations between latent variables (Table 10).

Furthermore, to validate our scale and to ensure the stability of the model, we use the bootstrap method (Efron & Tibshirani, 1993). Bootstrapping is used to estimate the precision of sample statistics such as regressions, variances, and covariance. Based on the results found after resampling (sample = 2,000), we conclude that the risk of instability of the model is very low. Regression weights, squared multiple correlations, and covariance are significant, with $p < 0.05$ (Table 11).

6 | DISCUSSION

This study represents an initial testing and validation of the scenario-planning scale. The development of such a scale responds to the recommendations of researchers who have called for additional studies to understand the theory and to support its implementation in organizations (Chermack, 2005; Hodgkinson & Healey, 2008; Tapinos, 2013). Existing theoretical and empirical studies confirm a lack of consensus with regard to scenario planning's definition and dimensions. Despite the popularity of this tool, very little work is ultimately interested in the construct and its dimensions. Therefore, its impact on other organizational competencies, such as effectiveness and performance, remains largely hypothetical.

Based on Churchill's paradigm (Churchill, 1979), this paper has attempted to report new insights about the

TABLE 6 Factor analysis outcome for key variables

Variables name and items	Mean	SD	Correlation between item and scale	Alpha if item deleted
Dimension 1: Information acquisition ($\alpha = 0.867$)				
SP_INFO1: In our organization, we collect and use the information generated during organizational changes	4.10	1.592	0.619	0.856
SP_INFO2: Employees' interaction and participation to gather information about possible changes are encouraged	4.51	1.550	0.717	0.831
SP_INFO3: We constantly evaluate the need to adapt to the business environment	4.62	1.511	0.756	0.822
SP_INFO4: Members of the organization use formal and informal means to find out about the most recent events regarding the market or the environment	4.65	1.548	0.719	0.831
SP_INFO5: We systematically examine and update our opinion about the business environment	4.65	1.563	0.638	0.851
Dimension 2: knowledge dissemination ($\alpha = 0.875$)				
SP_KNOW1: We explicitly go outside of our organization to seek for new ideas	4.35	1.567	0.705	0.848
SP_KNOW2: New ideas and approaches on work performance are experimented continuously	4.41	1.399	0.725	0.843
SP_KNOW3: There is a consolidated and resourceful R&D policy	4.31	1.355	0.568	0.867
SP_KNOW4: We always acquire knowledge from outside sources and benchmark competition	4.52	1.357	0.690	0.848
SP_KNOW5: We acquire knowledge from external sources and our main competitors	4.53	1.374	0.662	0.861
SP_KNOW6: We can quickly distribute knowledge in our firm	4.66	1.392	0.614	0.861
Dimension 3: Scenario development and strategic choices ($\alpha = 0.854$)				
SP_SCSTRA1: We define the impact/uncertainty matrix and determine the key scenario factors	4.70	1.155	0.545	0.856
SP_SCSTRA2: Developed scenarios make a connection between past events, present and future	4.80	1.307	0.735	0.807
SP_SCSTRA3: We offer strategic choices based on scenarios developed	5.08	1.204	0.762	0.798
SP_SCSTRA4: We confront the strategic choices with the different possible futures	5.19	1.067	0.618	0.837
SP_SCSTRA5: Strategic choices are transformed into actions	5.29	0.942	0.712	0.818

TABLE 7 Goodness-of-fit indexes for alternative models ($n = 133$)

