

The Breakthrough Forecast

Market Sweet Spots 2016 to 2025



There are three main messages in *The Breakthrough Forecast*:

1. Capitalism, markets and business offer our best hope of achieving a sustainable economy by the second half of the 21st century—but for this to happen all three must begin to evolve profoundly by 2025.
2. Market analysts are now tracking ‘Sweet Spots,’ across 10 critical sectors [see page 7] of the economy which we aim to map—with the value of the investment in such markets now running into trillions of dollars. Meanwhile, we spotlight 21 ‘Breakthrough Sweet Spots’ where new solutions are emerging.
3. The most interesting opportunity spaces are emerging where different technologies and business models overlap, suggesting the need to identify, incubate and expand such Sweet Spots.

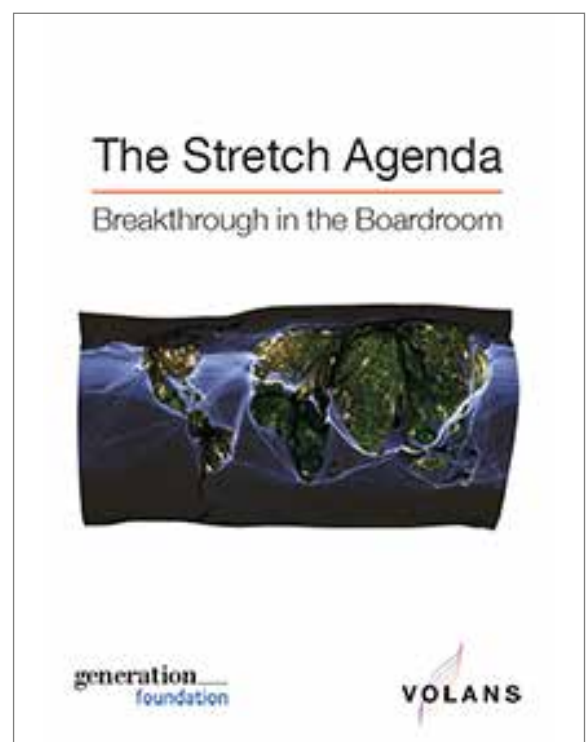
At the heart of this program of work is a deceptively simple question: How much is the future worth? For some, the future is a resource to be fracked, with value drawn forward into today’s world at the expense of future generations. For others, our economic and accounting mindsets and tools systematically undervalue the future.

So, for example, a growing number of attempts have been made to show how much ecosystem services are worth and to put a value on natural or social capital. But in what follows we look at the question from a different angle, asking how much market value will be created in the coming decade as the transition to new technologies and business models accelerates.

In this version of the *Forecast*, we zero in on 21 technology trends that look set to shape the conversation and our economies by 2025. In later versions, a series of updates will be posted tracking projections and valuations in key markets.

A linked C-suite briefing, *The Stretch Agenda* [<http://www.volans.com/work/the-stretch-agenda>], launched on 12 May 2015, is a dramatization of some top team dynamics we have observed over many years of working with business. It offers insight into the types of conversations now beginning to play out around boardrooms in the Global C-Suite. We zoom in on a fictional global company, ‘MN-Co’, where a group of leaders is exploring how to shift their business model to address the profound economic, social and environmental challenges ahead. Questions they ask themselves include: If not us, who? If not now, when?

The reality of the opportunities mapped here was underscored for us when GE announced in May 2015 that in the first decade of its Ecomagination platform, the relevant products and services had made \$200 billion - and Ecomagination revenues hit \$25 billion in 2013 alone. That’s some Sweet Spot!



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Introduction

The main focus of the current version of the Forecast is on 21 Breakthrough Sweet Spots. In later versions, we plan to open the analysis out to application areas like Energy, Food, Health and Transport in a series of updates in the coming months. In this version, we begin with an Introduction—and then sketch the wider context for the project, before providing short briefs on each of the Sweet Spots in Chapter 2. To provide some of the background to the analysis, we conclude by distilling some of the market wisdom of our interviewees in Chapter 3.

