the futures foundation
engaging all Australians in creating a better future...

Volume 22, No. 6, December 2022

FUTURE NEWS

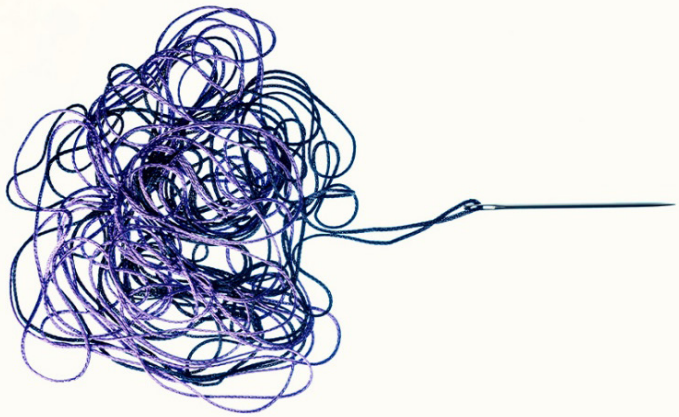
TO CONNECT, TO INFORM AND TO INSPIRE

IN THIS EDITION

futures foundation Australia • Ross House, 247 Flinders Lane, Melbourne 3000 • Phone: 03 9029 5787

6 STRATEGIES FOR LEADING THROUGH UNCERTAINTY

by Rebecca Zucker and Darin Rowell



If there was ever any doubt about the importance of a leader's ability to navigate change, uncertainty, and disruption, the emergence of the global pandemic in 2020 made this necessity abundantly clear. And while we all hope to avoid future pandemics, one thing is certain — we cannot avoid ever-increasing complexity.

The leaders we work with often report feeling stuck, ill-equipped, or overwhelmed as they face the growing challenges of their roles. Understandably, it's easy to feel this way when the complexity of our world has surpassed our "complexity of mind," as Robert Kegan and Lisa Lahey describe in their book, *Immunity to Change*. To put this in concrete terms, computing power has increased more than a trillion-fold since the mid 1950's, but our brains remain unchanged.

In order to effectively lead others in increasing complexity, leaders must first learn to lead themselves. Although each leader faces their own unique circumstances, we have observed six strategies that accelerate your ability to continually learn, evolve, and navigate progressively more complex challenges.

EMBRACE THE DISCOMFORT OF NOT KNOWING

Throughout our careers, we are conditioned to come up with the answer — as in a single, definitive, correct answer. Given that our brains are hardwired to see uncertainty as a risk or threat, it's physiologically normal to feel stress when faced with unfamiliar situations. This is especially true for high achievers who have built their career on knowing or finding the "right" answer. Although avoiding these unpleasant feelings is a natural human tendency, it can become a significant barrier to learning, future growth, and ultimately performance.

Rather than avoid these feelings, we must learn to acknowledge and embrace the discomfort as an expected and normal part of the learning process. As described by Satya Nadella, CEO of Microsoft, leaders must shift from a "know it all" to "learn it all" mindset. This shift in mindset can, itself, help ease the discomfort by taking the pressure off of you to have all the answers.

DISTINGUISH BETWEEN COMPLICATED AND COMPLEX

Most of us use the terms complex and complicated interchangeably when, in fact, they represent critically different circumstances. For example, tax law is complicated, meaning it is highly technical in nature and difficult to understand, but you can break the problem down into discreet parts, consult with an expert (or several), and generally find a solution.

Conversely, complex challenges contain many interdependent elements, some of which may be unknown and may change over time in unpredictable ways. In addition, an action or change in one dimension can result in disproportionate and unforeseen outcomes. As an example, foreign policy and climate change are complex challenges. While there may be no shortage of opinions on these topics, there are no clear solutions. As a result, solutions to complex challenges typically emerge through trial and error and require the willingness, humility, and ability to act, learn, and adapt.

LET GO OF PERFECTIONISM

In a complex environment, the context is continually shifting; thus, aiming for perfection is futile. Instead, aim for progress, expect mistakes and recognize that you have the ability to continually course correct as needed. For high-achievers, prone to perfectionism, egos and desired identities (e.g., of being successful or being "the expert") can get in the way. To let go of perfectionism, identify, and acknowledge your specific core fears that are triggered — such as "I'll fail," "I'll look bad," or "I'll make the wrong decision." Underlying these fears is an often implicit and unexamined assumption that "if any of these fears come to fruition, I wouldn't be able to recover from it."

We've worked with several clients over the years to help them actively debunk these assumptions by having them talk with others they respect about the role of mistakes or failure in their careers. They hear a lot about learning, new opportunities, and professional growth that emerged as a result, but never the career-ending catastrophes that they imagine. Loosening the grip of these assumptions over time can allow you to let go of perfectionism and accept that mistakes and failure are to be expected along the way.

