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How to improve scenario analysis as a strategic management tool?

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Abstract

Scenarios are claimed to support strategic decision makers. They are especially effective in dealing with uncertainties. This paper addresses some drawbacks of the conventional scenario method, which is especially directed at handling these uncertainties, and indicates possible avenues for methodological adaptations. We take the approach, which rests in the Shell tradition, as exemplary for our discussion on the mainstream scenario methodology. This approach has some limitations when it comes to dealing with simultaneous trends and countertrends, and trends or clusters of trends that are not thought of beforehand, especially the methodological requirements of causality and consistency, which might be limiting factors in this respect. This paper indicates alternative ways for scenario construction. It discusses the use of either recombinant scenarios, context scenarios, or inconsistent scenarios and/or combinations of these scenarios. These options explicitly incorporate the notion of 'paradoxical trend' as the codriver of future developments into the methodology.
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1. Introduction

Since the 1970s, both academics and practitioners have propagated multiple-scenario analysis to deal effectively with the many uncertainties that surround the future of business organizations. As we all

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know, the external environment is full of unexpected changes, and it is sometimes hard to detect ambiguous trends, which makes long-term forecasts often worthless the moment they are produced. To effectively deal with this, managers increasingly substituted the scenario method (and similar methods) for forecasting techniques. Scenario analysis is not aimed at obtaining forecasts but advocates the creation of alternative images of the future development of the external environment. In doing so, scenarios highlight crucial uncertainties, with impact on the (strategic) decisions managers have to make. This is what we want to discuss in this paper. While the preceding forecasting substitution argument still holds, the scenario approach has undergone some considerable changes since its introduction. Newly developed functions have, without any doubt, increased the attractiveness of multiple-scenario analysis to managers [1]. For instance, scenario analysis now claims to support the entire strategic management process, enclosing aspects as varied as the generation of options [2,3], the building of consensus [4] and even the process of strategy implementation [3]. In short, scenarios are effective in dealing with uncertainties. Liebl [5,6], however, argues that managers are confronted nowadays with totally new and entirely unanticipated situations that are indicative of blind spots inherent in this method. He states that the scenario approach, as it is commonly practiced, is not able to deal with complex developments and trends, which can be characterized as paradoxical, because they tend to be systematically excluded as logically impossible or inconsistent during the scenario-building process. Especially that conventional and trend-based scenarios that are based on simple causalities and on mere extrapolations of the past and the present to the future cannot very well deal with these kinds of trends, which used to be an exception but now become the rule [7,8]. Moreover, the selection logic of scenarios may hamper drawing conclusions from them [9]. In this paper, we address some of the current drawbacks of the conventional scenario method and indicate possible avenues for methodological adaptations. To this aim, we discuss the scenario process and functions of scenarios. Next, we go into some of the restrictions and criticisms related to the current view of scenarios. Subsequently, we indicate the possible ways to extend scenario planning, to take into account various recent insights about environmental turbulence. We end the paper with concluding remarks.

2. Scenario methodology

Various approaches for constructing scenarios can be found in the literature [3,10–15]. For instance, Ringland [15] describes the following set of organizations (methods) dealing with scenarios: Battelle Institute (BASICS), the Copenhagen Institute for Future Studies (the futures game), the European Commission (the Shaping Factors–Shaping Actors), the French School (Godet approach: MICMAC), the Futures Group (the Fundamental Planning Method), Global Business Network (scenario development by using Peter Schwartz's methodology), Northeast Consulting Resources (the Future Mapping Method) and Stanford Research Institute (Scenario-Based Strategy Development). Ringland indicates that most of the organizations she surveyed loosely uses what she calls Pierre Wack Intuitive Logics. This approach, initiated by former Shell group planner Pierre Wack, concentrates on "creating a coherent and credible set of stories of the future as a 'wind tunnel' for testing business plans or projects, prompting public debate or increasing coherence" (p. 183). Initiated and developed in the 1960s and 1970s, it aims at finding ways of dealing with mindsets of managers so that they can anticipate various futures and prepare for them [3,16–18]. During the past few decades, this way of thinking on dealing with scenarios essentially is spread out from Shell to many other organizations and institutions, for