Model	χ^2	d.f.	(χ^2/d.f.)	p	GFI	AGFI	CFI	TLI	NFI	RMSEA
Null model	1224.704	120	10.206	0.000	0.336	0.248	0.000	0.000	0.000	0.267
One first-order model	647.654	104	6.227	0.000	0.558	0.423	0.508	0.432	0.471	0.201
Three uncorrelated factors	321.201	104	3.088	0.000	0.770	0.700	0.803	0.773	0.738	0.127
Three correlated factors	263.411	101	2.608	0.000	0.801	0.732	0.857	0.830	0.790	0.110
Second-order model	263.414	102	2.582	0.000	0.801	0.734	0.858	0.832	0.790	0.109
Recommended values	—	—	<2	—	>0.9	>0.9	>0.9	>0.9	>0.9	<0.08

measurement of the scenario-planning construct. In the validation process, both the exploratory factor analysis and the confirmatory analysis corroborate the existence of three dimensions of scenario planning. Based on the second-order analysis, scenario planning is considered to be a latent variable under three dimensions: information acquisition, knowledge dissemination, and scenario development and strategic choices. According to our results, the proposed measurement scale of scenario planning has a high level of reliability. Moreover, our confirmatory analysis indicates that convergent and discriminant validity are verified.

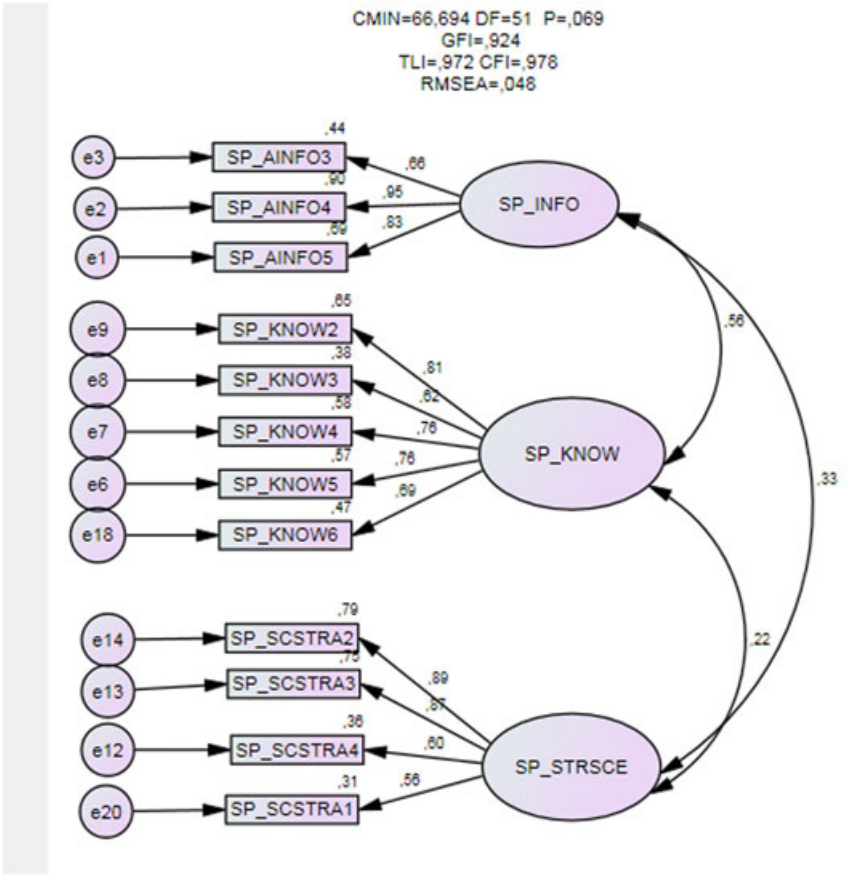

FIGURE 1 Three first-order factors [Colour figure can be viewed at wileyonlinelibrary.com]