Background

“A pessimist sees the difficulty in every opportunity,” said Sir Winston Churchill. By contrast, “an optimist sees the opportunity in every difficulty.” *The Breakthrough Forecast* is an adventure in clear-eyed market optimism. In an era where systemic challenges are proliferating, a new breed of innovator, investor and business leader sees unparalleled opportunities to develop and scale radically different solutions.

So how should we think about the market opportunities for business in the Breakthrough Decade to 2025? What sort of trends and market valuations might we expect? Who is already making such forecasts—and what are they predicting? What sort of assumptions are they making about the likelihood of breakthroughs in technology, business models and public policy?

These are just some of the questions we are asking. So what follows is an exercise in painting—or at least sketching—in numbers. Once, big numbers were expressed in millions, then billions, now trillions. As we head toward 8 billion people on the planet by 2025, the biggest market growth opportunity in history is emerging all around us. Ultimately, it will be measured in tens and then hundreds of trillions.

Here’s why: adapting our technologies, businesses, cities and economies to cope with new demographic, social, economic, environmental and political realities is spurring and shaping the evolution of multiple new industrial revolutions, markets and business models.

New forms of value are being prioritized, accounted for and, increasingly, delivered. *The Breakthrough Forecast* is the first panoptic survey of the various initiatives now under way to track, value and influence this profound transition in the global economy. In particular, we are looking for emerging market ‘Sweet Spots’, where new, hybrid forms of value are being created.

Breakthrough Decade, 2016-2025

We first trailed elements of the *Breakthrough Forecast* at the World Green Economy Summit in Dubai, in April 2015. Our message: the world stands on the threshold of the biggest market opportunity in the history of capitalism--and the period through to 2025, which we dub the ‘Breakthrough Decade,’ will be make-or-break.

Ten years is a long time at a transformational point in the global economy. But numerous studies predict scientific, technological and business breakthroughs over the period to 2025, including *ScienceWatch*.

And markets are waking up to the opportunities. Since 2007, as we noted at the Summit, \$6.22 trillion had been invested by *Earth Day 2015* in the Green Economy, according to data compiled for the *Green Transition Scoreboard*. But it is worth noting that the value of the markets created in the process will be dramatically greater.

Unfortunately, because current measures of value—like GDP and GNP—are too often blind to such trends, politicians, governments, financial markets and business leaders are systemically ill-informed on the twin potential for transformative change and for new forms of wealth creation.

Numbers and data are key, even if—on the basis of different assumptions—they can be used to sketch many different futures. On the downside, for example, current projections suggest that:

- The financial cost of air pollution in Europe is more than \$1.6 trillion (£1.5 trillion) a year, according to the *World Health Organisation (WHO)*, which they found, equates to about a tenth of the GDP of the continent.
- If the world becomes serious about reducing the global carbon bubble, we would need to write-off value in excess of \$20 trillion, according to the *Capital Institute*.

‘We are looking for emerging market Sweet Spots, where new, hybrid forms of value are being created.’

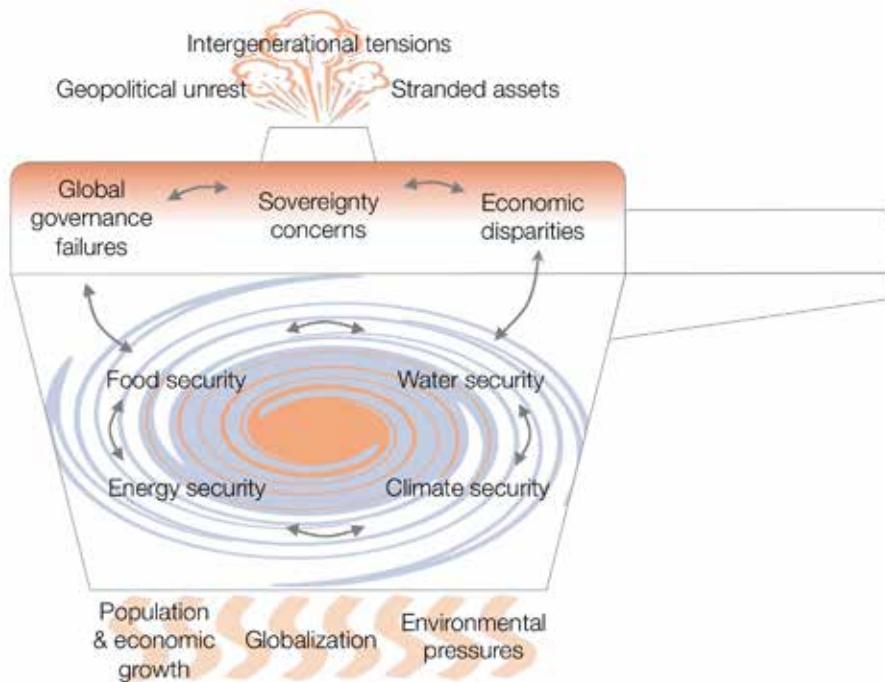
- We are seriously mismanaging the world's oceans, a resource valued at \$2.5 trillion a year, says the World Wildlife Fund. If they were a country, they would be the world's seventh largest economy.

