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Scenario Planning for Strategic Decision-Making, Learning, and Managing Uncertainty

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SUMMARY

In times of radical uncertainty marked by geopolitical conflict, technological disruptions, societal transformations, and climate risk, scenario planning is critical for strategists. In this introduction to the special issue on scenario planning, we showcase scenario planning as a dynamic, integrative approach for strengthening strategic decision-making, facilitating organizational learning, and enhancing management amidst uncertainty without trying to predict the future. We highlight what we see as the collective contributions and managerial takeaways of this special issue that underscore the relevance of scenario planning for organizations seeking adaptability, resilience and success in turbulent environments, and suggest directions for future research.

KEYWORDS: scenario planning, strategy, decision making, learning, uncertainty, resilience

Introduction

The strategic landscape is unquestionably uncertain—even *radically* uncertain.[1] Climate change, the COVID-19 pandemic, wars in Gaza, Ukraine, Iran, and Sudan, the introduction of artificial intelligence (AI) and other technological breakthroughs, rapid changes in tariff and other trade policies, forced migrations and their backlashes all manifest challenging conditions businesses

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must address, and if at all possible, strategically. In this uncertain and ambiguous landscape,[2] it is no surprise that acronyms like VUCA (volatility, uncertainty, complexity, ambiguity), TUNA (turbulent, uncertain, novel, ambiguous),[3] BANI (brittle, anxious, nonlinear, incomprehensible) and RUPT (rapid, unpredictable, paradoxical, tangled)[4] have gained traction. The ability to imagine, anticipate, and prepare for new challenges and seize unprecedented opportunities[5] amidst this uncertainty is necessary for organizations of all types.

This special issue of *California Management Review* refocuses on the value that scenario planning can bring to strategizing amidst uncertainty. Scenario planning helps executives explore plausible ways the future could unfold while recognizing the future remains in many ways uncertain.[6] Scenario planners typically develop a small set of contrasting scenarios,[7] each describing a plausible future state and how it might impact the operational or strategic environment.[8]

After the French government,[9] RAND Corporation, and the US military began using scenario planning in the 1950s,[10] Royal Dutch Shell took scenario planning into the corporate realm in the 1970s.[11] Shell's use of scenario planning influenced its broader adoption;[12] it was said to have "a huge influence on how businesses, governments, and other organizations think about and plan for the future."[13]

There is rich and growing peer-reviewed literature on scenario planning;[14] though much of it resides outside mainstream management research outlets—a seemingly paradoxical reality, given its practitioner-driven foundations. Within management and strategy research, scenario planning has emerged intermittently over the years—notwithstanding notable publications—and it has at times been misrepresented.[15]

Perhaps one reason for the sporadic presence of scenario planning within mainstream strategy and management literatures is that its use is both an art and a science.[16] Scenario planning relies on deep analyses of an organization and its strategic environment, and uses a variety of methods and techniques[17] to develop a creative set of scenario end-points and narratives on how these are reached over time[18] to inform strategy. This analytical and creative process taps both the right and left hemispheres of the brain,[19] making it somewhat elusive to define and measure despite its proven advantages to strategic management, organizational learning, and decision-making.[20]

One goal in proposing this special issue of *California Management Review* was to create space for authors working at the intersection of management and scenario planning to publish new research in an outlet where the rigor of their research, relevance to practice, and key takeaways for managers could be highlighted.

As the articles in this special issue attest, scenario planning is becoming increasingly sophisticated as managers imagine and anticipate plausible futures to support strategy development and keep their organizations flexible and resilient.[21] Articles in this issue show instances where scenario planning goes far beyond

navigating and strategizing for general uncertainty and volatility, to supporting acquisition decisions,[22] as well as to occasions where scenario planning is mandated.[23] The use of AI in scenario planning is another aspect attracting increasing attention,[24] and while several AI-related papers submitted to the special issue did not make it through the editorial and review processes we appreciate the rigorous practical research being done in this area. As this topic advances, we look forward to seeing more publications exploring this domain.

As one of only a handful of editorial collaborations focusing on scenario planning in management journals, this special issue contributes important insights into the contemporary role that scenario planning is playing in organizations. Scenario planning can help especially in strategic decision-making, organizational learning, and managing uncertainty—each of which solidifies its value to management more broadly. In this article, we preview the special issue contents and discuss the articles under each of the interrelated themes addressed by this issue—namely, strategic decision-making, learning, and managing uncertainty—and provide key managerial takeaways to advance scenario planning practice. Also, we highlight future research opportunities raised by the special issue articles, to set the agenda for advancing scholarship of scenario planning as an essential tool for managing in the unpredictably and rapidly evolving twenty-first century.