example, SRI and GBN [15][2]. In their overview, Barbieri Masini and Medina Vasquez [19], compare this Shell approach to Godet's approach [10]. Based on our literature reviews (e.g., Refs. [1,5,6]) and on our reviews of sections on scenarios in the strategic management literature, we find that the former approach is much more pervaded. In this paper, we therefore take this so-called Shell-scenario research tradition as exemplary for the mainstream scenario approach[3]. Although there is no real standardized process and many differences can be observed between the various approaches within this tradition, in general, they show some basic structure. Because of space limits, we confine ourselves to a few characteristics, which represent this basic structure. We start with a discussion of the general phases of a scenario process. However, we do not dig deep into the process [ways of finding and clustering information, the dynamics between group members, the iterations, the role of the facilitator(s), etc.]. Constructing scenarios almost automatically results in an iterative process wherein people move back and forth between interrelated phases and activities. Moreover, various authors stress that line managers themselves should be actively involved in the scenario process (e.g., Refs. [4,13]; see Fig. 1).

One of the earlier steps identifies the factors that fundamentally determine future developments. These so-called driving forces [13] or causal factors [12] are classified as either constant, predetermined or uncertain [12]. Constant factors are those structural factors that are very unlikely to change (e.g., people's need for food or income). In the case of predetermined factors, change is largely predictable. For predetermined factors, the outcomes and their probabilities are known, that is, those factors that can be forecasted with reasonable accuracy. Examples of predetermined factors are demographics (e.g., the development of teenage population in the United States) and the future number of cancer patients eligible for radiation treatment [13,20]. According to Schwartz [13], these predetermined trends and developments are either slowly changing phenomena, already in the pipeline of the future, or are results of constrained situations or inevitable collusions. Scenario analyses, however, mainly focus on uncertain factors. Uncertainties refer to those factors of which the outcomes are known, but not yet their coming about. They are so unique as not to provide use with an indication of likelihood [3,9].[4] Examples of (fundamental) uncertainties are economic growth in countries, like Iraq, and the development of the political relationship between Continental Europe and the United States. In the scenario processes under consideration, this classification constitutes a crucial step in the scenario process as the uncertainties determine the main differences between the scenarios, while the constant and predetermined elements remain the same for every scenario. The clustering of the driving forces is an important activity in Phases 2–4. The aim of clustering is to reduce the number of relevant driving forces into a smaller and more manageable number of higher level constructs, for human beings are usually severely constrained in their possibilities to adequately cope with the host of different stimuli and data they are confronted with [17,21]. The next action is then to identify the (two) general areas of critical uncertainty, which will form the bases of the scenarios. Van der Heijden et al. [17] indicate in their most recent book that this can be done by drawing a two-dimensional ranking space which indicates on the one hand the 'level of impact' (high/low) and on the other the 'level of (un)certainty' (high/low). The two most important and most unpredictable (uncertain) clusters/factors are subsequently chosen for scenario construction (see Fig. 2).

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[2] Many authors fit in this tradition because they are influenced by their former Shell experiences or, directly or indirectly, make use of, or build on, these experiences, for instance, Ringland [15], Schwartz [13], Van der Heijden [3], Wack [16].

[3] We refer to Refs. [10,19] for a discussion on other methods of scenario planning.

[4] Lempert et al. [9], in this respect, indicate that uncertainties exist when those involved do not know or cannot agree on (1) the appropriate models to describe the interactions among the relevant factors, (2) the probability distributions attached to the relevant factors, and/or (3) how to value the desirability of alternative outcomes of the relevant factors.

Step 1: Identify focal issue or decision

Step 2: Key forces in the local environment

Step 3: Driving forces

Step 4: Rank by importance and uncertainty

Step 5: Selecting the scenario logics

Step 6: Fleshing out the scenarios

Step 7: Implications for strategy

Step 8: Selection of leading indicators and signposts

Step 9: Feed the scenarios back to those consulted

Step 10: Discuss the strategic options

Step 11: Agree the implementation plan

Step 12: Publicize the scenarios

Fig. 1. A possible representation of the process of scenario development [1,15].

