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Using corporate foresight to enhance strategic management practices

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Abstract

The ever-increasing environmental complexity makes strategizing a difficult multidimensional task. In this paper, we conducted a corporate foresight case study in an SME in packaging industry in Iran. The case study offers a detailed procedure of implementing corporate foresight (CF) and how it can reshape traditional strategic planning. A multi-methodological approach was taken in this case study. Once an intraorganizational team in studied company was formed, archival document analysis, PESTEL and weak signal analysis, importance/uncertainty matrix, cross-impact balanced (CIB) analysis, scenario construction, wind tunneling, robust decision-making, and premortem session were used to create foresight intelligence. This paper presents a detailed description of how CF can be linked to conventional strategizing and reshape it. Key variables, driving forces, critical uncertainties, and 4 plausible scenarios are presented. The case study illustrates that as alternative realities challenged the foresight teams ingrained presuppositions, they found the dialectic between "weight of history" and "pull of future" both revelatory and indigestible. The CF intervention illuminated the fragility of preexisting strategic objectives, the implicit optimism bias underlying them, and an overflowing-plate syndrome of formulating too many strategic objectives. Consequently, studied company decided to revisit their strategic objectives, prepare a contingency plan for worst-case scenarios, and begin developing a crisis-ready culture. The comprehensive case study demonstrates how CF can enhance and contradict traditional strategizing, presents a rich know-how of added value of scenarios, and provides some subtleties and complexities of CF interventions.

Keywords Corporate foresight, Strategy, Scenario thinking, Strategic planning

Introduction

The classic features of the twenty-first century, namely, volatility, uncertainty, complexity, and ambiguity [4], have made organizational strategizing a conundrum, and corporations are obliged to be increasingly more proactive through future-oriented approaches [48]. As a result, application of corporate foresight (CF) is considered by many companies and industries [29, 53, 54, 57], and numerous companies have reported about the added value of CF to strategic management [49], p. 157). CF has been defined as a "practice that permits an organization to lay the foundation for a future competitive advantage" [50], p. 1). Despite its rich tradition, this emerging field suffers from a number of deficiencies [50]: lack of clearly defined terminologies; being in early stages of theoretical consolidation, i.e., being "pre-paradigmatic" [57]; and poor connection to the general management research; therefore, it is incumbent on practitioners and academicians of the field to improve the theoretical soundness and empirical know-how of the field. Furthermore, the integration between CF and organizational structures is still poorly formed [10]. Iden et al. (2017) argue that the organization of the emerging field of strategic foresight is weak and in need of theoretical progress. More recently, in a systematic literature review which looks back at 50 years of contributions to corporate and organizational

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foresight in the *Technological Forecasting and Social Change*, three recommendations for future research are made: (1) further development of application of foresight is organizations, (2) linking CF to strategy practice and theory, and (3) making a connection between CF and innovation, engineering, and R&D management practices and theory [22], p. 1). One step in tackling abovementioned gaps can be conducting case studies and demonstrating how CF can be integrated into conventional practices of strategic management to broaden, deepen, and sharpen them. Following this research agenda, this paper provides a comprehensive description of a CF project in an Iranian small- and medium-sized enterprise[1] (SME) in the packing industry during which we tried to combine conventional strategic practices and CF. This paper contributes to both pragmatic know-how of implementation CF in organizations and how CF can enhance organizational strategic intelligence.

Literature review

CF is essentially multimethodological. It is a meta-analysis of past, present, and future and tries to triangulate among various sources of analysis and knowledge acquisition to help corporate strategic intelligence in "all time horizons of strategic planning" [49], p. 157). It "creates value through providing access to critical resources ahead of competition" [50], p. 2). CF is an action-oriented, systematic, and participatory process of future-intelligence gathering [41], p. xi). For a proper conceptualization of CF, one should think "in terms of gerunds or verbs" (Weick, 1979 as cited in [2], p. 2) and go for continuous planning instead of plans. CF is not a technical or rational process but a social sense-making practice "permeated by the Maslowian dialectic between the need to know and the fear of knowing" [11], p. 944).

CF enables organizations to catalyze innovation [20, 27, 52], "respond to the latent vulnerabilities of the environment" [13], p. 2), attain superior market position [51], p. 3), pinpoint exceptional course of action [19], synthesize exploration matrices for environmental scanning [5], anticipate trends and weak signals [3], be ready for multiple scenarios [16], and build dynamical capabilities in VUCA world [59]. Conducted properly, the resultant forward view can be translated into "information asymmetries" which benefit both managers and corporations [1], p. 793). It can even "be harnessed to rewrite industry rules and create new competitive space" [24], p. 76). In other words, CF is not merely a scanning—sharpened exploratory—tool but a tool of "future making" [71].

As for the major steps of CF, it usually includes three phases of perceiving (gathering weak and strong signals of change), prospecting (translating signals into insight), and probing (designing appropriate responses to emerging changes) [30], pp. 2–3). In the perceiving phase, the breadth of foresight resources matters. Inclusion of external sources and widening the knowledge sources in foresight practices can overcome "one-dimensionality and narrow-sightedness" [26], p. 1).

By studying application of CF in business development, Højland and Rohrbeck [30] surmise that while CF literature is rich in techniques and procedures of cognitive search (perceiving and prospecting), but experimental search (probing) is under-utilized and under-researched [30], p. 31). Similarly, in an exploratory study, foresight experts state that foresight can be more helpful in post-sensing activities, thereby improving organizational performance [60]. Nestik [44], based on an expert panel, enumerates some cognitive and psychological biases which can negatively affect all phases of CF: overconfidence, future anxiety, stereotyping, and hindsight bias (p. 78), to name but a few.

As for methodological integration, a wide array of methods and techniques have been incorporated into CF: scenario construction [27], system dynamic modelling [9], Delphi studies [32], business war gaming [58], road mapping [42], benchmarking, and business analytics [7], causal layered analysis [34], and morphological analysis [43].

Among all of them, scenario building has been recognized as "a, if not the," primary vehicle of CF [28], p. 363) which was famously utilized by Shell during the 1970s to anticipate the possibility of an oil crisis [68]. Best scenario practices are time- and resource intensive, include multi-stakeholder perspectives, and deal with plausible instead of probable futures [47]. Hirsch et al. [28] propounds that qualitative scenarios cannot add full value to CF and thus propose a quantitative participatory procedure to link scenario construction to CF. This approach assists CF by providing an analysis of possible impact of factors and ruptures, thereby making uncertainty management possible [28].