Preview of the Special Issue Contents

The following sections provide brief descriptions of each article to provide context for the depth and breadth of this special issue. Each article contributes to the literature where scenario planning and management intersect. These contributions range from globally difficult problems to particular scenario planning interventions, and collectively exhibit the range and applicability of scenario planning to diverse management issues.

Beyond Box-Ticking: Improving Climate Scenario Planning for Informed Corporate Decision-Making

This study by Wade et al.[25] critically examines how large companies use mandated climate-related scenario planning and finds that many are treating it as a "box-ticking" disclosure exercise rather than an important strategic tool. Scenario planning can help organizations understand climate risks and opportunities, stress-test strategies, build resilience, and support investor decision-making. Yet analysis of public reports from 24 major Australian companies across six climate-exposed sectors reveals major differences in scenario methods, data, assumptions, and the extent to which results influence real decisions. Most firms studied provided limited detail on how scenarios were built, what assumptions underpinned them, and how they informed strategy.

The study evaluates scenario quality along dimensions such as plausibility, coherence, transparency, internal consistency, creativity, and relevance—it adds comparability as a crucial marker for financial reporting. Results show wide

variation in temperature projections, reference datasets, and parameters, making it difficult for investors to compare firms, opening space for greenwashing and cherry-picking favorable futures. Overall, integration into decisions was frequently found to be vague, with only a subset of firms demonstrating concrete shifts in investment, business models, or risk management.

Given Australia's high and varied exposure to climate risk and its move to mandatory IFRS-aligned climate reporting, these findings have international relevance. The authors argue for clearer standards and practical guidance on scenario methods, data sources, and reporting expectations. They propose a six-question framework to help managers align scenario purpose, stakeholders, methods, quantification, assumptions, and decision integration.

Bringing Intuition Back to Scenario Planning

This article by Sadler-Smith and Metz[26] explores how intuition can play a more explicit, disciplined role in intuitive logics–based scenario planning. Intuitive logics is the standard scenario method, rooted in the work of Kahn and Wack,[27] designed to move beyond linear forecasting by creating a few rich, plausible alternative futures. Although this approach explicitly values gut feeling and tacit knowledge, the concept of intuition has remained underdefined and underused in practice.

Drawing on psychology and management research, the authors define intuition as a fast, experience-based, largely unconscious mode of processing (System 1) that complements slower, analytical reasoning (System 2). Intuition typically manifests as *gut feelings* grounded in pattern recognition, and can take two main forms: automated expertise (expert intuition built from repeated exposure to similar situations), and holistic hunch (creative synthesis of diverse, often weak signals into novel insights about the future). Both forms are valuable but each has risks; expert intuition can reinforce business-as-usual thinking, while holistic hunches can be misapplied or dismissed if not understood or tested. The article identifies seven cross-cutting themes where intuition theory and intuitive logics intersect—narratives, somatic markers, automated expertise vs. holistic hunch, remarkable people, collective intuitions, protecting against downsides, and integrating intuition and analysis—and provides practical recommendations for each.

The authors conclude that explicitly acknowledging, structuring, and testing intuition can enhance foresight, support learning, and improve strategic decision-making—especially in volatile, uncertain, complex, and ambiguous environments where data and prediction alone are insufficient.

From Narratives to Valuation: Strategic Scenarios as Option Games

This article by Smit and Moraitis[28] proposes that high-stakes investment decisions—especially in mergers and acquisitions (M&A) and large infrastructure projects—can be improved by combining scenario planning with real options and game theory into what the authors call "option games." The core problem

they tackle is the strategic tension between flexibility (waiting, staging, adapting investments) and commitment (moving early to preempt rivals and shape the game).

They suggest that traditional tools fall short on their own. Scenario planning is good at telling rich, qualitative stories about multiple futures but often lacks the numerical granularity needed to guide concrete bids or investment timing. Discounted cash flow models simplify uncertainty into single projections or crude best/base/worst cases, often ignoring competitive dynamics and disruptive change. Real options and game-theoretic models provide rigorous valuation of flexibility and strategic insights but are typically too technical and abstract to be used directly by executives. Option games integrate the strengths of these approaches, and two detailed applications illustrate it: one concerns a flexible, staged airport expansion under uncertain demand and environmental constraints, the other a mining company's acquisition strategy.