Note that this is essentially the approach proposed by P. Schwartz [13]. By playing out these uncertainties as if they had occurred, each scenario depicts another future state. In doing so, the scenarios together highlight the importance and consequences of these uncertainties. By making plausible scenario plots or stories [13] and by looking for causal structures, each scenario is filled with
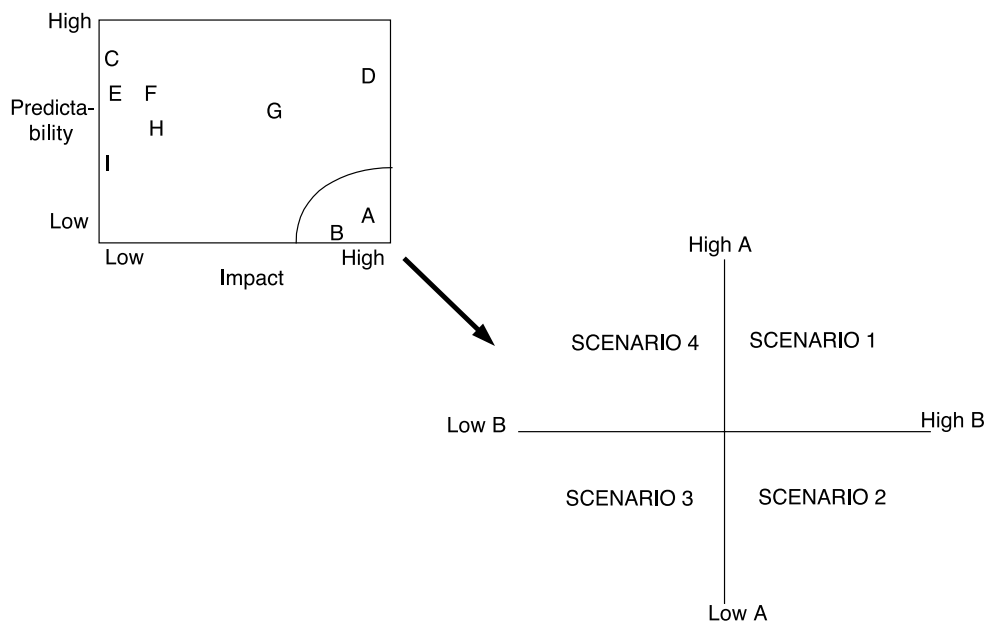

Fig. 2. Scenario construction, adapted from Ref. [17].

interrelated events, trends and patterns. To let scenarios be accepted by organizations, managers participate in the construction process of scenarios and translate them to their decision situations in order to be understandable, feasible and internally consistent. They do not have to reflect the 'most likely' future nor the one entitled as 'good' or 'bad', as such qualifications are meaningless, and each of the scenarios may be just as plausible given the host of future uncertainties.

Next, we discuss the functions of scenarios for managers and their organizations. The traditional uses of scenarios and scenario development are evaluation and selection of strategies, integration of various kinds of future-oriented data, exploration of the future and identification of future possibilities. More recently, scenarios aim at making managers aware of environmental uncertainties, stretching managers' mental models, and triggering and accelerating processes of organizational learning [1]. The last three functions have been added through the years as experience with multiple-scenario analysis grew. Moreover, they are the main reasons behind the present popularity of scenario thinking among business organizations. In contrast to the first three functions, which have a more methodological character, each of the next three circles around the mental models of managers. As Wack [22] puts it: "scenarios deal with two worlds: the world of facts and the world of perceptions" (p.140). Scenario analysis aims at influencing managers' way of thinking by offering managers several fundamentally different future perspectives on the world around them. These perspectives indicate and/or visualize the fundamental future uncertainties, by which (strategic) managers are confronted. The perceptual differences also influence the images people construct of the future, both consciously and unconsciously [18]. As we look further into the future, the number of ways in which the future may develop grows exponentially [10]. Given their cognitive limitations, people can only conceive part of this future range of possibilities. Scenarios are a way of looking at the future by using and combining various images. They are convenient ways for, as Schwartz [13] puts it, 'rehearsing the future' or, as Van der Heijden [3] indicates, 'memorizing of the future'.