RESIST OVERSIMPLIFICATIONS AND QUICK CONCLUSIONS

It's tempting to oversimplify complex challenges, so that they seem less daunting. For example, breaking a challenge into its respective components can help you to feel like you have a greater command of the challenge at hand, but it can also narrow your view and obscure critical interdependencies, leading to a false sense of security. Likewise, drawing analogies from challenges that you've faced in the past, can be useful but it can also lead you to miss the unique nuances of the present challenge.

Many high achievers have a bias for action and become quickly frustrated when facing challenges that don't present an evident solution and clear course of action. Instead of caving to the desire for quick resolution, leaders must learn to balance their need for action with a disciplined approach to understanding both the core problem and their own biases. For example, hiring a DEI leader at an organization, by itself, is insufficient if more systemic issues like outdated recruiting, promotion, development, and compensation practices go unaddressed.

DON'T GO IT ALONE

Many of the leaders we work with report feeling isolated as they face the continuous change and uncertainty in the challenges they face. Part of their sense of isolation comes from an implicit belief that they need to solve all of the issues themselves. As the complexity and volume of our workload increases, our natural tendency is to double down on our focus and individual efforts. When facing relatively short-term challenges with known solutions, this can be an effective strategy. However, when facing challenges where the full scope of issues and interdependencies, let alone solutions, are unclear, it can be a disaster. Instead, this is when it's most important to cultivate the practice of intentionally reaching out to your network and beyond for insight and perspective.

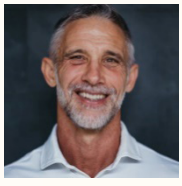
There is an inherent limit for each of us regarding what we can know and our ability to have an objective perspective on any given situation. Yet, we can exponentially expand our knowledge and perspective by cultivating and connecting with a network of peers and colleagues — each with their own set of experiences and perspectives. As stated by one CEO client, "When I'm trying to make sense of a complex issue, the first thing I do is reach-out to people whose opinion I value and whose experience is in some ways different from mine. I want to know "How are they are looking at the situation? What's their point of view? Who else should I talk to?" He went on to explain, "It's not so much that I expect them to have an answer, as I want to plug into their thinking and their sources."

ZOOM OUT

Leaders often get stuck in the challenges they face because they are too immersed in them. "Zooming out," or moving from "the dance floor to the balcony," as described by Ron Heifetz, Marty Linksy, and Alexander Grashow in *The Practice of Adaptive Leadership* provides you with a broader perspective and a systemic view of the issues and can shine a light on unexamined assumptions that would otherwise not be visible. From this "balcony" or elevated vantage point, interdependencies and larger patterns become observable, potentially revealing unforeseen obstacles and new solutions. This more holistic perspective allows for greater adaptability and course correction, when needed. Making a regular practice of conducting this dance floor-balcony shift, you can build your capacity to see the bigger picture and become more agile.

It seems that any given week provides ample reminders that, as leaders, we cannot control the degree of change, uncertainty, and complexity we face. However, adopting the strategies above can improve our ability to continually learn, grow, and more effectively navigate the increasing complexity of our world.

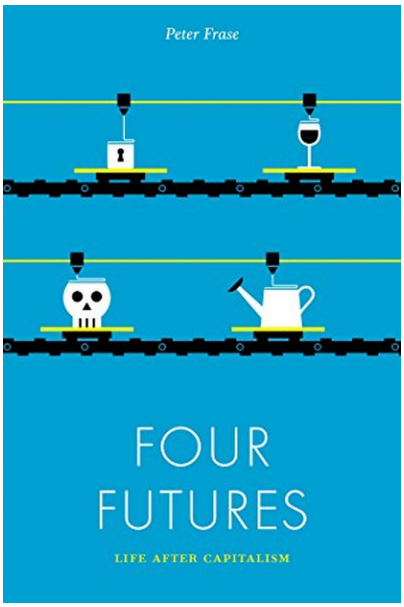
Rebecca Zucker *is an executive coach and a founding partner at Next Step Partners a leadership development firm. Her clients have included Amazon, Clorox, Morrison Foerster, Norwest Venture Partners, The James Irvine Foundation, and high-growth technology companies like DocuSign and Dropbox.*



Darin Rowell *Ed.D. is a senior advisor and executive coach that helps companies accelerate performance through the focused development of their top leaders and teams*