The article's contributions center on: (1) translating sophisticated option game theory into a normative, practitioner-friendly framework; (2) showing how option game visualizations can sharpen scenario-based valuation in M&A and other capital-intensive decisions; and (3) offering a stepwise guide (scope, players, trends, uncertainties, solve the game, stress-test assumptions) that turns uncertainty from a vague backdrop into a structured strategic advantage when managed well.

Navigating Scenario Planning in the Face of Bias, Strategic Persistence, and Power Dynamics

This article—an autoethnographic study by González and Heracleous[29]—examines how scenario planning at NASA's Johnson Space Center (JSC) influenced long-term strategic direction despite initial leadership resistance. Led by a Complete Member Researcher with more than three decades inside NASA, the study reveals how strategic persistence, cultural bias, and entrenched power structures can shape the use of scenarios in large technical organizations.

JSC historically operated under destination-driven strategies aligned with shifting presidential priorities for human spaceflight. In 2005, a new Center Director asked for a twenty-year strategy that anticipated an evolving environment, prompting NASA's Advanced Planning Office to create scenarios that incorporated emerging commercial and international space capabilities. A hand-selected team of "remarkable thinkers," intentionally chosen from outside the leadership cohort, developed three plausible futures emphasizing program management, operations excellence, or an expanded "integrator" role linking NASA with commercial and international partners.

Leadership resisted these scenarios, influenced by such cognitive biases as representativeness, availability, and anchoring (as documented by Tversky and Kahneman).[30] Many leaders believed commercial human spaceflight was unrealistic and preferred to assume JSC's historical dominance in human spaceflight

would continue. At a 2006 strategic retreat, leadership rejected the externally-focused scenarios, and instead created their own destination-driven alternatives that reinforced traditional assumptions.

Despite this, the scenario process catalyzed important organizational shifts. Discussions during and after the retreat began to embrace the integrator concept, ultimately leading to strategic alliances, creation of a Chief Technologist role, innovation initiatives, partnerships with industry, and cultural adoption of scenario terminology.

The study highlights three challenges leaders must assess before scenario planning: strategic persistence rooted in past success, deep cultural biases, and organizational power structures. It also shows that even when leadership initially rejects scenario outputs, scenario processes can seed new mental models, broaden perspectives, and enable long-term strategic evolution. This case contributes practitioner and theoretical insights into how unconventional scenario teams can influence strategy within complex, hierarchical organizations.

Conceptual Positioning of the Papers

The four articles assess a wide set of applications, and manifest notable differences in the units of analysis examined and thematic orientation of their content. We depict these visually in Figure 1. Applications of scenario planning can range from an individual project to the societal level. Among the four papers, Wade et al. address firm and industry levels, Sadler-Smith and Metz span individual to firm levels, Smit and Moraitis describe project-level applications, and González and Heracleous provide a firm-level study. Similarly, the content of scenario planning studies can offer insights through descriptive as well as prescriptive analyses, and we depict the type of insights of each paper on the horizontal axis of Figure 1.