Case studies also have been commonplace among practitioners and theoreticians of CF. Table 1 presents a review of some CF-related case studies and their methodology, industry, and major contribution. In the selection of these papers, different parameters were taken into consideration, the number of citations, prolific authors of corporate foresight, revenant reputable journals, recent publications, and inclusion of case studies from variety of industries. All of these case studies use numerous techniques and methods in the research design. They can be classified into two main categories: the first group applies

[1] The name of the company will not be revealed due to the research agreements.

Table 1 A review of exemplars of corporate foresight case studies (source: authors)

Authors	Methodology	Industry	Key contribution
Calof et al. (2020) [6]	Multimethod (expert panel, SWOT, wild cards, etc.)	Russian service company	A detailed practical know-how of CF implementation and its contribution to organizational innovation
Klos & Spieth (2021) [37]	Multimethod (foresight workshops, interviews, group discussions, etc.)	German construction sector	How personal technological frames of managers alter during CF activities. Despite initial impact of foresight on managerial sense-making mechanisms, managers revert back to pre-foresight frames
Tavana et al. (2021) [63]	Multimethod (technology development framework, scenario, DEMATEL [a], etc.)	Communication industry	Development and implementation of a unique structured foresight and scenario-planning procedure
Idoko & MacKay (2021) [33]	Longitudinal study of applying horizon scanning	UK financial institution	Description of the performative dimension of CF: CF tools do not only describe a future state but also create it
Haarhaus & Liening (2020)[b] [23]	Mixed method (interviews, surveys, and quantitative empirical investigation)	Various industries	Demonstration of positive association between strategic foresight and firm's dynamic capabilities, namely, strategic flexibility and decision rationality
Milshina & Vishnevskiy (2018) [42]	Multimethod (road mapping, scenario, PEST analysis, etc.)	Russian SMEs[c] in the medical cluster	A pragmatic know-how of implementing roadmap-centered CF for a cluster of SMEs leading to priority-setting and alternative investigation
Peter (2019) [46]	Multimethod (scenario workshops, environmental scanning, weak signal analysis, etc.)	Swiss bank PostFinance	A report about application of different versions of CF in a company since 2006 and its resultant foresight policies: (1) development of a foresight framework, (2) establishment of a network of trend scouts, (3) confirmation of foresight continuum to ensure flexibility
Torres & Pena Jr (2021) [65]	Interviews and document analysis	Brazilian Agricultural Research Corporation	A description of the impact of CF on mitigation of bounded rationality in decision-making processes
Heger & Boman (2015) [26]	Semi-structured interviews and online surveys	EIT[d] ICT labs (100 partners)	Exploration of how networked foresight is predominately used for "sensing activities" and somewhat for "activity initiation" (p. 1)
Battistella (2014) [3]	Multimethod (multiple case studies, interviews, secondary data analysis, etc.)	Telecommunication industry (8 companies)	Characterization of CF systems: designation of a particular foresight system structurally or culturally, improvement of organizational foresightfulness, development of control systems for dissemination of foresightfulness
Marinova et al. (2013) [39]	Multimethod (archival record analysis, direct observation, interviews, etc.)	A European bank	A trichotomous approach to analysis of CF at managerial, organizational, and environmental level of analysis
Heiko & Stillings (2013) [27]	Multimethod (scenario, Delphi, participatory workshops)	A German producer of high-performance materials	Conceptualization and execution of an "innovation-focused scenario process," extraction of market scenarios, development of prototypes and business models

Table 1 (continued)

Authors	Methodology	Industry	Key contribution
Sarpong & Hartman (2018) [56]	Semi-structured interviews	European sportswear retail industry	How top-down mechanisms of management can lead to dissipation of organizational "foresightfulness" among middle managers
Castillo-Camarena & López-Ortega (2021) [8]	Multimethod (bibliometrics, expert panels, Delphi)	A case study in TRDCs[e]	Juxtaposition of current situation of the enterprise with created future intelligence to set priorities
Öner & Beşer (2011) [45]	Assessment survey	Turkish multinational company	How CP projects might be assessed to detect their pitfalls and challenges and improve future CF executions
Rohrbeck (2010) [49]	Multimethod (multiple case studies, interviews, internal-document analysis	Several European industries	Development of a maturity model to assess future preparedness of organizations
Gershman et al. (2016) [20]	Multimethod (survey, interviews, internal-document analysis)	Russian state-owned enterprises	Development of a technology roadmap suitable for SOEs
Fathi et al. (2021) [15] Spaniol & Rowland (2022) [61] Hansen et al. (2021) [25]	Multimethod (MICMAC, soft operational research, Delphi) Multimethod (scenario, road map) Open innovation and open foresight	Iran's textile industry Roll-on/roll-off shipping ecosystem in the Baltic Sea Forest sector multinationals	Development of exploratory scenarios and its impact on an industry in a developing country with and without sanctions Investigates the function of corporate foresight at the level of ecosystem to orchestrate the ecosystems and design a set of shared future options Designs a pathway for traditional forest sector companies to investigate opportunities to hasten their sociotechnical transition

[a] Decision-Making Trial and Evaluation Laboratory

[b] This is not a case study per se. It introduces strategic foresight as antecedent of firms' dynamic capabilities. It has been included in the table due to its unique contribution to role of strategic foresight in organizations

[c] Small- and medium-sized enterprises

[d] European Institute of Innovation and Technology

[e] Technological Research and Development Centers

CF into strategic management process of a chosen firm and describes the subtleties of implementation and how CF enhanced conventional strategizing procedures. The second group assesses the effect of CF on manger's perception, innovativeness, and flexibility of the company, i.e., future readiness of the firm. Our case study has contributions to both of these areas.

Methodology

Integration of CF into conventional organizational strategizing has been repeatedly highlighted [22, 50, 57]. As single cases focus on the particular rather than the general, it provides CF researcher with an opportunity to "drill down," "penetrate into every nook and cranny," "look at it from various angles," and develop a "polyhedron of intelligibility," thereby getting a three-dimensional view rather than a one-dimensional one [64], p. 5). In this single case, we tried to create this analytic three-dimensional picture through data and methodological triangulation [73]. Case studies can be more useful "in the early stages of research on a topic or to provide freshness in perspective to an already researched topic" [14], p. 548). This paper is a report of a CF project conducted in an Iranian SME in the packaging industry. The project lasted for around 1 year. The time horizon of the CF project was 2032. In the meantime, the firm tried to train his staff in order to establish a permanent foresight unit within its organizational structure. The whole project was only facilitated by researchers; the intraorganizational team were not passive bystanders or *consumers of foresight* but proactive conversant and conductors of the whole process. As the CF literature suggests, improvement of empirical know-how of CF processes and the integration of CF into conventional strategic management is of paramount significance [22, 57]. Højland and Rohrbeck [30] contend that probing phase of corporate foresight is under-researched In order to contribute to these research agendas, we will first describe steps of application of CF in an SME in details. We will then try to provide answers to the following research questions related to the probing phase which have been formulated based on both the abovementioned research gaps and our client's concerns:

- *Research question 1*: In the probing phase of a CF process, how can scenarios be used to challenge manager's perceptions?
- *Research question 2*: In the probing phase of a CF process, how can scenarios be used to test the resilience of preexisting strategies?