Book Review

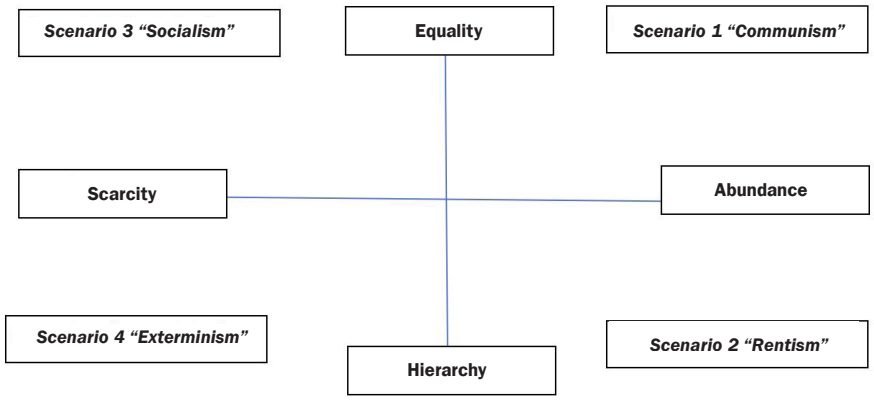
by Kevin Jae



Four Futures
Life After Capitalism
Peter Frase

PETER FRASE'S Four Futures: Life After Capitalism is an attempt to think through and imagine the hyperbolic end points of our current major dilemmas, namely, the "spectres of ecological catastrophe and automation" (p. 1). Frase's contribution to the discussion is his framing, which is centred on "politics, and specifically class struggle" (p. 21). This is a much-needed contribution: most discussions on the future of work are strangely apolitical and do not discuss ownership of capital and worker power.

Frase employs two variables and one constant to construct his four scenarios. The two variables are the ecological crisis and class power. The constant in all four futures is the assumption that automation will completely eliminate human labour. With the two variables, Frase creates a two-by-two matrix grid, with Abundance and Scarcity (relating to the ecological crisis) on the x-axis and Equality and Hierarchy (relating to class power) on the y-axis.



Scenario 1, "Communism," is a world of equality and abundance. In this scenario, everyone is liberated from the compulsion of work to sustain life. Instead, work has become "life's prime want" (p. 41). Frase speculates on how the world could end up in this scenario. First, a policy like Universal Basic Income could subvert power relations in the system. Freeing people from meaningless work (e.g., low-paid service sector jobs) would increase the average wages paid to meaningless work, leading to eventual automation of work by capitalists, subsequent abundance, and finally, the disappearance of the money economy. While the scenario assumes relative equality, Frase does not expect status hierarchies to disappear. However, in the place of hierarchies in the current world, which "tends to align all other social hierarchies with the master hierarchy based on money" (p. 59), he thinks that "a hundred status hierarchies [will] bloom" to replace the master hierarchy of capital.

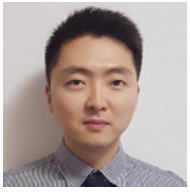
"**Rentism" is the second scenario**, which combines abundance and hierarchy. The laws of intellectual property are important for understanding this scenario. Intellectual property „dictates not only rights to the possession of physical objects but also over the copying of patterns" (p. 71). Owning the intellectual property (i.e., the patents and copyrights) gives the possessor the means to produce abundance. In this scenario, the ownership of intellectual property is monopolized by a small group. The economic system is thus based on the extraction of rents through intellectual property. Since automation has eliminated the necessity of human labour and wage income, there is a contradiction at play in the economic system—while useless as workers, people will still be necessary as consumers in this world. The major source of jobs that could plausibly exist are connected to the IP sector: workers will be creators of IP, lawyers, marketers (due to the limited number of consumers to buy IP), and guards (to protect those who own the IP).

The third and fourth scenarios incorporate considerations of the climate crisis, which will create conditions of scarcity and limit potential consumption.

Scenario 3: "Socialism"—this scenario is constructed from conditions of equality and scarcity. The scenario is named as such because the state will need to take an outsized role to stimulate and organize the massive transformations in infrastructure and energy systems while ensuring relative wealth equality to ensure that everyone adapts to climate change, not just the wealthy. The state's outsized role is not to suggest that economic activity will be based on central planning: the state can set production targets and let the market work to create an efficient outcome.

Finally, the scenario "Exterminism" results from hierarchy and scarcity. In this scenario, only a small privileged few are able to enjoy a high standard of living (so this is a situation of communism for the few), and automation has made the poor masses superfluous as producers of economic value but potentially dangerous for the rich. The „solution" for the elite class? Extermination and repression of the masses. Frase discusses the trends that are already happening to frame this scenario: there is our heavily militarized society, the militarization of the police, walled-off enclaves for the rich, the surveillance state, and a prison system that, in the United States, „now incarcerates 2 million people" (p. 135). Like the other scenarios, there are already signals that point to a possible emergence of this scenario.

Looking through Frase's references and resources, I was surprised to find that he does not engage with futures studies. Instead, he puts himself in the tradition of speculative fiction and world-building. Yet, despite his ignorance of the field, in Four Futures, Frase writes a provocative and compelling futures-related work. His work shows the importance of good scholarship and thinking in the futures field and the importance of multidisciplinarity. Futurists need to be thinkers who provoke multiple visions of the future; we cannot be mere experts of foresight techniques.