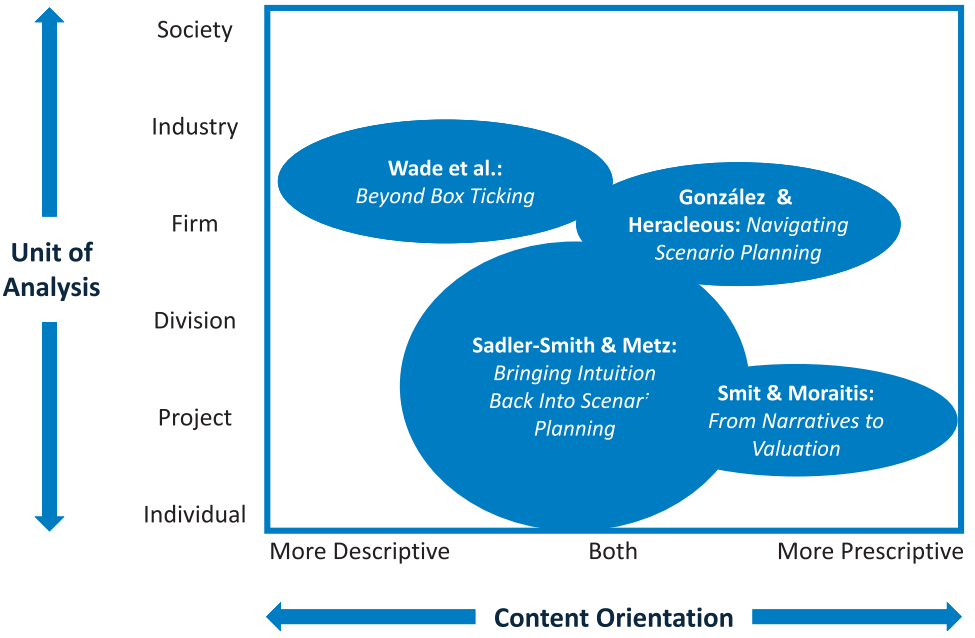
Themes and Managerial Takeaways

The key themes of our original call for papers are evident in the articles: Strategy, Learning, and Managing in Uncertain Contexts, all of which are interconnected. Next, we discuss these themes, describe how the papers relate to each, and summarize managerial takeaways.

Strategy

Developing a small set of scenarios helps strategists think more systemically[31] about key opportunities and challenges, and can help compensate for biases that lead to poor choices, like narrow thinking and overconfidence.[32] Scenario planning seeks to enhance the quality of strategic conversations as well as decision flexibility,[33] and has been found to help leaders develop more flexible strategies.[34] Scenarios also support option generation and decision-making by allowing strategies to be tested and refined against them[35] to develop better

FIGURE 1. Conceptual positioning of the papers



strategies that prepare an organization for different possible future contexts, seize opportunities, and hedge against downsides.[36]

All articles in this special issue speak to the ability of scenario planning to support better strategy. Collectively, they cover topics ranging from improving decision-making rigor (Smit and Moraitis, Wade et al.) and the wisdom of harnessing wider cognitive diversity (Sadler-Smith and Metz), to the influence of power dynamics on strategic conversations and decisions (González and Heracleous). Overall, these artices reinforce the premise that scenario planning enables robust and adaptive strategy.

Some authors have argued that scenario planning on its own is not sufficient and needs to be paired with other practices to have lasting impact.[37] That perspective is supported by Smit and Moraitis, who complement scenario planning with option games to improve investment decision-making. In a similar vein, Wade et al. advocate for companies to move beyond treating scenario analysis as a "box-ticking" exercise, and instead invite them to thoroughly engage scenarios to improve climate change resilience efforts and enhance their transparency to investors.

The benefits of approaching strategy from multiple diverse perspectives was reflected in several ways in this special issue. In their study of scenario planning at NASA, González and Heracleous show how scenario planning led by a non-leadership team affected leadership decision-making in the long run despite facing initial resistance. Sadler-Smith and Metz underscore the role of intuition in scenario planning to support better long-term decision-making.

Key takeaways that emerge in relation to strategy and strategic decision-making include:

- The quality of strategic decision-making rests on inputs from diverse perspectives and integrity of the scenario planning process. With a scenario planning process that is transparent and rigorous (Wade et al., Smit and Moraitis), scenario planning enables multiple voices (González and Heracleous), and cognitive approaches (Sadler-Smith and Metz) to enhance decision-making.
- Scenario planning remains a combination of art and science—bridging analysis and imagination. Collectively, complementing intuition (Sadler-Smith and Metz), qualitative analysis (Wade et al., González and Heracleous), and quantitative analysis (Smit and Moraitis) can support rigorous, creative strategies.
- Scenarios enable strategies that balance flexibility and commitment, whether using options-based models (Smit and Moraitis) or other approaches.

Learning

Scenario planning has long been established as a useful "approach towards learning about the business environment"[38] and aid to organizational learning.[39] It facilitates learning by updating the mental models of decision-makers,[40] and surfacing and challenging managerial assumptions about what is plausible,[41] to help identify a wider range of potential future opportunities and threats[42] and promote better decision-making.[43] Scenario planning has also been found to expand participants' mental models of what they perceive as important, increase systems thinking, and increase trust between participants.[44]

This special issue furthers such learning in unique ways. Taken together, the articles address intuitive learning (Sadler-Smith and Metz), managerial learning despite resistance (González and Heracleous), developing more quantified insights (Smit and Moraitis), and overcoming a potential barrier to learning (Wade et al.).

Sadler-Smith and Metz lay out the value of intuitive learning to develop and surface tacit knowledge during scenario planning, which can reshape mental models. They advise working with both individual and collective intuitions by listening to how one's body responds during scenario work, and including remarkable people in the process—a reference to Wack's[45] term for people who have the ability to think outside the norm, frame situations differently, sense change, produce novel insights, and be thought of as worth listening to.