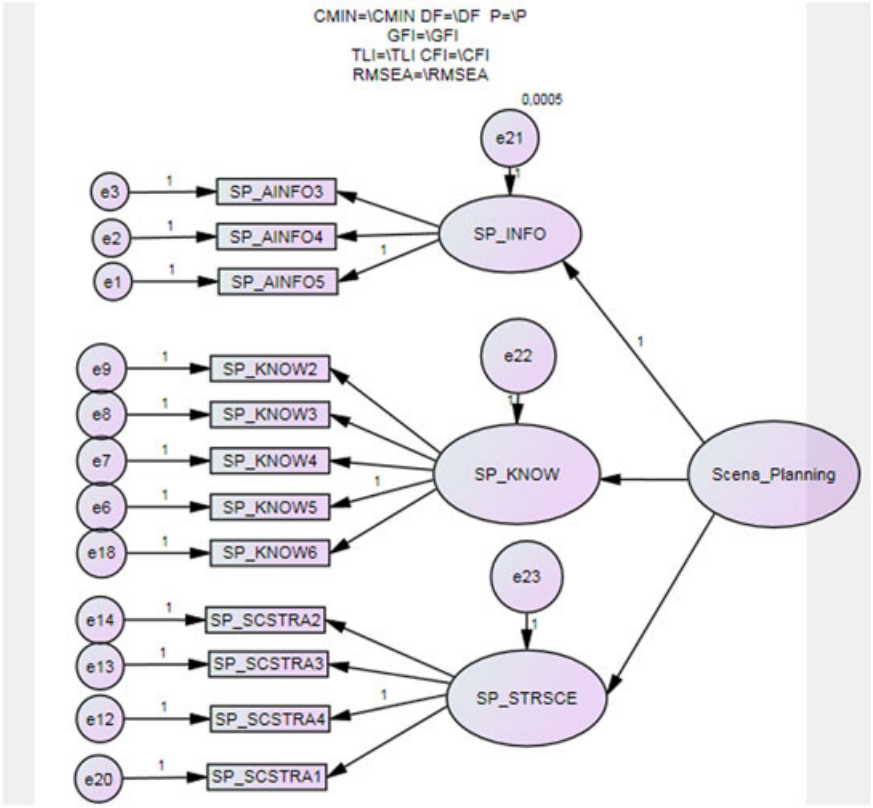

FIGURE 2 Three first-order factors, second-order factor [Colour figure can be viewed at wileyonlinelibrary.com]

TABLE 8 Construct measurement summary: confirmatory factor analysis and scale reliability

Construct	Standardized regression weight	AVE	CR
Dimension 1: Information acquisition		0.5	0.74
(SP_AINFO)			
SP_INFO3—SP_INFO	0.661		
SP_INFO4—SP_INFO	0.947		
SP_INFO5—SP_INFO	0.829		
Dimension 2: knowledge dissemination		0.51	0.83
(SP_KNOW)			
SP_KNOW2—SP_ KNOW	0.807		
SP_KNOW3—SP_ KNOW	0.616		
SP_KNOW4—SP_ KNOW	0.764		
SP_KNOW5—SP_ KNOW	0.758		
SP_KNOW6—SP_ KNOW	0.689		
Dimension 3: Scenario development and strategic choices		0.502	0.79
(SP_SCSTRA)			
SP_SCSTRA2—SP_SCSTRA	0.891		
SP_SCSTRA3—SP_SCSTRA	0.868		
SP_SCSTRA4—SP_SCSTRA	0.604		
SP_SCSTRA1—SP_SCSTRA	0.560		

TABLE 9 Regression weights and critical ratio (CR)

			Estimate	SE	CR	p
SP_INFO	<—	Scenario_planning	1.000			
SP_KNOW	<—	Scenario_planning	0.447	0.080	5.573	***
SP_STRSCE	<—	Scenario_planning	0.164	0.051	3.239	0.001
SP_AINFO5	<—	SP_INFO	1.000			
SP_AINFO4	<—	SP_INFO	1.132	0.099	11.471	***
SP_AINFO3	<—	SP_INFO	0.771	0.093	8.270	***
SP_KNOW5	<—	SP_KNOW	1.000			
SP_KNOW4	<—	SP_KNOW	0.997	0.118	8.474	***
SP_KNOW3	<—	SP_KNOW	0.802	0.118	6.775	***
SP_KNOW2	<—	SP_KNOW	1.084	0.122	8.919	***
SP_SCSTRA4	<—	SP_STRSCE	1.000			
SP_SCSTRA3	<—	SP_STRSCE	1.621	0.222	7.298	***
SP_SCSTRAT2	<—	SP_STRSCE	1.806	0.247	7.326	***
SP_KNOW6	<—	SP_KNOW	0.922	0.121	7.619	***
SP_SCSTRA1	<—	SP_STRSCE	1.002	0.185	5.420	***