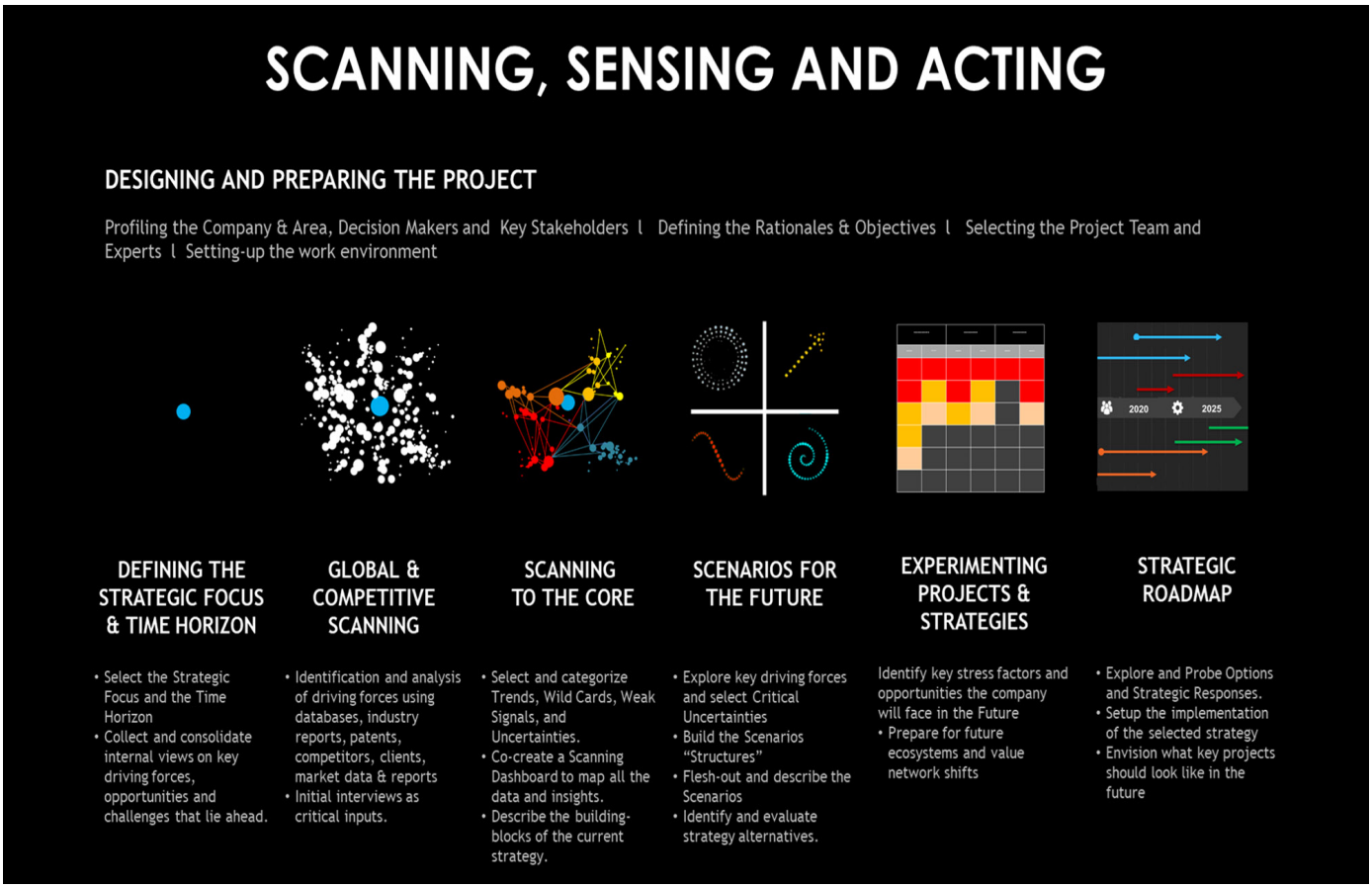


Kevin (Joong Woo) Jae *is a graduate from the University of Toronto with a Bachelor of Commerce and a Master of Arts in Anthropology.*

FUTURISTS IN ACTION

SCANNING, SENSING AND ACTING

by Paulo Carvalho



The "Scanning, Sensing and Acting" framework presented in this article starts with the statement that organizations need not only to have the "map" of their territory, but also the "radar" that can place and guide them in turbulent, ambiguous, and uncertain environments.

STAGE 1: "DESIGNING AND TRAINING"

This is a crucial stage of the framework that deals with the specific design of the process, the presentation of the process to the company ("client"), the training of the participants in the project and the end-to-end preparation of the entire process.

In this first stage, we can underline important decisions and activities (there is not a single sequence for the activities presented below and they are not necessarily included in all projects).

The analysis and a deep profiling of the client, the decision-makers and the stakeholders are important tasks to identify and clearly distinguish who the client is, who the decision maker(s) is (are), and what are the most important stakeholders. This is also crucial to decide and clearly define the rationales and objectives of the process, and to select the project team (or core team), participants and experts to be involved in the project.

A key question in any process that includes strategic thinking and action is the support and the presence of the top management in critical moments of the process. This is very important not only to make the (sometimes difficult) connection with the decision makers, but also to get leadership along the process.

A training or "sensibilization" session for the participants is fundamental when we are dealing with specific terms and concepts that may not be familiar to managers. In this sense, this is a key activity in the conceptual model. It includes the presentation of the different phases of the process and a rigorous explanation of key concepts of Environmental Scanning, Competitive Intelligence and Scenario Planning to the project team, distinguishing the concepts of trends, uncertainties, Weak Signals and wildcards, and explaining what the scenarios are.