Figure 1 presents the detailed process of the research.

In the prospecting phase of CF, we used CIB which is an expert-based technique of analyzing "the mutual impact of relations of a system's principal elements" based on "qualitative impact networks" [70], p. 6). In this soft system approach, once the list of most important factors (descriptors) is created, the expert panel discusses their interdependencies in several rounds. In the cross-impact matrix, experts are asked to evaluate the impact of descriptor *i* on descriptor *j* using the following qualitative scale [70], pp. 8–10):

- −3: Strongly restricting influence
- −2: Moderately restricting influence
- −1: Weakly restricting influence
- 0: No influence
- +1: Weakly promoting influence
- +2: Moderately promoting influence
- +3: Strongly promoting influence

Once the matrix is filled by the experts, it is fed into ScenarioWizard software to create the consistent scenarios. When the list of principal's elements of a system is high, checking the resultant matrix manually is a herculean task. ScenarioWizard facilitates the process of investigating interdependencies, removing inconsistencies, and developing scenarios. This can be considered as a methodological enhancement to qualitative scenarios especially when the number of principal elements is high or the group conducting the CF has a quantitative background.

Description of the CF process in our case study

In order to construct scenarios and after a quite extensive literature review and semi-structure interviews via skype due to the pandemic lockdowns, in the transition from perceiving to prospecting, firstly, brainstorming sessions were conducted inductively to elicit trends, weak signals, and emerging issues from the members of the foresight team. Next, the results of the literature review, environmental scanning, and brainstorming sessions were deductively presented to the foresight team during several expert panels. Their relevance, probability, significance, and impacts were thoroughly discussed. When there was a huge discrepancy between, say, an emerging issue and organizational routines of the team, futures wheel was used to initiate a strategic conversation and explore the primary, secondary, and tertiary consequences of it [21]. Eventually, 52 variables were collected and elicited as the initial variable inventory. Table 2 provides the list of these variables. They were then ranked using importance/uncertainty matrix for the next round of prospecting phase. Table 3 shows the list of 10 selected key variables.

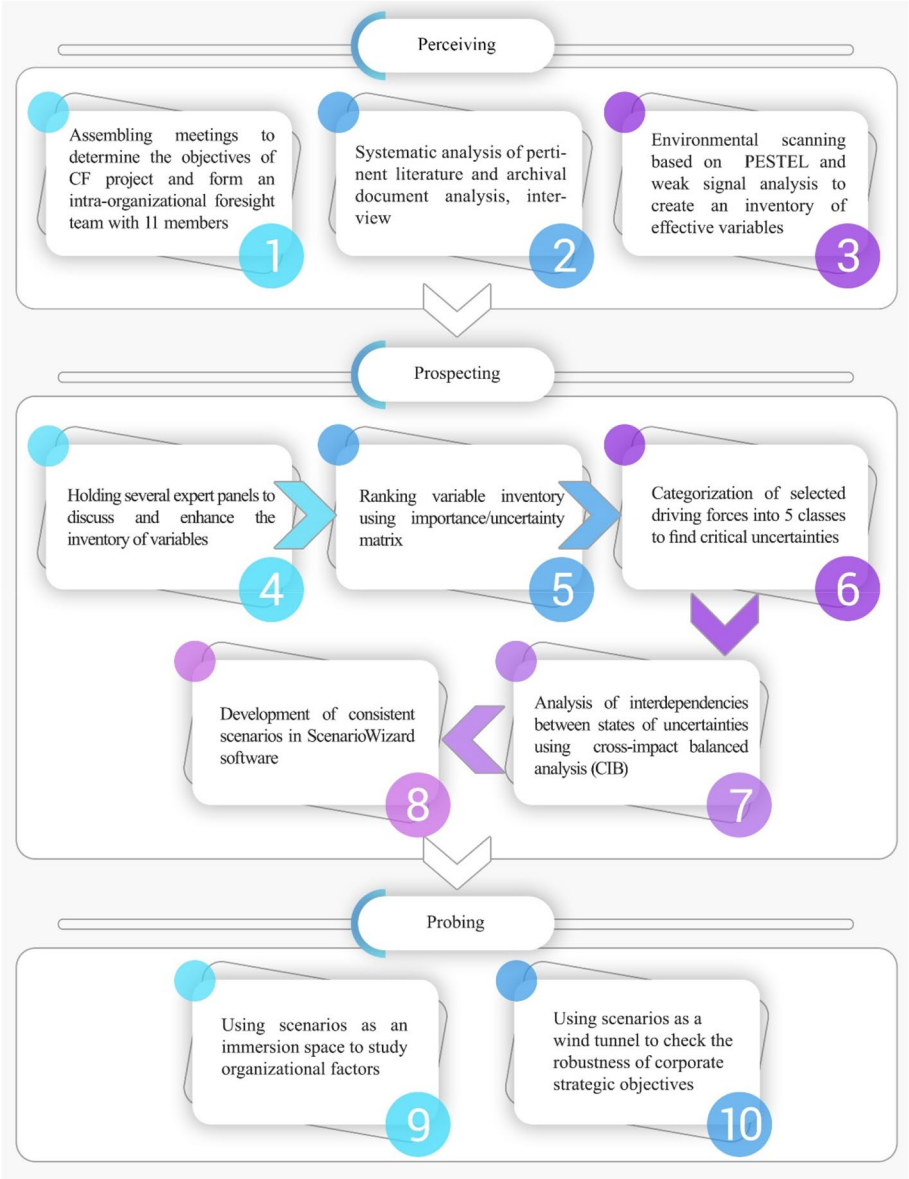

Fig. 1 Detailed process of the research

Figure 2 presents importance-uncertainty matrix created by the foresight team in an expert panel. Different scenario-planning techniques suggest different procedures to reduce the list of initial key variables to a couple driving forces which can be used as the primary building blocks of scenarios in a deductive manner. The perceptional knowledge iceberg, i.e., event, patterns, and structure (Senge, 1990 as cited in [67], pp. 103–104), influence diagrams [67], p. 231), and expert-oriented techniques have all been suggested and used to detect the underlying forces of change. In this study, key variables which had importance and uncertainty of higher than or equal to 5 were selected as the final list of driving forces (see Table 3).