The results imply that the first dimension of scenario planning is related to information acquisition. It is composed of items representing the practices implemented within companies in order to develop this practice (Table 12).

This process is based on both internal and external sources. Internally, information can be acquired through institutional routines, the culture of the company, and the experience of direct learning. The latter comes from the internal analysis of the shares of major competitors

TABLE 10 Correlation of constructs

Construct	1	2	3
Information acquisition (SP_INFO)	**0.5**		
Knowledge dissemination (SP_KNOW)	0.308	**0.51**	
Scenario development and strategic choices (SP_SCSTRA)	0.107	0.047	**0.502**

TABLE 11 Bootstrap results

	Parameter			Estimate	Lower	Upper	p
Standardized regression weights	SP_INFO	<—	Planifica_scena	1.000	1.000	1.000	0.001
	SP_KNOW	<—	Planifica_scena	0.557	0.421	0.668	0.001
	SP_STRSCE	<—	Planifica_scena	0.329	0.166	0.472	0.002
	SP_AINFO5	<—	SP_INFO	0.829	0.758	0.881	0.001
	SP_AINFO4	<—	SP_INFO	0.947	0.897	0.997	0.001
	SP_AINFO3	<—	SP_INFO	0.661	0.554	0.748	0.001
	SP_KNOW5	<—	SP_KNOW	0.758	0.663	0.830	0.001
	SP_KNOW4	<—	SP_KNOW	0.764	0.678	0.832	0.001
	SP_KNOW3	<—	SP_KNOW	0.616	0.503	0.714	0.001
	SP_KNOW2	<—	SP_KNOW	0.807	0.725	0.869	0.001
	SP SCSTRA4	<—	SP_STRSCE	0.604	0.487	0.701	0.001
	SP SCSTRA3	<—	SP_STRSCE	0.868	0.806	0.925	0.001
	SP_SCSTRAT2	< —	SP_STRSCE	0.891	0.824	0.943	0.001
	SP_KNOW6	<—	SP_KNOW	0.689	0.585	0.777	0.001
	SP_SCSTRA1	<—	SP_STRSCE	0.560	0.428	0.657	0.002
Squared multiple correlations	SP_STRSCE			0.108	0.028	0.222	0.001
	SP_KNOW			0.310	0.177	0.446	0.001
	SP_INFO			1.000	1.000	1.000	0.001
	S_SCSTRA1			0.313	0.183	0.432	0.002
	SP_KNOW6			0.475	0.343	0.604	0.001
	SP_SCSTRA2			0.794	0.680	0.889	0.001
	SP_SCSTRA3			0.754	0.649	0.855	0.001
	SP_SCSTRA4			0.365	0.237	0.491	0.001
	SP_KNOW2			0.651	0.526	0.755	0.001
	SP_KNOW3			0.380	0.253	0.510	0.001
	SP_KNOW4			0.584	0.459	0.692	0.001
	SP_KNOW5			0.574	0.440	0.668	0.001

TABLE 12 Information acquisition

SP_INFO3	We constantly evaluate the need to adapt to the business environment
SP_INFO4	The members of the organization use formal and informal means to find out about the most recent events regarding the market or the environment
SP_INFO5	We systematically examine and update our opinion about the business environment

(Hershey, 1980; Lawrence, 1984). In other situations, companies are seeking information from external sources to better identify key trends and compare their performance with their market (Dickson, Farris, & Verbeke, 2001). Information acquisition enables an effective scanning of the environment and facilitates the building of alternative futures through which the impact of environmental changes is explored.