That said, in *The Breakthrough Forecast* we are more interested in the potential upsides. Some indicative upside forecasts are as follows:

- Frost & Sullivan's Annual Renewable Energy Outlook 2014 forecasts that global installed capacity of renewable energy will more than double from 1,566 gigawatts (GW) in 2012 to reach 3,203 GW in 2025, at an average annual growth rate of 5.7%.
- Manufacturers of electric motors for use in vehicles expect to see demand for their products soar over the next decade, as electric cars, hybrid engines and electric bikes, boats and aircraft all become increasingly popular. So says a new report from analyst firm IDTechEx, which predicts the global electric vehicle market will be worth \$500 billion in 2025, driving a \$144 billion market for vehicle electric motors.
- The latest report from Global Water Intelligence (GWI) predicts that salt removal and wastewater recycling technologies are expected to become an essential ingredient in operational strategy, growing by 11.4% over the next five years to reach a total market value of \$11.96 billion by 2025.
- Rising urbanization, coupled with increasing disposable income in BRIC countries and concerns about food contamination, is driving increasing acceptance for organic baby food products, not only among high-income groups, but also middle-income consumers. The BRIC organic baby food market was valued at \$1.24 billion in 2014 and is expected to reach \$3.53 billion by 2020.
- Verdantix forecasts the global sustainability consulting market will grow from \$877 million in 2015 to \$1.01 billion in 2020, at a CAGR (compound annual growth rate) of 4%.

Figure 1
Pressure cooking our future

Source: © Volans, 2015, inspired by the World Economic Forum's work on Global Risks since 1995



These are just a few of the opportunity spaces where market forecasts are now being produced. From 2015 on, the UN Sustainable Development Goals (SDGs) will have an impact on such growth trajectories, though little detailed market research work has been done on the specifics to date.

One exception in terms of market analysis is Aviva's Roadmap for Sustainable Capital Markets, though this is short on numbers. More generally, Jeffrey Sachs notes that:

Just as the world has made tremendous progress with the [Millennium Development Goals], we can find our way to achieving the SDGs. Despite the cynicism, confusion, and obstructionist politics surrounding efforts to fight poverty, inequality, and environmental degradation, a breakthrough is possible. The world's major powers may appear unresponsive, but that can change. Ideas count. They can affect public policy far more profoundly and rapidly than detractors can imagine.

That, at least, is the hope. It is more likely to become reality if we can work out how to give leaders and decision-makers in all parts of the economy a much better sense of tomorrow's opportunities—and of some of the ways in which governments can shape markets to deliver the right outcomes.

Market kaleidoscope

When it comes to sustainability-oriented market opportunities, one key barrier for business leaders and investors has been optics. Once, they had to use the

equivalent of magnifying glasses or microscopes to spot most early stage markets shaped by the sustainable development agenda. Or, because the opportunities spotlighted were so far in the future, powerful telescopes would have been needed.

But now the commercial evidence is surfacing all around us—creating the sort of landscapes and patterns you might expect to see through a kaleidoscope. In this *The Breakthrough Forecast* (Version 1.1) we offer a market kaleidoscope, spotlighting 21 Sweet Spots for future growth and wealth creation.

Different people will shake this kaleidoscope in different ways, with different levels of enthusiasm and energy. As a result, they tend to spot different patterns. Some see interest and investment building around Conscious, Inclusive or Responsible Capitalism, others a growing push towards Regenerative or Sustainable Capitalism.