To create scenarios based on uncertainties which can turn out to have opposing eventualities, the. foresight team drew several influence diagrams based on their similarities, interdependencies, and causal relations and reduced driving forces into four critical uncertainties. We tried to investigate the interplay between driving forces and investigate uncertainties. The critical uncertainties can be seen in Table 4. This table presents grouped similar driving forces, the underlying critical uncertainty related to those driving forces, and various possible states of

Table 2 The primary list of 52 variables

Labels	Variables	Categories	Labels	Variables	Categories
V_1	The possibility of resuming JCPOA negotiations	Political	V_{27}	Changing customer preferences	Social
V_2	Failure to form an agreement with the USA and European countries	Political	V_{28}	Lack of specialized manpower	Social
V_3	The risk of war	Political	V_{29}	The rise of health-conscious packaging	Social
V_4	America-China interactions and tensions	Political	V_{30}	The demand for specific packaging to increase the shelf-life	Technological
V_5	The emergence of multinational companies in Iran	Political/ economic	V_{31}	The rise of 3-D printing	Technological
V_6	China's growth and approach in the packaging industry	Economic	V_{32}	Changes in the combination of primary and secondary packaging	Technological
V_7	The rise of sustainable packaging	Environmental	V_{33}	The increasing demand for optimal automated packaging	Technological
V_8	Population and demand increase	Economic/social	V_{34}	Inclusion of robots in packaging	Technological
V_9	The rise of small-scale aquaculture system for households	Economic/technological	V_{35}	Digital currency	Technological
V_{10}	Tourist flows to Iran	Political/economic	V_{36}	Production of packaging machines with non-ferrous alloys	Technological
V_{11}	"Price competitiveness" of tourism industry in Iran	Economic	V_{37}	Co-creation in design and packaging	Technological
V_{12}	Iraqi labor migration to Iran	Social/political	V_{38}	The introduction of hybrid packages	Technological
V_{13}	Connecting the roads of Iran to Syria and Lebanon	Political/economic	V_{39}	Global regulations related to sustainable packaging	Legal
V_{14}	The New Silk Road	Economic/political	V_{40}	Mandatory circular economy	Legal
V_{15}	The rate of economic growth	Economic	V_{41}	The high levels of energy consumption in Iran compared to the global average	Social
V_{16}	The unemployment rate	Economic	V_{42}	Changes in tax laws in Iran	Legal
V_{17}	The inflation trends	Economic	V_{43}	Universal basic income and minimum wage laws	Legal
V_{18}	The replacement of China as the leader of the packaging industry	Economic	V_{44}	Changes in intellectual property law in Iran	Legal
V_{19}	Raw materials oscillation	Economic/technological	V_{45}	Facilitation of export laws	Legal
V_{20}	Desire for lower cost packaging	Economic	V_{46}	Global warming and Iran's deteriorating environmental resilience	Environmental
V_{21}	The global demand for packaging machines	Economic	V_{47}	The rise of herbal packaging	Environmental
V_{22}	Diversification and technological convergence	Economic/technological	V_{48}	Carbon taxation	Legal
V_{23}	The rise of green lifestyle	Social	V_{49}	Recycling and upcycling of the secondary packaging	Environmental
V_{24}	The rise of demand for environmentally friendly packaging	Environmental	V_{50}	The water crisis in Iran	Environmental
V_{25}	Aging population	Social	V_{51}	Iran's potential capacity to use solar energy	Environmental
V_{26}	The worsening condition of poverty in Iran	Social	V_{52}	Land subsidence in Iran	Environmental

the critical uncertainty. We reduced the number of drivers by groping similar variables and attributing a main driver to them. For instance, consider U_1: we grouped failure to form an agreement with the USA and European countries, the risk of war, tourist flows to Iran and "price competitiveness" of tourism industry in Iran together, and attributed "international interactions" as the major driver of these variables. These systematization and prioritization leads are an irreducible element of any scenario work. Critical uncertainties can take each of these alternative states and lead to different eventualities. As Table 4 illustrates, 2, 2, 2, 2, and 3 states were designated to international interactions, China's growth, environmental conditions, regimen of production, and the role of customers in value chain respectively. These different states were labeled and fed into ScenarioWizard software.

As Table 4 illustrates, 5 critical uncertainties can have 11 different states. Next, we did a CIB in an 11×11

Table 3 Selected 10 variables as key variables

Labels	Variables	Categories	Importance-uncertainty scores
V_2	Failure to form an agreement with the USA and European countries	Political/economic	(7, 6.5)
V_3	The risk of war	Social	(6.5)
V_4	America-China interactions and tensions	Political	(7.7)
V_{10}	Tourist flows to Iran	Economic	(7.5)
V_5	"Price competitiveness" of tourism industry in Iran	Economic	(7.5)
V_6	China's growth and approach in the packaging industry	Technological/economic	(6.5)
V_{24}	The rise of demand for environmentally friendly packaging	Social	(7.5)
V_9	The rise of small-scale aquaculture system for households	Social/technological	(6.6)
V_{31}	The rise of 3-D printing	Technological/social	(6.5)
V_{37}	Co-creation in design and packaging	Social/technological	(5.7)