Finally, this process is based on a workshop format with a strong participatory and co-creative approach with most of the work being made within working groups, using creative and participatory techniques. Depending on the time available and the specific objectives of the process, it's possible to include some research desk work between specific stages of the process where the facilitators and participants make specific contributions that will be used as inputs for the following workshop sessions.

STAGE 2: "SCANNING"

The second stage of the conceptual framework is about the "Scanning" of the external environment of the organization and includes critical decisions that will guide and impact the entire process and results of the project.

Two of the most fundamental decisions in all the process are the definition of the strategic focus and time horizon. These decisions will have a major influence on the more exploratory or decision-making orientation of the process. They will also determine the possibility of using different approaches for scanning the environment. (vd. the differences between a more exploratory environmental scanning process versus a more decision-oriented Competitive Intelligence process).

Those decisions about the strategic focus and the time horizon are not predetermined or necessarily given by the "client" or the decision-maker and can be decided in a brainstorming or interviews with different kinds of people from inside and outside the organization.

One of the important premises of this conceptual model is that the scanning is not only focused on the so-called "transactional" or competitive environment of the company, where we can use some kind of general "framework" (vd. Porter's five forces model). It's very important that the participants or the project team start the scanning process with an "outside-in" approach, trying to identify relevant information in what we can call the "contextual" or more distant environment. Relevant information means information that besides being distant from the company's competitive environment or the strategic focus of the process can have an important impact on both "targets".

To facilitate this process of exploring the impacts of distant drivers in the strategic focus of the process we can use different kinds of tools or exercises. The scanning of global drivers or trends can be done through a STEEP analysis (the acronym for Society, Technology, Economy, Environment and Politics) or using other type of framework.

Another distinctive premise of the model is the critical importance, in the scanning stage, given to the categorization of multiple types of information and different types of sources of information.

The scanning and categorization of different types of information imply that participants will have to organize all the information gathered in the scanning process by categories: megatrends; trends, Weak Signals; wildcards and uncertainties

The use of different types of sources implies that along the process the participants are invited to search in different types of information sources. The result of this scanning stage, which can combine a participatory and interactive workshop approach and a subsequent research desk work, is the building of what we call a "Scanning Dashboard", where all the relevant information is presented in an organized and visual way.

This "Scanning Dashboard" is developed around the selection, categorization and positioning of different types of driving forces In the research that was made we used a two dimensional "radar":

- Information categorization: Megatrends, Trends, Wildcards, Weak Signals, and Uncertainties.
- Frameworks to organize information in the "transactional" and the "contextual" environment" (we can combine a STEEP Analysis with other frameworks like the Porter's Five Forces Model).

STAGE 3: "SENSING"

The third stage, that we called "Sensing", starts with the building of the Scanning Dashboard and it is based on the selection, exploitation and interpretation of the multiple and different types of driving forces, selected and structured in the previous stage of the conceptual model or framework.

Although we can use the "Scanning Dashboard" as the basis for the Scenario Planning process, it's possible to include an additional phase in the process, which implies the building of a system diagram.

This structure or system diagram can be developed from a deeper analysis and further selection of the different categories of information included in the "Scanning Dashboard" and should provide a more integrated and systemic view of the problem or the strategic focus. In this step, it's important to assure that this structure or system diagram doesn't get too complex in its building process and presents itself sufficiently "readable" and useful to the participants in the process.

The central part of this third stage of the conceptual model is based on the building of scenarios, using a co-creative and participative approach with the project team working in groups and being involved in all the steps of the Scenario Planning process.

The Scenario Planning process used is strongly inspired by the so-called "intuitive-logic" school of Scenario Planning, with a special focus on the Shell and GBN approach of scenario building, with some important adaptations.

With the initial decisions and steps of any Scenario Planning process already made in the previous scanning stage, namely the definition of the strategic focus and time horizon, and then the scanning and identification of the most important driving forces, the crucial step in this phase of the process is the selection and definition of the critical uncertainties and the definition of contrasted configurations with the subsequent work around its specific meaning, scope and description.

It's from the critical uncertainties and subsequent possible evolutions (contrasted configurations) that the participants will build the scenarios structures. These "structures" work as the main frameworks for each of the scenarios to be further developed and described (we are using a "deductive" approach to the scenario building).

The fundamental work of selecting the critical uncertainties is made from the "Scanning Dashboard" (and the structure or system diagram, when there is time and resources for it) and the selection of critical uncertainties from the several uncertainties identified in the previous stage of the process.

The other information presented in the "Scanning Dashboard" (Megatrends, trends, Weak Signals, and wildcards) can be important in the scenarios building process, with a particular focus on the role of Weak Signals as sources of emergent or new issues that can influence the structure and internal dynamics of the scenarios to be developed.

As mentioned above, scenarios can be used as multiple and contrasted "Contexts" or "Environments" to explore and make sense of different trends, Weak Signals and wildcards identified on stage two of the conceptual model.