Iterative organizational learning despite resistance is apparent in González and Heracleous' work. Similar to Sadler-Smith and Metz, González and Heracleous also highlight the value of including what they call *remarkable thinkers* (another reference to Wack's[46] remarkable people), which they define as people known for their ability to challenge assumptions, think unconventionally, and think outside institutionalized perspectives to stimulate novel insights about organizational uncertainties.

Smit and Moraitis' work complementing scenario planning with option games supports learning about key trade-offs between committing early to influence competitors and gaining access to proprietary information versus waiting and retaining maximum flexibility. Finally, in their work advocating for the ability of scenario planning to promote organizational learning in relation to climate change, Wade et al. argue that since Australian reporting regulations have left the choice of scenario planning process and reporting style to the companies themselves, and since some companies often rely on external consultants for this work, opportunities for organizational learning may be lost or reduced.

Our takeaways in relation to learning hinge on scenario planning as a process for deepening organizational understanding of itself, the future, and how to think about the future:

- Scenario planning is a learning system, whether through revisiting past scenario planning processes (González and Heracleous), critiquing scenario planning practices (Wade et al.), or codifying tacit knowledge (Sadler-Smith and Metz).
- Learning is collective, distributed, and individual. Scenario planning is a meaning-making process that brings diverse knowledge and perspectives together, as seen in González and Heracleous' study of NASA, while Sadler-Smith and Metz show it is also an individual process of learning from one's experience.
- Scenario planning teams that include people who will challenge assumptions, bring outside views, and think outside-the-box will produce more novel insights. Whether you call them remarkable people[47] (Sadler-Smith and Metz), remarkable thinkers (González and Heracleous), or something else, having these people on the scenario planning team will help develop valuable insights and deeper learning about the future.
- Learning integrates instinct and analysis. By incorporating intuition, emotions, and experiences (Sadler-Smith and Metz), scenario planning can serve as a space for holistic learning.

Managing in Uncertain Contexts

The value of scenario planning is most evident when the strategic landscape is extremely uncertain or turbulent.[48] Such conditions present added challenges to leaders responsible for strategic planning and delivering on those plans, especially when relying on more mainstream decision analytic tools, such as extrapolative forecasting, discounted cash flow analysis, or stochastic modeling.[49] The increasing use of acronyms like those cited earlier—VUCA, TUNA, BANI and RUPT—show that organizations are currently facing extreme uncertainty. Scenario planners are, for example, advising leaders to build expansive scenarios to provide a more robust foundation for strategies to manage in the current tariff and economic policy environments.[50]

Scenario planning acknowledges the world is inherently uncertain[51] and that we cannot predict what will happen.[52] Rather than attempting to predict the future, scenarios work with uncertainty to strengthen our ability to navigate it,[53] providing organizations with a process to develop flexible strategies that prepare for multiple plausible future outcomes[54] and build organizational resilience.

Similar to the other themes of the issue, and given that navigating uncertainty is core to what scenario planning offers, it will come as no surprise that all the articles converge around it. Across them, scenario planning emerges as a rigorous practical way to engage uncertainty by: Thinking more expansively and creatively (Sadler-Smith and Metz), using uncertainty as an advantage to bolster quantitative analyses (Smit and Moraitis), executing on uncertainty responsibly (Wade et al.), and adapting institutionally (González and Heracleous).

Laying a strong foundation about the unknowable future, Sadler-Smith and Metz underscore that uncertainty is a condition to bring forth intuitive foresight. More poignantly, they underline the importance of intuition in organizational adaptation and preparedness for an uncertain future. As a set, their recommendations facilitate the development of richer and more useful scenarios that can better challenge assumptions, integrate disparate information, and help leaders manage uncertainty with more confidence.

By modelling the uncertainty inherent in competitive corporate acquisitions and investments as scenarios, Smit and Moraitis use scenarios to help organizations navigate the flexibility and commitment trade-offs that accompany high-stakes financial decisions—asserting that scenario planning can turn uncertainty "from a liability into a strategic advantage."

Wade et al. spotlight how the lack of standards about scenario application and reporting of scenario-guided decisions can counter-intuitively exacerbate uncertainty and "erode trust and credibility" in the eyes of external stakeholders. Continuing their critique, and offering solutions, the authors argue that while scenario planning "conducted with fidelity" can be important for navigating climate change uncertainty, and identify multiple ways that companies can improve their practices to better manage climate change uncertainty, they still must manage physical and transition risk amidst changing climate patterns.