They are all right, to a degree. But in talking about Breakthrough Capitalism, we have aimed to spotlight the urgent need for all business leaders and change agents to stretch their horizons and ambitions, refocusing from risks to opportunities, from problems to solutions, from downsides to upsides.

The Breakthrough Forecast is work in progress. Our ultimate goal is to develop a dynamic online intelligence portal for leaders called 'The Breakthrough Showcase.' We invite suggestions and other inputs in terms of, new areas to be covered, emerging trends we should highlight and track, and possible resources to evolve the platform. Contact John Elkington john@volans.com.

Figure 2
Sustainable Development Goals
 Source: United Nations Department of Economic and Social Affairs



10 sectors

To capture emerging patterns of growth, we plan to cluster a larger list of Sweet Spots into 10 economic sectors, just a sample of the many that make up tomorrow's economy: Diets & Nutrition, Business Education, Energy, Finance & Accounting, Health, Lifestyles, Materials, Services, Transport, and Water & Sanitation.

All such sectors will be powerfully shaped by new technology. We see the decade to 2025 as heralding not just a new Industrial Revolution or even a new Renaissance, but a new Cambrian Explosion. In the same way that the Cambrian Era saw an unprecedented explosion of new life forms, including the evolution of eyes and novel body forms, we see the Breakthrough Decade as the beginning of a massive, global radiation of new mindsets, technologies and business models.

The 21 Breakthrough Sweet Spots sketched below are our current top choices in terms of technologies promising to produce breakthrough solutions. We hope to explore emerging applications in key sectors in later iterations of *The Breakthrough Forecast* and in the forthcoming online intelligence portal for leaders, the Breakthrough Showcase”

1. **3D Printing:** Prototyping Tomorrow
2. **Accounting:** Tomorrow's Bottom Line
3. **Air-Conditioning:** The Cold Economy
4. **Biomimicry:** Nature's Magic
5. **Business Education:** Breakthrough 101
6. **Calming:** Stress Reducers
7. **Clean Water:** Thirst For The Future
8. **Construction:** Smart Cities
9. **Data:** Big & Little
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11. **Electric Vehicles:** Charging Ahead
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20. **Space:** Reaching Escape Velocity
21. **Visualization:** Seeing is Believing

The 21 Breakthrough Sweet Spots are our current top choices in terms of technologies promising to produce breakthrough solutions.

21 Breakthrough Sweet Spots



Where is breakthrough innovation going to happen? And where is it most needed? We zoom in on a number of zones in the global economy where the process is already under way.

The world is awash in opportunity. And the period to 2025 will see business, financial markets and a growing number of both politicians and policy-makers stepping up to the seemingly impossible task of spreading the new mindsets, technologies, business models and policy frameworks needed for a world of 8 billion pressing up hard against planetary boundaries.

That, in headlines, is the message of *The Breakthrough Forecast*.

Our 21 Breakthrough Sweet Spots are illustrative, not definitive, offering a set of market lenses through which to observe our future in embryo. There will be some familiar picks here, but all are based on our interviews with market analysts and thought leaders through into 2015. In some cases, the size of the ultimate market is indicated by the size of the current market: in accounting, for example, that is over \$100 billion a year. A worthy target for the integrated and wider sustainability accounting movements.

As such people are aware, many new technologies go through a *hype cycle* (see Figure 3), with an early surge in interest reaching a 'Peak of Inflated Expectations,' followed by a slump once the short-term failings of early versions

become evident. Over time, however, some technologies then move through the 'Trough of Disillusionment' up the 'Slope of Enlightenment,' which is what we increasingly see with the 21 technology-driven trends. The next stage is the 'Plateau of Productivity,' where a given technology becomes endemic.

The Breakthrough Forecast spotlights some of the blocks from which tomorrow's 'Breakthrough Business Case' can be built. Each entry includes a brief introduction, signposting ways into the conversation. The aim is to give a sense of: the status quo, market forecasts, and ethical, human, social and environmental challenges spotlighted by critics.