STAGE 4: "ACTING"

The fourth stage, that we have called "Acting", includes the exploration of the scenarios and can include the identification of implications and options, the definition of a set of possible strategic responses or even the definition of a strategic vision for the company or business unit.

Although we can use multiple management and innovation methods and tools in this forth stage of the conceptual model, the use of a specific tool and subsequent expected results must be clearly defined in the beginning of the process (when we are defining the objectives and outputs, and designing the entire process in detail).

The objectives and purposes of an environmental scanning and a Scenario Planning process can be more exploratory (vd. identifying challenges and opportunities) or more decision-oriented (vd. responding to a specific strategic decision).

In both cases it's very important to bear in mind that scenarios are a powerful tool to deal and incorporate uncertainties in the strategic decision process, they can work as an input to change the mental models of the decision makers, and can be used as an organizational learning tool.

This forth stage of the process explores how we can identify key implications and develop strategic options from the scenarios, described and presented in the previous stage, and allows the simulation of different competitive environments which are able to stimulate the participants to answer to specific challenges related to the strategic focus of the process.

As mentioned above, the developed scenarios can be used to achieve different goals and can be combined with several concepts and management tools, among which we can highlight the following:

- Probe Implications (what the meaning of each scenario is and what they imply to the company) and Strategic Options (confronted with alternative competitive futures, which options are the most appropriate to face in each scenario?);
- The scenarios being used to design more elaborated and integrated Strategic Responses;
- The scenarios helping a company or a business unit to (re) design its "Business Idea", using the concept of the "business idea" by Heijden (Heijden, 1996);
- The Key Competitive Factors and Key Internal Factors to be developed and pursued by the company in each scenario.

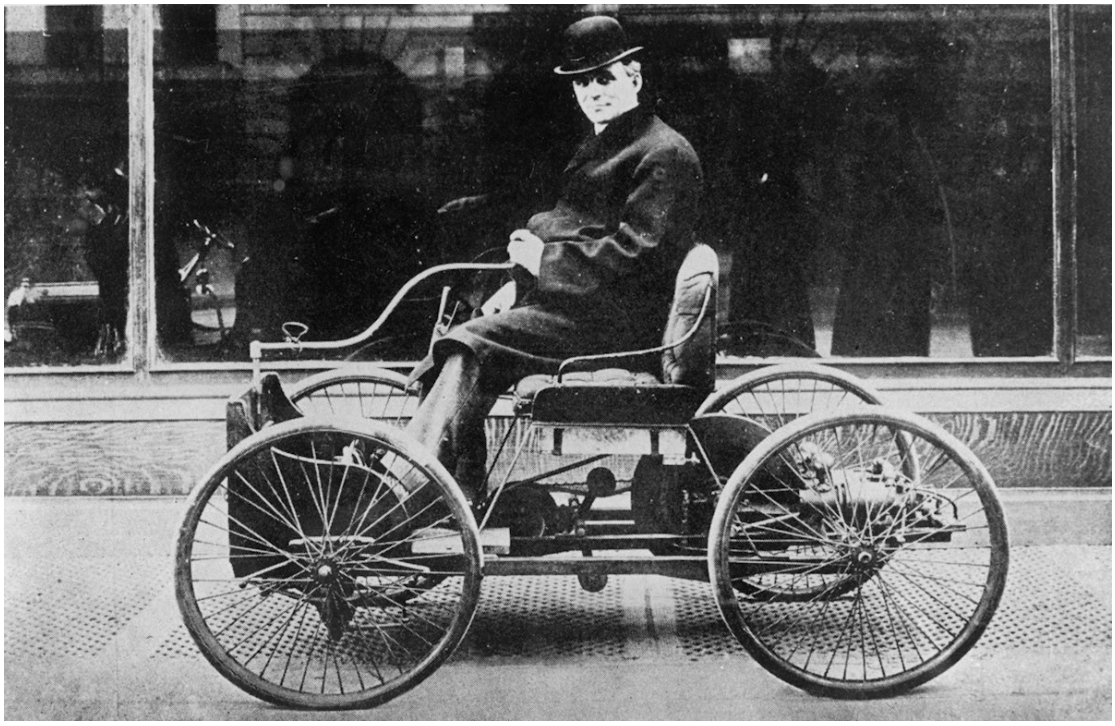
Besides this very diverse use of the scenarios as a strategic management tool, they can also be used as an organizational learning tool, helping to stimulate and institutionalize a "Strategic Conversation". The question in this fourth stage is not about what we can do with the scenarios developed in the third stage of the process, but rather what we want to do with them from the beginning of the process.

Paulo Carvalho is special faculty in the Human-Computer Interaction Institute at Carnegie Mellon University. He usesthe tools of cognitive science (experimentation, computational modeling, and big data analytics) and educational technology to understand how we acquire new knowledge and improve education.

Signals in the Noise

TWELVE TECHNOLOGIES DESTINED TO CHANGE OUR FUTURE

by Thomas Frey



If you ask ten different people what were the most important inventions in all history, you'll likely get ten different answers.