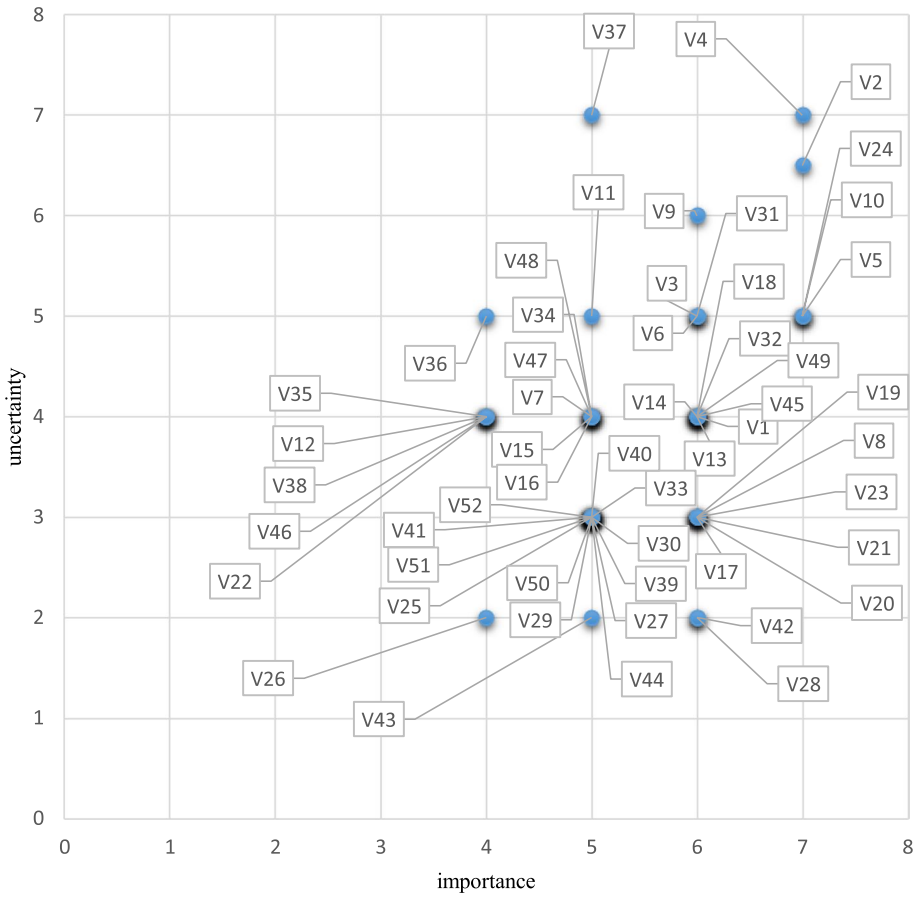

Fig. 2 Importance-uncertainty matrix

matrix. The focal question, at this stage, was "if any of designated states of each critical uncertainty occur, how can they effect other states?" A qualitative scale from -3 to $+3$ was used by experts to fill out the matrix. To fill out the matrix, for instance, at the intersection of second state of U_1 (boundless interaction) and first state of U_5 (consumption), the expert was asked the following question: if Iran had a boundless interaction with the world, how would that influence the state of consumerism approach? The given qualitative evaluation ($+1$) means

Table 4 Different states of driving forces, their designated name, and labels

Uncertainty label	Underlying critical uncertainty	States	State description	Relevant key forces
U_1	International interactions	A_1	Bounded	•Failure to form an agreement with the USA and European countries •The risk of war •Tourist flows to Iran • "Price competitiveness" of tourism industry in Iran
		A_2	Boundless	
U_2	China's growth	B_1	Revolutionary	•America-China interactions and tensions •China's growth and approach in the packaging industry
		B_2	Evolutionary	
U_3	Environmental conditions	C_1	Resilient	•The rise of demand for environmentally friendly packaging •The rise of small-scale aquaculture system for households
		C_2	Breakdown	
U_4	Regimen of production	D_1	Distributed/home based	•The rise of 3-D printing
		D_2	Centralized/factory-based	
U_5	The role of customers in value chain	E_1	Consumption	•Co-creation in design and packaging
		E_2	Prosumption	
		E_3	Co-creation	

that according to the experts, normal interaction with the world has a "weakly promoting influence" on the level of consumerism Table 5.

Figure 3 demonstrates 4 consistent scenarios developed by ScenarioWizard software. In what follows, the states of critical uncertainties in each scenario are described as follows:

i. First scenario: Boundless interaction with the world/China on top of world economy/collapsed environment/production is majorly centralized or factory based/customers are passive consumers.
ii. Second scenario: Bounded interaction with the world/China on top of world economy/collapsed environment/production is majorly centralized or factory based/customers are passive consumers.
iii. Third scenario: Boundless interaction with the world/China on top of world economy/collapsed environment/production is majorly centralized and factory based/customers are prosumers.
iv. Fourth scenario: Boundless interaction with the world/China on top of world economy/resilient environment/production is majorly distributed and home based/customers are co-creators along manufacturers.

In Fig. 4, we have provided a short narrative describing the scenarios. The original scenarios were much longer. These scenarios were initially drafted by participant in the workshop and revised and finalized in several rounds by collaboration of the foresight team. The narration is in the first person—as if a member of foresight team narrates the scenario in 2032.

In the next step, similar to immersion technique described in Wilson and Ralston [72], we used scenarios as an immersion space and asked the foresight team to reimagine some dimensions of their organization within each scenario in mind (see Table 6. The organizational dimensions were chosen based on the macro levels of the contextual environment investigated using PESTEL technique and micro-organizational levels. It should be noted that the list of these dimensions is exemplary and not exhaustive; scenarios can be used as an immersive medium to investigate any other dimensions at micro, meso, and macro levels.

After that, we used scenarios for wind tunnel testing of preexisting strategies. In this framework, a wind tunneling table is formed where suitability and resilience of already-existing strategies are assessed and stress tested within all scenarios [66, 67]. Prior to this CF intervention, the strategy department of this Iranian SME had conducted several conventional strategic planning projects and had formulated 18 strategic objectives which were the highest level of strategic guidance of the company (see Table 7).

Once scenarios were constructed and comprehensively discussed within the foresight team, in one expert panels, we asked experts to discuss the suitability and resilience of these strategic objectives within all scenarios. Subsequently, they gave a score on Likert scale from 7 (the most robust) to 1 (the least robust) to each of these 12 strategic objectives based on their robustness within each of four scenarios. Figure 5 presents the robustness of these strategies in each scenario.

The panel consensus was that any strategic objective with a score lower than 4 is considered as being not

Table 5 Results of cross-impact balanced analysis

CIB matrix		International interactions (U1)		Chinas growth (U2)		Environmental conditions (U3)		Regimen of production (U4)		The role of customers in value chain (U5)		
		Bounded (A1)	Boundless (A2)	Revolutionary (B1)	Evolutionary (B2)	Resilient (C1)	Breakdown (C2)	Distributed/ home based (D1)	Centralized/ factory based (D2)	E1) consumption)	E2) prosumption)	Co-creation (E3)
International interactions (U1)	Bounded (A1)			0	0	−1	1	−1	3	1	−2	−3
	Boundless (A2)			0	0	−2	2	2	1	1	1	2
China's growth (U2)	Revolutionary (B1)	−1	2			−3	3	3	2	3	2	1
	Evolutionary (B2)	0	1			−2	2	2	1	2	1	0
Environmental conditions (U3)	Resilient (C1)	−1	−1	−2	−1			1	−2	−3	−1	2
	Breakdown (C2)	1	−1	−1	−1			0	−1	−2	0	1
Regimen of production (U4)	Distributed/ home based (D1)	0	0	3	2	3	−2			−3	1	3
	Centralized/ factory based (D2)	0	0	2	1	−3	3			3	0	−2
The role of customers in value chain (U5)	Consumption (E1)	0	0	−2	−1	−3	3	−3	3			
	Prosumption (E2)	0	0	2	1	1	−1	−2	2			
	Co-creation (E3)	0	0	3	2	3	−3	3	−3			