However, when we consider the current external environment of organizations, we can observe trends and countertrends, complex trends, and trends or clusters of trends that had not been thought of beforehand. In short, complexity is growing, causality relationships may be ambiguous, and changes are speeding up—with severe consequences. Particularly, the sociopolitical and cultural environment turns out to be practically unpredictable, public issues emerge as total surprises, and companies are faced with the simultaneity of trends and countertrends [5]. Here, we enter an area in which scenarios offer little help because uncertainties are surpassed by unknowables, indicated in Fig. 3 as the area where only 'hope' may be helpful [3].

Methods and techniques of forecasting, in general, aim at the predetermineds; these predictable elements can more easily be forecasted. While scenario planning is more suitable to deal with (not too many) uncertainties in the not too far distant future, events like the September 11 incidence and the subsequent war on terrorism by the United States of America were not conceivable in the year 2000. Exploring and discussing the implications of such unknowables may become very relevant for decision/policy makers. Scenario planning, as we discussed it above, is well equipped to deal with predetermineds and uncertainties. It leaves the unknowables out of the discussion. In the next section, we discuss this aspect more in-depth.

This short methodological overview is the basis for our further discussion of scenarios [5,6,23]. Our remarks center on the following:

– The fact that scenarios aim at predetermineds and uncertainties, whereas unknowables are mostly left out of the discussion.
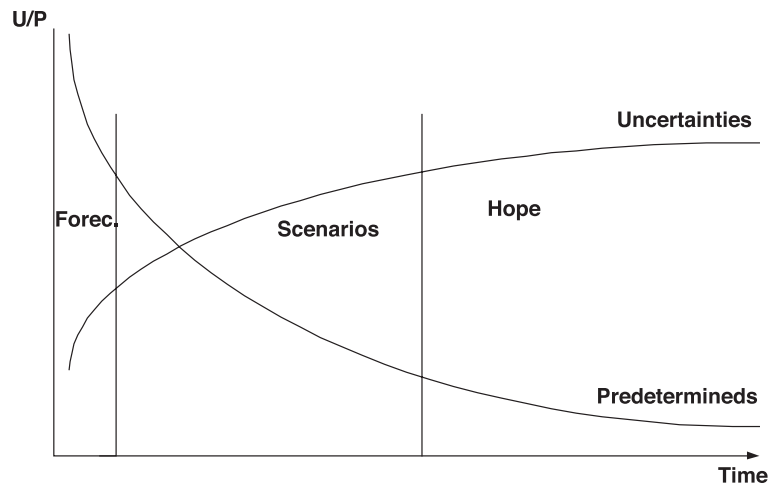
Fig. 3. Forecasting, scenarios and hope [3].

– The functions of scenarios—scenarios are used for choosing among strategic alternatives and they determine the way of perceiving and thinking of decision makers. What happens to strategy formulation if scenarios are not consistent and/or causality is infringed?

These aspects, which are related to each other, are subsequently discussed in the next section.

3. Limitations of the scenario approach

The first issue, that of unknowables, is related to the idea that the scenario approach has to deal with what is known and what is not known in order to provide relevant information for early-warning purposes. As indicated, scenarios especially aim at predetermineds and uncertainties. Predetermineds exist based on the assumption that the alternative future outcomes of events and developments, and their probabilities, are a priori known; in case of uncertainties, the outcomes are known but not their probabilities. For unknowables, even the outcomes are not known. Moreover, these unknowables cannot, by definition, be forecasted and, therefore, they form the ultimate challenge because they could become very relevant for decision makers. This growing problem was brought to management attention by Ansoff [24], who distinguished between 'uncertainty' and 'ignorance' with respect to future developments and emphasized the role of the latter with respect to strategic discontinuities. This has severe implications for the kind of information that has to be processed in strategy formulation, resulting in specific requirements for scenario building. The classification of Schoemaker [25] can be helpful to illustrate what we mean here. Schoemaker [25] discusses future relevant knowledge by distinguishing between three classes of knowledge:

1. Things we know we know
2. Things we know we do not know
3. Things we do not know we do not know.

Knowledge of Type 1 is evident. Scenario building is especially helpful at supporting knowledge development of Type 2. The main challenge is to transform knowledge of Type 3 into knowledge of Type 2. This represents the genuine task of an early-warning system such as scenario planning. By making assumptions on the relevant issues or trends/events, which are not visible yet, and by discussing these, their implications can be indicated and discussed. The idea here is searching for something without knowing what it is and where to find it. Several creativity-enhancing or brainstorming kind of methods and techniques, of course, can be used for this aim [26]. This also depends on the mindsets of decision makers and the way they come into being and can be adapted. As such, learning capabilities of the involved actors are important here. In this respect, contextual understanding and perception of trends/developments/events are important. See Ref. [6] for a more in-depth discussion of this issue. In our opinion, scenario planning, as discussed above, should be more receptive for and oriented towards exploring and discussing also these unconceivable elements. Otherwise, the requirements for a true early-warning function would not be met.

The second issue indicates that scenarios do not prevent management from being surprised. Companies are regularly confronted with entirely unanticipated situations. Thus, although scenario building does not mean forecasting and nobody would seriously claim that scenarios should predict the future in exact detail, it is striking how often situations occur that were simply not included or were excluded as 'logically impossible' or 'inconsistent' during the process of scenario building. Consistency testing is one of the main tasks during the scenario construction process [3,14]. However, a main problem with this is that scenarios, therefore, cannot deal with inconsistency, especially when the future (or even current) situation does not lie within the corridor of the various 'extreme but consistent' forecasts but rather lies beyond it and reveals different dimensions in surprising combinations [5]. If scenarios, based on the conventional concept of straightforward, nonparadoxical trends and/or simple dichotomies, ignore trends transgressing boundaries and contexts, they are not helpful in exploring the future but rather tend to produce misleading results. For instance, in scenarios, often expected GDP growth is taken as an indicator for economic growth; however, the assigning of high and low levels of growth depends on the context (e.g., for China, a GDP growth of about 5% would be relatively low, but for the United States, it would be high). In addition, if causality and direct cross-impacts are used as the only driving mechanisms for reaching a consistent result, new associations are likely to be neglected. Causality indicates that a high level of growth of GDP cannot coincide with a high level of unemployment (a situation now known as jobless growth) or a low level of investments. If scenarios do not or cannot deal with this, which, in fact, represents a situation with a higher degree of complexity, serious problems for strategic decision making may pop up. In case scenarios are used as supportive tools that provide or influence interpretation schemes for strategic managers to give meaning to events, they may as well provide either better lenses or blinkers in organizational decision processes. Let us have a look at Randall's [27] four scenarios for the Internet. Randall had postulated that the following four global traits be extreme and, therefore, mutually exclusive: "interactive, entertainment-focused, community-based medium, which has mass market appeal"; "passive, narrowly segmented medium, which allows users to receive customized information and niche-oriented services"; "interactive, transaction-oriented medium, which provides both consumers and professionals with a range of commerce-based activities"; "unorganized, unstructured, chaotic frontier, which offers questionable value to consumer and professional markets". All these traits seem quite familiar for us today; we are more or less confronted with all four scenarios at the same time—a far more complex setting than each single extreme scenario. Obviously, the important point was not that there was some driver that has developed in one or the other direction, but that the phenomenon of segmentation did occur. If a company had constructed these four scenarios and had been focusing on the drivers without

realizing the segmentation, it might have become helplessly confused when interpreting the occurring events because the level of analysis (the Internet) turned out to be inappropriate.

These issues do not so much reflect the failure of scenario-workshop participants' and the facilitator's lack in creativity and imagination, but rather indicate inherent methodological restrictions of scenario planning as discussed in this paper. This is of particular relevance because scenarios are not only a means of identifying robust strategies which may prove useful in very different environmental settings[5], but they also give meaning to (future) events [6]. Can these issues be handled and how can it be done? The key to answering this question lies in our opinion in how to deal with trends, new (unknown) trends and especially paradoxical trends that are crucial for a firm's future but cannot yet be foreseen. In addition, complementary to this, recent developments in computer-supported scenario development offer a possible avenue to deal with this challenge [9].