Here's one pretty good list from National Geographic that would be hard to argue with:

1. Printing press
2. Light bulb
3. Airplane
4. Personal computer
5. Vaccines
6. Automobile
7. Clock
8. Telephone
9. Refrigeration
10. Camera

Here's another that includes several of the same items plus the nail and the compass, and it even goes a bit further back in time to give credit to the inventor of the wheel – a very good addition. And here's one more, this one remembering to include the gas-powered tractor and anesthesia. Good catch.

Now, I'm not saying it's easier to be a historian than a futurist, but it's probably less complicated to look backward at one's leisure to acknowledge breakthrough technologies than it is to predict new ones at a time when so many technologies are on the cusp.

Debates about the significance of historical breakthroughs are academic exercises or something one does with friends over a glass of wine. But consideration of the merits and ultimate utility of pending and future breakthroughs takes place in boardrooms with billions of dollars on the line. After all, things that seem destined to be extraordinary and ultimately commonplace may prove to be a bust. Supersonic transport comes to mind, even though it's probably too early to give up on that.

But I don't mind going out on a limb in predicting what the most significant emerging technologies will be over the next ten years. These are the twelve I'm watching, and I think you should be as well:

Signals in the Noise

TWELVE TECHNOLOGIES DESTINED TO CHANGE OUR FUTURE

1. AUTONOMOUS TRANSPORTATION

I've become convinced that autonomous transportation will be the most disruptive technology in all of history. On this topic, most people right away think of cars and trucks as a first step. In fact, those may be the last autonomous vehicles to be fully developed and embraced due to the relatively complex and unpredictable environment they'll be operating in.

But we've already come a long way in other modes of transportation. Unmanned rockets are delivering satellites to space orbit and supplies to the international space station. Soon we'll see unmanned cargo ships plying the oceans. Submarines will follow shortly. Commercial jets are nearly autonomous now and under computerized control for much of each journey.

And, yes, eventually we'll see wide-spread autonomous, dry land transportation – especially once we get past the mindset that perfect safety is the only acceptable option. Add all of this together and not only will transportation be turned on its head, but we'll also have massive redesign of our buildings, airports, seaports, highways, and cities themselves to accommodate it.

2. ARTIFICIAL INTELLIGENCE

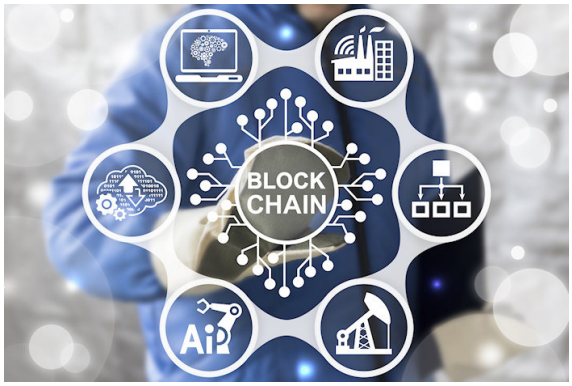
AI certainly isn't an emerging technology, but what will be new is the extent it will be a part of nearly every other emerging technology. AI is the basis of computer learning. Faster computers with access to more data will enhance nearly every aspect of our lives: transportation, healthcare, business, national security, entertainment, and more.

We'll begin to view AI as a commodity – almost like a utility – that's delivered into every home, office, device, car, and highway in our world.

3. BLOCKCHAIN

Blockchain technology will soon become an element of our behind-the-scenes infrastructure for nearly every kind of transaction (defined in the broadest sense) that requires the secure transfer and maintenance of assets or information. It's hard to imagine any industry that won't be impacted as they strive to becoming more secure and efficient. If an industry relies on contracts, financial transactions, personal identification information, or asset management, for example, blockchain technology will be working in the background.

Is blockchain the final word in IT security? Unfortunately no. Blockchain can be hacked, but it's not worth losing sleep over. As long as we rely on technology, i.e., computers and the internet, we'll have cyber thieves. We need to accept that we'll always be in a cycle of smart people developing secure systems that other smart people quickly learn to exploit. But, we're continually raising the bar in the process.



4. CRYPTOCURRENCY

Cryptocurrency is one of the primary applications and earliest adopters of blockchain technology. Soon, you won't need to understand blockchain to use cryptocurrency; it will be as easy and natural and using a credit card. The currency behind it, though, will be blockchain-based. Bitcoin was the first, but the emerging crypto economy is now valued at over $2 trillion. This means over $2T in economic expansion, with no governmental strings attached, and we're just getting started.

Regulators will eventually accede to this inevitability and implement buffers and guideposts to prevent the kind of valuation volatility and scams that have caused most people to stay away from engaging in cryptocurrency. Increasingly, nations will transform their currencies to digital, doing away with pesky paper and even peskier coinage. Our personal cryptocurrency wallets will typically have a variety of currencies at our disposal.

Signals in the Noise

TWELVE TECHNOLOGIES DESTINED TO CHANGE OUR FUTURE

5. CRISPR

That's "clustered regularly interspersed short palindromic repeats," by the way, the emerging science of genetic manipulation using DNA splicing. We looked at this several weeks ago in the context of de-extincting a version of a Woolly Mammoth by splicing its preserved DNA into an Asian elephant.