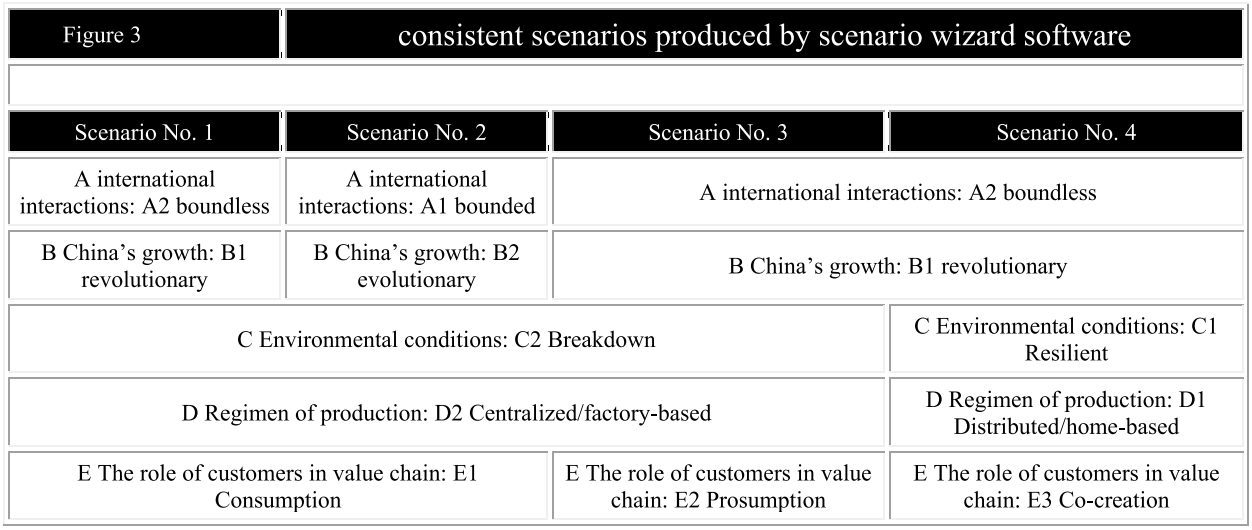

Fig. 3 Consistent scenarios produced by scenario wizard software

robust within that particular scenario. Five strategic objectives proved to be robust in all scenarios:

i. Creating competitive advantage by customizing products
ii. Make a differentiation in market by maximizing the automation of products.
iii. Timely delivery of the product
iv. Increasing customer satisfaction

As Fig. 5 illustrates, while the second scenario which can be regarded as the worst-case scenario challenged many of the strategic objectives, in the fourth optimistic scenario, most of the strategic objectives were regarded meaningfully robust. The red scenario contested the participant's understanding about the nature of risk and the boundary between "normal" and "abnormal" [18], and many participants initially confused scenarios as a "possible future state" with a "probable future state" and thus attributed a low probability to this scenario.

Epilogue: probing phase, scenarios, and research questions

Scenarios can be used to investigate strength, weaknesses, threats, and opportunities, once business as usual is replaced by alterative realities. It provides the organization with a chance to reconsider its long-held assumptions and sources of competitive intelligence. Nonetheless, mangers usually have difficult time deriving strategic thinking from scenarios [68]. To facilitate this and move toward probing, we combined scenarios with SWOT, a modified version of strategy canvas [35], and robust decision-making [38]. We used scenarios as an immersion space [72] to check the dialectic between external factors and internal organizational issues. Next, we used scenarios as a wind tunnel — a playing field — to evaluate robustness of corporate strategies. We will use the results of this case study to provide some answers for our research questions in this section. In doing so, a certain degree of generalization will be unavoidable:

Research question 1

In the probing phase of a CF process, how can scenarios be used to challenge manager's perceptions?

Scenarios can be used as an immersion space [72] to help participants to have a firsthand experience of alternative realities, decrease their psychological and hypothetical distance with alternative realities, and challenge their deep-seated assumptions. Questions addressing the consequence of scenarios can be asked: "What are the opportunities and risks for us as a result of the scenario? What would we have to do in case the scenario became reality?" [17], p. 364). This kind of techniques can play a pivotal role in integration of CF and conventional strategizing, thereby building the so-called connecter. The dialectic between past and future, between external and internal, between "business as usual" and "alternative realities," and between "preexisting strategies" and "strategies from future" can lead the strategic conversation toward either synthesis in a Hegelian sense or a transformative spiral change of mental models which pushes the envelope of strategy and results in a strategic epiphany. For CF to flourish, this dialectic has a profound significance both at methodological level of designing and implementing techniques and cognitive level of affecting mental models of CF clients.