4. Alternative ideas to formulate scenarios

Ideas on how to address the above discussion can be found in the recent literature on scenarios. Gregory and Duran [23] and Ringland [28] give a set of guidelines or lessons to construct scenarios:

Gregory and Duran [23]
- Use concrete examples.
- Use representative events.
- Use easily recalled supporting evidence.
- Use commensurate measures across alternative scenarios, even if irrelevant.
- Ask the decision makers to project themselves into the situation.
- Ask the decision makers to predict how they would act (and feel) in the scenario.
- Consider participants' prior experience with the target event.
- Use plausible explanations.
- Use causal arguments.
- Ask participants to explain outcomes, perhaps using an established list.
- Treat the premise or outcome as true or as having occurred by using the past tense.
- Use implausible rival scenarios.
- Use multiple scenarios.
- Avoid reactance.
- Monitor the situation in which scenarios are presented to individuals.

Ringland [28]
- It may not be necessary to develop scenarios: discussion of existing ones may provide the desired framework for discussion and decision.
- Take the time and effort to ensure all team members are familiar with the process.
- Decide on the desired outcome: whether a set of scenarios should be for discussion or decision or dialogue between industry players.
- Ensure there is a wide range of input.
- Include unbelievable scenarios.
- Do not be content with the first set of scenarios created.

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   [5] Also metaphorically conceived as wind tunneling or using scenarios as testbeds.

Some of the messages of this review refer to deriving implausible/unbelievable scenarios, which can be the case when scenarios also include developments that indicate novel, not very well interpretable trends and events. An example of such a situation concerns the political preferences of the Dutch voters: in early 2002, the left–right 'purple' coalition of social democrats (labour party and D66 party) and liberals (VVD) seemed to continue for another period of four years. In spring of 2002, the new (right wing) party of populist Pim Fortuyn (List Pim Fortuyn, LPF) suddenly came up and subsequently became the second largest party in the Netherlands after the elections in May 2002 (without precedent). After a short period, in which the LPF formed a government with the conventional Christian Democrats (CDA) and VVD, this government fell again. At this moment (ultimo 2003), there is a new government of CDA, VVD and D66—again, a new coalition. The normally predictable Dutch politics is clearly under attack [29]. Therefore, allowing really novel developments into scenarios might be a first step in order to introduce growing complexity.

Although the established scenario methodology is clearly suitable in instances where the variation in uncertainties represents the various new conditions, for more turbulent situations such as described above, we think that this methodology should be modified and stretched. Originally, applying a certain causality and consistency structure, in which the attributes of the chosen scenario elements could assume (exclusive) different values and are unambiguously related to each other, creates the scenarios. In this way, a scenario represents a combination of alternative values of some of the key driving uncertainties (see Fig. 2). We think that this need for such a structure may be moderated; for instance, it's not really always compulsory to regard causality as a necessary prerequisite for scenarios. This was also pointed out by Van der Heijden [3], who focused on causality primarily because, for managers, it is the preferred way of thinking. Moreover, hindsight outcomes can often be explained in causal terms [8]. Furthermore, consistency is mainly used for conveniently reducing the number of scenarios to a manageable amount. This is a purely pragmatic reason. Consistency is only required for definitional relationships; that is, all (causal) relationships based on a certain underlying behavior may change with that behavior, a phenomenon that was thematised by Galtung [30] as an effect of 'third variables'. Consequently, a second step, to increase the complexity of scenarios, consists of allowing the exclusion of causality restrictions and the inclusion of inconsistency effects, particularly paradoxical trend (cluster)s, which include both trends and their corresponding countertrends. Some other authors, for example, Shakar [31], speak also of 'paradessence'. Typical examples are glocalisation (i.e., local specialisation in a globalizing economy), authentic inauthenticity (see Ref. [32]; a perfect blend of reality and simulation; a stylish mix of fashion themes from different periods; the ironic but tasteful use of citations from low culture in high art, etc.) or the rise of the Bobo (see Ref. [33]; *Bo*urgeois *Bo*hemians, who combine a bourgeois lifestyle with bohemian attitudes and values).