That's just the tip of the CRISPR iceberg, though. The emerging CRISPR toolset will expand our capabilities to customize embryos to optimize human beings in many ways. In just a few years, a pregnant woman will have the option of going to a geneticist to discuss certain "enhancement options" for her unborn child. They'll also be able to remove problematic genes in order to reduce the likelihood of certain diseases and physical conditions.

6. METAVERSE

This is one of the most fascinating advances I've had the opportunity to explore in a long time. The metaverse is essentially Internet 3.0, maybe even 10.0, based on an increasingly robust infrastructure that can support the presence of an alternate reality we can experience for ourselves. We see bits and pieces of it now, with concerts, online gaming, and virtual offices.

But ultimately, we'll have metaverses that are as real and expansive as any Matrix or Ready Player One scenario. It's not a stretch to say that in the future, we'll be taking virtual vacations in the metaverse – spending a week's salary with a metaverse agency to experience an African safari or an Alaskan cruise, enjoying the sights and sounds and the company of our fellow travelers.

7. TOUCHABLE MIXED REALITY

This is an evolutionary development with metaverse implications. First, there was virtual reality (VR) – a virtual world, complete with sights and sounds (and only sights and sounds) experienced with the specialized headset. Next was augmented reality (AR) – in which we experienced the real world with virtual objects overlaying them (e.g., Pokémon Go). The next step is mixed reality (MR) – in which real and virtual worlds are combined. MR allows us to overlay physical items into the virtual environment.

MR will be a gamechanger in … well, games of course, and also in numerous entertainment and learning environments from engineering to medicine.

8. LIVING ROBOTS

Despite the name, this innovation isn't as creepy or eyebrow-raising as it sounds. While this phrase may conjure up the image of human clones, remember that a "robot" is simply a controlled, programmable machine that can carry out a complex task.

But instead of metal casings and hard-wired circuitry, they're made with biological tissue. The earliest versions of living robots can best be characterized as "programmable organisms," blobs of tissue made from biological stem cells that are manipulated and shaped to be living organisms that perform tasks. Initially, we'll program them, for example, to deliver medicine within a human body or clean up radioactive waste in hazardous sites. Beyond that, though, who knows!

9. HYPER-INDIVIDUALIZED EDUCATION

Education is a $2 trillion annual business that operates in much the same way it did 200 years ago with large classrooms filled with students who are all taught the same way and, for the most part, the same thing. But classroom technology has been advancing rapidly, especially during the pandemic.

Ultimately, we'll have massive databases of teachable material from which students and their advisers can craft a unique curriculum and even a unique degree. The material will be delivered in a way that the student can best relate to. Lectures. Virtual field trips. Group discussions (see metaverse discussion above). One-on-one tutorials with an AI teacher bot.

Degrees will be obtained more quickly, and graduates will have a much better-defined specialty that will minimize the time spent by their first employer in on-the-job training.

10. HYPER-INDIVIDUALIZED MEDICINE

This is also known as personalized medicine. Doctors in the near future will collaborate with us on prevention, diagnosis, and treatment options based on our own unique genomic profile. With the benefit of this information, they'll know what conditions we're susceptible to and that must be monitored closely. And when a condition presents itself, they'll know which drugs or other treatments will be effective, ineffective, or even harmful.

We've seen some early successes with personalized medicine with oncology therapies, and it will ultimately extend significantly beyond that.

11. INTERNET FOR EVERYONE

With communication satellites filling our low-Earth orbit, people in more and more of the far corners of the Earth will have access to information through the internet. As long as local regimes don't try to limit citizen access, information will be more widespread and transferrable – for better or worse, but hopefully more for the better.

Who knows how many 21st century potential Einsteins and Mozarts will emerge when there is greater exposure to information and ideas? With a truly World Wide Web, we'll see tremendous growth in global GDP, and maybe as I call it, in GNK – global net knowledge that will drive mankind's progress forward, bringing light and enlightenment where it's needed most.

12. LAB GROWN EVERYTHING

While lab-grown meats have gotten all the attention, we'll soon have similar processes for lab-growing construction material, fabrication materials, and much more. Our labs will make tremendous progress in speed-growing natural materials that have the same cellular structure as the "real" items that have previously only been grown at the rate of nature.

This will be a huge ecological and social win as we no longer will need to mine diamonds, clear cut forests, or maintain massive cattle feedlots, for example. We'll also have new sources for medical and health products like breast milk, nutraceuticals, ointments, and more. This will cause short-term employment issues for sure, but once the science is worked out, the labs will essentially become factories and the workers there won't need PhDs.

100 YEARS FROM NOW

I can't imagine a more fantastic future than if these technologies come to fruition and play out fully! And if this blog is somehow discoverable in 100 years, I hope another futurist will see it and chuckle about our simplicity or, even better, note how we identified 2021 trends that did indeed shape the world they're living in.