First scenario:	Second scenario:
On 25th October 2030, 120 Iranians died in metropolises due to extremely high levels of air pollution. On this day, though, the contract for construction on the biggest steel companies in the world was signed by China. All these factories will be set up with Chinese investment and supply of Iranian manpower. Due to the expansion of the working class and the middle class in China and the subsequent increase in wages up to 8 dollars per hour of work in this country, the available and cheap Iranian workforce with 1.2 dollars per hour of work has attracted capital in recent years. SNOWA[1] launched a new air purifier assembly line with Chinese parts, and only one model with a certain price is in the production line. In energy sector the priority is to provide energy for the use of factories, but one day a week, industries have power outage. Plastic consumption has increased compared to the last year and the demand for packaging machines at the lowest price is increasing. In this regard, Chinese packaging machines have been launched on the market at higher prices than Iranian machines, but due to their performance and speed of operation, they have been more popular. The research and development units of Iranian packaging machine manufacturing companies are copying Chinese machines, and meanwhile, the managers of these companies are looking to finance to plan the volume of production for the coming year, 2032.	Despite the efforts of Iran's trading partners such as China, the toughest sanctions in history were imposed on Iran. The sale of oil has reached its lowest level in the last 50 years, i.e., 100,000 barrels per day. All money transfer options are blocked. Carbon taxation and recycling protocols are now mandatory but Iran does not follow these universal protocols which has resulted in a new set of environmentally-imposed sanctions. It is not even possible to provide filters for De-Dusters equipment related to different factories to absorb air pollutants from their production line and reduce environmental aspects. Refinery industries are not exempted from these sanctions, and produced gasoline only for domestic consumption. None of the neighboring countries, or traditional buyers of Iran's gasoline, are willing to buy Iran's gasoline. America's leap in artificial intelligence and biotechnologies has widened their economic gap with China. The recent severe sanctions have led to food rations and the distribution of coupons among the people in Iran. The police and military forces are in charge of price control but the black market for basic needs seems uncontrollable. Provision of electricity for domestic use is rationed. The competition between companies producing internal packaging devices with the minimum amount of plastic consumption has intensified in order to reduce the final product price. In this regard, these companies are closing down their research and development units and are just trying to survive.
Third scenario:	**Fourth scenario:**
Boundless Interactions and relations with the world have led to the sale of 6 million barrels of oil per day and the transfer of money without restrictions. Meanwhile, China as a world superpower has been able to double its GDP from 2022 to 2032. China is Iran's major trading partner and the largest customer of Iran's fossil fuels. All countries are constantly monitoring the movement of China in all fields and are looking to exploit the emerging technologies and phenomena of this country. Iranian Factories are still thriving and producing at near maximum capacity, but the consumerist approach has been faded and companies are forced to consider the needs and expectations of interested parties and customers in the production process and final products. packaging machines producing companies are have to customize the packaging machines regarding costumers expression(which is mainly technology-oriented) in order to fulfil costumers needs and increase their market share. . Majority of the energy consumption is still fossil fuel, about 85%, but the research and development units of the packaging machines companies have developed machines working with solar power for mass supply to the market in the next 3 years. Research and Development in emerging technologies of the packaging industry is also an important approach in packaging machine producing companies	Seven years ago, the slogan (Every household has a 3D printer) was more like a dream than a big hairy ambitious goal[2]. But China made this dream a reality and proved that big goals are also achievable. Achieving this goal, caused some big companies to lose their marketplace. Every household can now easily print a wide array of products at home. Despite the fact that China has overtaken the West as the world's first economy, the pressures of social responsibility and non-governmental organizations have forced China to consider environmental standards. A packaging machine manufacturing company has successfully used the co-creation approach in order to increase customer satisfaction with this slogan: every customer has his own seat in our factory's design unit. Creativity and innovation play a vital role in product design in the field of packaging, and companies seek to acquire relevant startups. Amazon's innovation in 2025 has reduced the cost of packaging and leaders of the industry have produced innovative solutions to combine primary and secondary packaging. The implementation of the Treaty of Paris known as the Treaty of the Century reduced the carbon footprint of every Iranian from 8 tons in 2019 to 4 tons in 2032. Coal mining was completely banned and many steel companies were completely re-designed. The budget of the department of environment experienced a twenty-fold increase in 5 years; Environmental pollutants self-declaration is mandatory for all factories and workshops. All factories and workshops, whether large, small, industrial or non-industrial, are required to establish ISO14001 (Environmental Management System) 2029 edition requirement. Bushehr nuclear power plant has been closed due to possibility of environmental aspects and health hazards. The use of plastic in packaging was banned in 2027. Seventy-five per cent of packaging machines available in the market are solar-powered.

Fig. 4 A short narrative of constructed scenarios

Table 6 Some reimagined organizational dimensions of Esfahan Pack Co. in 4 scenarios

Scenario organizational dimension	Orange scenario No. 1	Red scenario No. 2	Yellow scenario No. 3	Green scenario No. 4
Energy consumption approach	Fossil energy available for production by quota	Fossil fuels at the hand of factories	Mainly fossil fuels and minorly renewable	Mainly renewable
Engineering and project management	Demand based for production increase	Based on political lobbies' commands	Based on needs and expectations of costumers	Creative oriented
Financial management	Credit supply for covering demand capacity	Pirate-esque division of revenue	Mainly controlled by governmental hierarchy	Private, competitive, socially responsible
Research and development	Bounded imitative R&D	Non-existent	Regarding needs and expectation of business environment	Properly financed open innovation platforms
Business environment	Sluggish and conservative	Struggling for survival	Technology-oriented development	Prosperity of startups and entrepreneurs
Human resource management	Micromanagement based	Personnel management	Incremental effective trainings	Motivate self-expression and talent management
Strategic management	Midterm fixed plans	Concerned with handling daily conundrums	Preparedness for improvisation	Long term and foresight based
Organizational identity	Robot like	Regimented/police like	Service oriented/meets average requirements	Anthropocentric/green/socially responsible

Table 7 The list of preexisting strategic objectives extracted from the Iranian SME's strategic documents

		Scenario 1	Scenario 2	Scenario 3	Scenario 4
Number	Strategic objective				
S_1	Creating competitive advantage by customizing products	5	4	6	7
S_2	Make a differentiation in the market by maximizing the automation of products	5	5	6	6.5
S_3	Timely delivery of the product	6	5	7	7
S_4	Informing customers of the organization's values in order to encourage loyalty	6	5	3	4
S_5	Implementation of knowledge-based system to achieve the related governmental benefits in the fields of branding, education, loan, employment, etc	2	3	4	3
S_6	Development of international relations in order to increase foreign market share and trade with neighboring countries	3	1	4	7
S_7	Improvement of legal, social, and environmental responsibilities by manufacturing of packaging machines with sustainable energy drive	2	1	3	7
S_8	Enhancement of human resource management in order to develop the current human resources and increase the commitment to the organization	3	4	7	5
S_9	Expanding the provision of remote business services	4	1	6	7
S_{10}	Effective communication with suppliers in line with digitization	3	2	5	6
S_{11}	Development of knowledge management regarding sharing needed knowledge for conformity of products and services within the organization	3	2.5	5	7
S_{12}	Increasing customer satisfaction	6	5	6	7

Scenarios can target "the microcosm" or "the picture of reality" [68] of the foresight team. As they distinguish the intrinsic difference between contextual and transactional factors, the frame their strategy rests on can be revealed [47], the "dialectic between the need to know and the fear of knowing" [11], p. 944) kicks in, and the dominant orthodoxy of inside-out approach is likely to be challenged. The impact of the contextual layer on the transactional layer can also be felt. In our case study, for instance, the foresight team found this dialectic both revelatory and at times difficult to digest. As they delved deeply into green scenario, they realized that proliferation of renewables, high rates of carbon taxation, and full blossom of reinvention of energy mean that they need to undergo a massive transition in terms of their identity, their mission, their customers, and the essence of their management. The "centripetal force" which kept the company within its "orbit and