The second dimension is oriented toward practices of knowledge dissemination. The results of the research imply that this dimension is composed of five items (Table 13).

Thus scenario planning is a process by which companies develop knowledge. One of the roles of scenario planning is to challenge and renew mental models. In an uncertain environment, mental models provide decision makers with ways to understand complex phenomena (Rohrbeck, 2012; Van der Heijden, 1996). Scenario planning is based on the acquisition, sharing, and interpretation of knowledge that permits us to address changing environments. According to Rhisiart, Miller, and Brooks

TABLE 13 Knowledge dissemination

SP_KNOW2	New ideas and approaches on work performance are experimented continuously
SP_KNOW3	There is a consolidated and resourceful R&D policy
SP_KNOW4	We always acquire knowledge from outside sources and benchmark competition
SP_KNOW5	We acquire knowledge from external sources and our main competitors
SP_KNOW6	We can quickly distribute knowledge in our firm

(2015), scenario planning is situated in discourses of strategy, learning, and the understanding of knowledge. It relies on the collective experiences used to acquire knowledge and develop skills. This process is supported by internal communication between actors and the relationship of the company with its stakeholders. Thus scenarios offer a chance to develop discussions of the current and future situations of the company and its environment.

Furthermore, Durance and Godet (2010) note that scenarios facilitate the transmission of company objectives at different hierarchical levels. They have an educational role (Bezold, 2010), and they promote the spirit of dialogue between the various stakeholders of the company (Ringland, 2010).

Thus, from a theoretical point of view, the "information acquisition" and "knowledge dissemination" dimensions are related to the preparatory phase of the scenario-planning process (O'Brien & Meadows, 2013; Wright et al., 2013). This step consists of the identification of driving forces and the generation of inputs for scenarios. Based on the intuitive logics methodology, Wright et al. (2013) note that the scenario-planning process integrates a variety of factors that will shape the future. As such, it focuses on the interaction between the predetermined trends, critical uncertainties and actor's behavior. Similarly, Amer et al. (2013) argue that business decisions are the result of a complex set of relationships among economic, political, technological, and social factors. In the information acquisition information stage, internal and external information enable us to clearly understand environment and provide insights to its evolution. Similarly, the prospective approach considers scenario planning as an analysis tool that permits us to scan the environmental factors and provide bases for future actions. This systemic method for thinking considers a variety of determinant factors and the internal and external forces that shape the system's complexity (Peterson, Cumming, & Carpenter, 2003).

Regarding knowledge dissemination, this dimension is related to the educational role of scenario planning. According to Koffman and Senge (1993), this process takes place through formal and informal interactions between actors. An analysis of the scenario-planning literature reveals that this strategic tool is a good instrument of communication between stakeholders, by helping them to understand their environment and the decision-making process (Bootz, 2010). As such, it promotes collective forms of learning through the questioning of individual knowledge. Scenarios focus on teasing on contradictions, challenging assumptions and reperceiving the organization and its environment.

This learning is manifested through collective discussions about the organization and its environment. Docherty and McKiernan (2008) note that, as a process, scenario planning is designed to encourage the management team to share their ideas and assumptions about the changing world. Indeed, this participative process aims at building proactive images of the future that affect managers' mental models (Burt, Mackay, Van de Heijden, & Verheijdt, 2016).

Moreover, these two dimensions are two crucial phases of organizational learning (Kandemir & Hult, 2005; Santos-Vijande, Lopez-Sanchez, & Trespalacios 2012). This organizational competency is achieved through the efforts of an organization when scanning environmental factors and understanding the behavior of competitors and stakeholders. It is also assured via knowledge dissemination, which promotes individual and organizational learning. At the individual level, it can improve the cognitive ability to anticipate (Bootz, 2010). Collectively, it plays an educational role for the different actors.