Thus, the question arises: How can alternative scenarios be formulated, when for instance, trend and countertrend are part of one and the same scenario? In the following, three options are presented. They are called recombinant scenarios, context scenarios and inconsistent scenarios.

First, one could switch from scenario elements (drivers) to trends as the basic entities for scenario development. In the conventional way of scenario building, clusters of trends are merely represented implicitly by alternative combinations of element values (i.e., values of drivers). For creating more comprehensive scenarios, one could recombine trend (cluster)s, which are assumed to occur simultaneously. This means that, for each scenario, we select from the set of available trends—paradoxical or not—a subset of trend (cluster)s that is regarded to be relevant. In doing so, the joint existence of trend and countertrend can be recognized, and (in)consistency is no longer an issue. The alternative scenarios

are now based more on association and co-occurrence [of trend (cluster)s] than on the notion of causality (among drivers). Because alternative scenarios are primarily distinguished by different recombinations of trend (cluster)s, we call them 'recombinant scenarios'. For writing a scenario storyline, causalities are not indispensable; if one looks at the stories developed for conventional scenarios, it is striking how seldom they refer to underlying causalities. Particularly, if the number of drivers is high and the causalities are manifold and complex, it becomes virtually impossible to identify how we ended up with a specific result. Then, the scenario story has to be told without a detailed reconstruction of the underlying causal mechanisms.

Second, alternative scenarios can be formulated by introducing so-called wild cards [34], that is, unusual events that may be disruptive to the base-case, surprise-free scenario. For example, such events may include the failure of the Euro currency, the breakdown of the global finance markets, or the decline of Internet use. In contrast to the conventional use of events as a trigger of 'what if' questions, it is more appropriate to ask the inverse question 'what (must happen), so that'. This question refers to the basic assumptions about causalities and, particularly, the circumstances and contexts in which these causalities are valid, or become invalid. For example, "what must happen, so that GDP growth may be associated with high unemployment?" or "what must happen, so that a government coalition of strange bedfellows will be formed?" Experience suggests that a development becomes particularly powerful when trends from different areas like economy, culture, technology, society, etc., coincide or merge. We have found this approach particularly useful for technology and product assessments when the risks and opportunities of innovations have to be evaluated. For example, one would ask in which contexts a product would have to be used in order to provide maximum utility or damage [6]. For a brand, one would investigate in which contexts, including functional aspects and aspects of use as well as the symbolic aspects, it would develop optimally or would be damaged most seriously, etc.

Contexts are particularly important where developments in the business environment are dependent on interpretations. Particularly, public issues are context-specific and, often, a matter of framing and perception. A context analysis may include the investigation of (cf. Ref. [6]) emerging trends or imminent events in the environment that may lend them to the sudden reframing of an issue, which could delineate new surprising cleavages or conflicts. Therefore, the characteristic feature of context scenarios is the appropriate variations of the contexts to find out about their consequences. Let us give an example. Recently, a German bank ran an advertising campaign with the slogan "Jedem das Seine" (lat. "suum cuique" or freely translated into English: "you get what you deserve"), which had formerly been used by the Nazis at the entrance of their Buchenwald concentration camp. Although it was done inadvertently, it led to a scandal. On the other hand, the slogan had been used in Germany some years earlier by an American fast food chain and a cellphone manufacturer without causing massive protest among the public [35]. This demonstrates that prediction is almost impossible and that eventualities have to be considered. When searching for eventualities, contexts are the relevant intermediary for this purpose: "Which contexts must be applied, so that maximum damage will happen?" This reversal has several methodological implications. First, we do not need a lot of scenarios to explore all sorts of 'what ifs', but have to identify the (few) combinations of contexts (i.e., scenarios) that are critical. Second, the procedure of building context scenarios is not identical with traditional best-case/worst-case scenarios. In the case of unpredictability, variables (i.e., scenario drivers) can no longer be set to their optimistic or pessimistic values beforehand. What these qualifications mean can no longer be an input to the investigation, but represents its output. Third, the "what must happen, so that" question has a clear

problem focus, which can help to avoid the consideration of useless but distracting scenario drivers. Taken together, these three implications reflect an orientation towards strategic issues [36] and, therefore, towards the requirements of strategic management. The procedure of building context scenarios is discussed in more detail in Liebl [6].