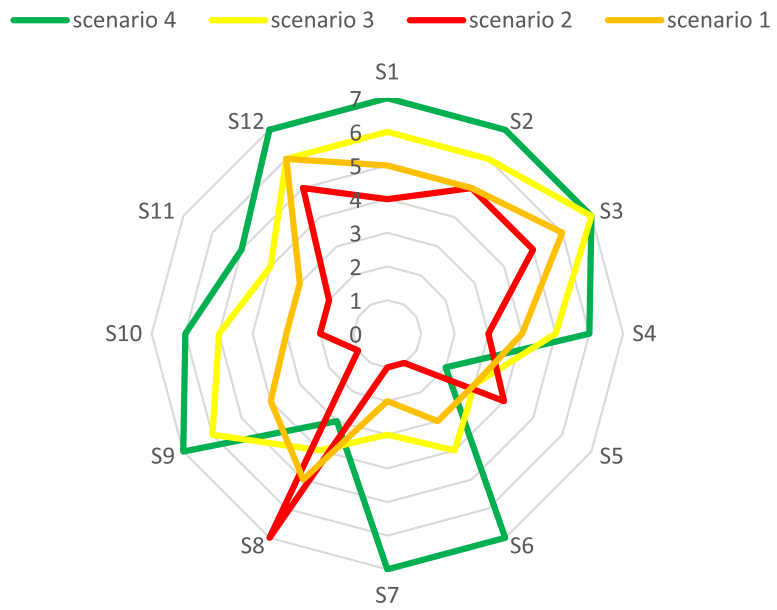

Fig. 5 Radar diagram of robustness of preexisting strategic objectives within scenarios

boundaries" was "counterbalanced" by a "centrifugal force" which invited the company to ask probing questions about the edge of the business and industry [12], p. 140). It even included thinking about the unthinkable: what if our company ceased to exist?

In such an immersion space, the internal–external juxtaposition and going to and fro between "the central and "the peripheral" are likely to reveal some alternative ways of organizational development which can prove to be radically different from the status quo. In our case study, the participants found this unpleasant and difficult to digest. Due to human's psychological aversion to discomfort and fear, the team occasionally got defensive or opted for "scenario denialism": "this is not what we do," and "we cannot and should not rock the boat" were brought up by some members of the team. Reactions of this nature provided that they are directed articulately, we believe, and can be regarded as classic symptoms of a successful CF intervention. Because it is a disciplined process of walking out of your comfort zone and experiencing angst, in fact, feeling uncomfortable and apprehensive is an irreducible component of strategy making [40]. Spiral dynamic or transcendence can only be achieved if second-order change instead of first-order change—which challenges ingrained presuppositions—is sought, welcomed, and accepted [69], p. 23). The willingness to "lock-in" on one scenario should be replaced by the ability to shuffle our mental schemata and switch among alternative scenarios to develop a fuller conception of what future can bring about.

Research question 2

In the probing phase of a CF process, how can scenarios be used to test the resilience of pre-existing strategies?

In CF intervention as in ours, participants are inclined to confuse scenarios as a "possible future state" with a "probable future state" and thus attribute a low probability to any scenario particularly scenarios they personally find unpleasant. Nonetheless, one should bear in mind that the added value of scenario thinking as a major component of CF will be deeply appreciated if only all scenarios are treated equally regardless of our subjective evaluation of them in terms of their desirability or probability. Inclusion of a wild card scenario can even improve the added value of scenario thinking. In the case of such scenarios, managers should try to decease organizational vulnerabilities toward them [62] by creating future options and/or contingency plans. During the discussions, the attribution of a low probability to the red scenario was more of a defense mechanism than a strategic response. In others words, many of the strategic objectives in Table 7 had been inadvertently formulated by "hoping for the best" but "not planning for the worst." To facilitate this, we conducted a "premortem" session [36] during which the most important strategic objective of the company had not been achieved and all plans to achieve them had gone wrong. This genuinely shook the foresight teams' optimism and overconfidence and made red scenario more tangible and worthy of preparing for. As declared by one of the middle managers in the expert panel, the whole process of counterfactual thinking changed the metaphor of management in his mind from

locomotive operator steering a train on fixed tracks to a captain who is in charge of ship amid sea waves. To overcome the pervasive optimism bias, with the help of CF, organizations can ponder over the worst-case scenario, distinguish between "the preventable" and "the not preventable," and prepare for both of them when they have the luxury of enough time.

Another issue raised during discussions based on wind tunneling was the number of strategic objectives which resembled "a scrambled mess of things to accomplish—a 'dog's dinner' of strategic objectives … [and] the label 'long-term' is added so that none of them need be done today" [55], p. 5). "When everything is deemed important, it creates an overflowing-plate syndrome" [31], p. 5). This was problematized both by failure of strategic objectives at the wind tunnel of scenario and the realization of implicit optimism bias and planning fallacy which underlay formulation of the strategic objectives. Using scenarios as a wind tunnel to evaluate the resilience of corporate strategies can help organizations to overcome the optimism biased, revisit their strategic objectives from a futuristic perspective, include "strategies from future," prioritize them and prepare a contingency plan for worst-case scenarios, and try to nurture a crisis-ready culture within themselves. As for the limitations of this study, our research tried to demonstrate how CF can be conducted in an SME and how it can reshape their strategy. We tried to report as much evidence as possible in this paper. Nonetheless, what we have provided here is anecdotal evidence of a single case which might be uncorroborated by other CF projects elsewhere. Multiple cases and longitudinal studies are needed to enhance the theory and implementations of CF.

Conclusion

This paper presented a detailed know-how of how to implement CF in an SMA in the secondary-packaging industry in Iran. We demonstrated how various methods can be woven together to design a sound CF process. Apart from a methodological contribution, the case study provided the researchers with an opportunity to examine subtle nuances of CF interventions. The intraorganizational team had difficulties handling the dialectic between "business as usual" and "alternative realities" and between "preexisting strategies" and "strategies from future." Foresight-based activities — external internal juxtaposition, wind tunneling, and counterfactual thinking revealed that they had a tendency to deny the periphery of their enterprise and they suffered from optimism bias and had formulated strategic objectives regardless of their robustness or feasibility. By the way, there was no strategy and symptoms of preparedness for emerging technologies, i.e., 3-D printers which can change the landscape of packaging industry. The CF intervention pushed the envelope of their strategy and nudged them that besides "hoping for the best," they should "plan for the worst" as well.

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Authors' contributions
A: MTD. B: AZ. C: AN. A conceived of the presented idea. A and B developed the theory and performed the computations. A, B, and C verified the analytical methods. All authors read and approved the final manuscript.

Declarations

Competing interests
The authors whose names are listed immediately below certify that they have no affiliations with or involvement in any organization or entity with any financial interest (such as honoraria; educational grants; participation in speakers' bureaus; membership, employment, consultancies, stock ownership, or other equity interest; and expert testimony or patent-licensing arrangements), or nonfinancial interest (such as personal or professional relationships, affiliations, knowledge, or beliefs) in the subject matter or materials discussed in this manuscript. The authors declare that they have no competing interests.

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