Thus our results support studies that address the role of learning in the scenario-planning process. The work of Chermack (2005) and Chermack, Lynham, and van der Merwe (2006) highlights the role of this planning tool in building learning through the acquisition of information and the management of environmental uncertainty (Tapinos, 2012). Its objective is to challenge mental models and assumptions (Rohrbeck, 2012; Van der Heijden, 1996). Mental models must be renewed in light of the dynamics of environmental conditions (Day & Schoemaker, 2004).

TABLE 14 Scenario development and strategic choices

SP_SCSTRA1	We define the impact/uncertainty matrix and determine the key scenario factors
SP_SCSTRA2	Developed scenarios make a connection between past events, present, and future
SP_SCSTRA3	We offer strategic choices based on scenarios developed
SP_SCSTRA4	We confront the strategic choices with the different possible futures

The third dimension of scenario planning is that of scenario development and strategic choices (Table 14). The items forming this factor are related to the last stages of the intuitive logics method (Bradfield et al., 2005), as well as to those of strategic foresight (Godet, 2000).

Thus the literature has broadly discussed scenario planning's contributions to promoting strategic conversations and developing strategies. According to Burt and Van der Heijden (2008), scenario planning has three main purposes: sense making, norm creating, and strategic choices. Such a framework indicates that strategy is a key component of scenario planning. In fact, the scenario-planning process focuses on different steps of strategy development. O'Brien and Meadows (2013) note that this process consists of three activities: preparation, scenario development, and the use of scenarios to develop strategic choices.

The scenario-planning literature focuses on the generation of strategies through the scenario-planning method. As described by Bowman (2015), this planning tool stimulates decision makers to develop and clarify the practical choices, policies, and actions that can be taken, as well as their consequences (Coates, 2000), and to enrich their portfolio of "possible strategic initiatives", thus leading to action (Van der Heijden, 2004). The development of scenarios and multiple "contingency plans" allows decision makers to manage uncertainty (Hines & Bishop, 2006). It enables them to test the robustness of plans of action. The strategies developed are tested against the set of assumptions about changes and environmental uncertainty. Favato and Vecchiato (2016), in their research on the strategic role of scenario planning, show the benefits of scenarios on flexibility and adaptation, as they establish a learning process that improves strategic decisions. As such, they enable us to continuously explore long-range opportunities and threats. Correspondingly, different approaches of scenario planning make an explicit link between scenarios and strategy development (Tapinos, 2012). The generation and development of scenarios provide strategic choices to managers. Thus the aim of the scenario is not to obtain forecasts but to support strategic thinking and make sense of uncertainties. The use of plausible futures is intended to enrich the strategic vision of the organization, leading to discovering the business environment and its evolution. Organizations are called to articulate theses possible strategic initiatives in order to clarify managerial choices and orientations.

7 | CONCLUSION

In the scenario-planning literature, research can be categorized into two types: substantive research and construct development, and validation research. The first area focuses on the investigation of the relationship between constructs that are measured by independent and dependent variables. The second area concerns the relationships among variables that may constitute a concept. According to Chermack (2005), the main problem is related to the lack of researchers who emphasize scenario-planning theory. Moreover, the substantive stream dominates the scenario-planning literature at the expense of attention to the measurement and validation of constructs. Our research is an attempt to partially fill this gap by proposing an operationalization of the scenario-planning concept. This study's main contribution is related to the definition of scenario-planning dimensions based on Churchill's paradigm (Churchill, 1979).

Our results provide strong support for the measurement properties as presented by our hypotheses. The results of our model indicate that scenario planning can be measured by three indicators: information acquisition, knowledge dissemination, and scenario development and strategic choices. This finding is important because previous researchers have never tested the dimensionality of the scenario-planning concept, nor its reliability and validity. Our study is a response to calls for more studies that explain the scenario-planning concept (Amer et al., 2013; Bradfield et al., 2005; Chermack, 2005; Tapinos, 2013).

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