Finally, González and Heracleous showcase how scenario planning can nudge an institution's "rigid commitment to existing strategies" to be rethought in light of a profoundly uncertain and rapidly evolving strategic landscape, and ultimately lead to new strategic directions and expansion of an organization's capabilities for managing uncertainty.

The issue provides three main takeaways in relation to managing in uncertain contexts:

- Accept uncertainty as given. Whether it be managing climate risk (Wade et al.), industry competition (Smit and Moraitis), institutional change (González and Heracleous), or managing in a VUCA environment more

generally (Sadler-Smith and Metz), every article in the issue underscores the inevitability of uncertainty, the inability to make accurate predictions about the future, and shows ways that uncertainty can be engaged strategically.

- Scenario planning helps develop resilience. The articles show the ability of scenario planning to support organizations as they undertake preparedness (Wade et al.), or counter strategic persistence in the face of political and sector uncertainty (González and Heracleous).
- Similar to the quality of strategic decision-making, navigating uncertainty competently relies on diverse thinking. Integrating approaches like intuitive reasoning (Sadler-Smith and Metz), qualitative techniques (Wade et al., González and Heracleous), and detailed analytical options modeling (Smit and Moraitis) can support organizations as they adapt to uncertain conditions.

Future Research Agendas

The contributions of articles in this special issue point to several potential research opportunities.

Assessing Scenario Quality and Effects

Wade et al. surface a pressing issue that scenario quality varies widely, and there is a lack of standard objective criteria to assess it objectively. Some of this is inherent in the nature of scenario planning which, as we noted previously, combines elements of art and science. As such, there may be no generalizable best way forward; though, other articles in the issue suggest possible ways to strengthen scenario quality standards. González and Heracleous show that unconventional scenario content can expand leaders' mental models and suggest that such evaluation criteria as the "challenge value of scenarios" can be formalized into comparative quality metrics. Sadler-Smith and Metz provide a theoretical basis for scenario quality centered on intuitive cognition, which includes distinguishing System 1 and System 2 thinking approaches. Together, the articles encourage the development of better frameworks for assessing scenario quality and measuring the cognitive benefits effects of scenario use. Future research in this direction can build on a growing body of research that seek enhanced scenario assessments.[55]

Connecting Scenarios with Analytic Decision Tools

Smit and Moraitis build on qualitative scenarios by adding such quantitative tools as real options and game theory models. Such integration of intuitive logic scenario planning with decision analytic approaches—that are often, but not necessarily quantitative—can extend the application of scenario planning to assessing the financial value of strategic options in various strategies. Designing, testing, and comparing hybrid scenario methodologies that integrate intuitive logics with real options,[56] computer simulation,[57] and other decision analytic tools presents promising opportunities for further research and practice. Such

hybrid models could guide, for example, the pairing of scenario narratives with operational models in the case presented by González and Heracleous, or explicitly guide the use of intuition in quantitative models by building on the theoretical foundation by Sadler-Smith and Metz.

Role of Inside, Outside, and Artificial Intelligence

All four articles acknowledge the important role of inside knowledge in scenario creation and application. González and Heracleous uniquely use autoethnographic insights, but all four articles imply that insider knowledge matters for data selection, scenario design, and cognitive effects. Sadler-Smith and Metz note that intuition is grounded in experience, suggesting that insiders may have richer intuitive expertise. In contrast, Smit and Moraitis note that outsiders such as consultants also engage with scenarios, and along with Wade et al. highlight a role for their outside knowledge, which can be important if not leaned on too heavily. A common aggregate theme here is the blending of insider and outsider knowledge bases and intuitions to enhance scenario quality, acceptance, implementation, and strategic outcomes.

AI remains an important under-explored topic. The application of AI in scenario development, analysis, and monitoring offers tremendous potential[58] as well as significant dangers, so many open questions remain in this evolving technology domain for scenario planning as well as society in general.[59]

Closing Thoughts

The importance of managing effectively in a radically uncertain world was an impetus for developing this special issue, as was the ongoing need to make new insights accessible to a broad range of practitioners and scholars. When viewed in combination, the four articles in this special issue underscore that scenario planning is a well-established integrative, multi-dimensional vehicle for making better strategy. The process deepens organizational and individual learning, and improves management in uncertainty by accepting that we can, at best, predict some elements of the future but not its overall gestalt. We hope to see more scenario planning research published in leading management and strategy publications, as the need for organizations to build capabilities that can navigate extreme uncertainty will remain with us for quite some time globally.

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