Third, there may be reasons why one may want to keep large parts of the conventional scenario technique including the recognition of cross-impacts. Then, it will prove useful to extend the scenario-building process by an inconsistency analysis to introduce (seemingly) paradoxical developments. This inconsistency analysis, essentially a sensitivity analysis with respect to cross-impacts and consistency measures, is carried out as follows: Those elements in a cross-impact or a consistency matrix that indicate low probability/high inconsistency are changed into high probability/consistency, respectively. As a consequence, a set of scenarios that were otherwise ruled out as inconsistent becomes possible. These resulting 'now-consistent scenarios' are subsequently analyzed and the workshop participants try to write a compelling storyline for them. It regularly turns out that it is not very hard to find a possible rationale, that is, a plausible change of contexts or a shift in the underlying causalities, for these scenarios were formerly regarded as virtually impossible. This technique of consciously introducing inconsistency has been successfully applied in a recent study on the Chinese market for dental care [37]. An alternative, inverse way of using inconsistencies could be applied in the case of quantitative scenario techniques: When assessing the inconsistencies of scenarios, the most contradictory constellations of scenario elements are identified. Then, the workshop participants are challenged to formulate complex, paradoxical trends that may lead to this kind of behavior, as a way to get access to some of the unknowables, which are particularly prone to surprise.

These ways of (re)thinking on scenarios offer potential to deal better with uncertain contingent events (such as low-probability, high-impact events) and paradoxical trends, which, per definition, cannot be predicted. Moreover, an interesting development to support this can be found in Lempert et al. [9], who discuss how, under assumptions of deep uncertainty (see footnote 4), a quantitative approach to scenarios can be helpful. They indicate the potential of mathematics and computers to complement strategic decision makers when it comes to long-term policy analysis. This potential mainly consists of developing such a large number or ensemble of scenarios by using specific scenario-generating software, that all possible future contingencies in the context of a certain strategic problem will be included. This is probably most fruitful in the context of recombinant scenarios.

5. Concluding remarks

In this paper, some possible extensions are suggested with respect to the scenario technique, as it comes forward in publications, that can be placed in the Shell-scenario tradition [2,3,13,16,17,22,38]. Some core elements of this tradition are described in Section 2. For instance, Van der Heijden [3] divides driving trends and future developments into predetermineds and uncertainties. He also explicitly indicates that he cannot deal with unknowables. According to Van der Heijden [3], hope is then the only solution. Causality and consistency are indicated as methodologically necessary criteria. In this paper, we discuss that this can lead to serious problems with scenario users and strategic decisions that are taken based on this method, especially in situations in which environmental turbulence (i.e., contingent developments, hypercompetition, coevolution) is very high, where dealing with predetermi-neds and uncertainties only might not be sufficient. Our discussion indicates that there are paradoxical

and complex trend (cluster)s that had not been thought of beforehand. We suggest three alternative ways for scenario construction. These include recombinant scenarios, context scenarios and inconsistent scenarios. Recent developments in scenario-generating software tools offer support potential for scenario developers (cf. Lempert et al. [9]). These options explicitly incorporate the notion of 'paradoxical trend' as the codriver of future developments into the methodology. They are also in line with the ideas of Bruun et al. [8], who discuss unconventional and event-based scenarios as alternatives for conventional/ trend-based scenarios. If we want to continue using scenarios as tools for perceiving, framing minds, and thinking of (top) managers (more recent roles of scenarios) and decision support in the context of strategic decision making (more traditional role of scenarios), these modified kinds of scenarios indicate possible avenues to address the mentioned problems.

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