We then spotlight actual or potential 'Sweet Spots' where breakthrough innovation is urgently needed. We understand the concerns about 'technology fixes' and unlimited growth models, but the *Forecast* is unashamedly about technological evolution and future market growth opportunities linked to the sort of priorities flagged in the UN Sustainable Development Goals.

Perhaps the best way to think of what follows is as a series of Wikipedia-style 'stubs', invitations to the wider world to help co-evolve future versions of the *Forecast*.

Figure 3
Gartner Hype Cycle

Source: Gartner. Wikipedia, downloaded May 2015.



1. 3D Printing: Prototyping Tomorrow

Could new design and manufacturing tools turn you into a dinosaur?



In a Nutshell

3D printing (or 'additive manufacturing') is a term covering a growing number of processes used to make three-dimensional objects, from automotive components to complete buildings. Additive processes are used, with successive layers of material laid down under computer control. These objects can be of almost any shape or geometry.

Links to Breakthrough

The democratization of key aspects of design, prototyping and manufacturing is unleashing a wave of innovation.

Growth Points

Market analysts still consider the additive manufacturing market to be a niche sector, but Siemens reports that it had a volume of up to €2 billion in 2012. It took the sector 20 years to reach a market value of €1 billion. The second billion was attained only five years later, and analysts now believe that it could grow at least fourfold over the next ten years. The level of Google searches for the term '3D printing' indicates the scale and pace of change.

The market and competitive implications have been sketched by McKinsey. 3D printing, they note, has come a long way from its roots in the production of simple plastic prototypes. Today, 3D printers can not only handle materials ranging from titanium to human cartilage but also produce fully functional components, including complex mechanisms, batteries, transistors, and LEDs. According to McKinsey Global Institute, related technologies could have an impact of up to \$550 billion a year by 2025.

Canalys, a market research firm, anticipates changes ahead and predicts the global market for 3D printers and services will grow from \$3.3 billion in 2014 to \$20.2 billion in 2019.

Sweet Spots

3D printing fits into a number of expanding Sweet Spots. A range of potential applications are listed [here](#):

- *The need for radical approaches to design, spurred by Cradle-to-Cradle and Circular Economy thinking*
- *The demand for new forms of rapid prototyping, to explore the frontiers of innovation*
- *A drive for resource-efficient manufacturing*
- *Given that 3D printers are a form of industrial robot, see also Robotics.*

Flash Points

Discussion of some of the potential risks and challenges can be found [here](#):

- *Evolution of 3D Printing Technology Raises Security Concerns, Infosec Institute, October 13, 2014*
- *3-D Printing Is Getting Huge Hype, But It Could Be One Massive Health Risk, Valerie Brown, Alternet, September 23, 2014*
- *The dark side of 3D printing: 10 things to watch, Lindsey Gilpin, March 5, 2014.*

2. Accounting: Tomorrow's Bottom Line

Integrated reporting will capture both financial and non-financial data



In a Nutshell

New forms of accounting are emerging to provide new forms of market intelligence, covering novel forms of value and capital. Capitalism's master discipline of Economics will also begin to be turned upside down, inside out.

Links to Breakthrough

Financial markets run on numbers. Tomorrow's bottom line accounting will ensure they use the right ones.

Growth Points

For a sense of the nature and size of the global accounting services market, take a look [here](#). The Big Four firms alone earned over \$100 billion in 2014.

And the mood is shifting. PwC surveyed the private equity industry's attitude to ESG issues in their [Global PE Responsible Investment Survey 2013](#). More than 100 PE houses in 18 countries responded, managing more than \$860 billion of assets. The survey reveals a belief that ESG issue management is valuable—whether it's protecting value through managing risk, or generating value by spotting opportunities. However, the research also found that ESG management is still mainly geared towards risk, rather than opportunity.

There is a huge learning curve to go up here, particularly in terms of how to integrate different forms of capital into corporate balance sheets and reporting. According to a 2014 survey by the International Integrated Reporting Council (IIRC), 92% of respondents saw increased understanding of

value creation as a benefit to Integrated Reporting. 71% saw a benefit to their board flowing from a better understanding of how the organization creates value. Meanwhile, 91% see an impact on external engagement and 68% see a better understanding of the business risks and opportunities, particularly those with long-term implications.

Sweet Spots

Accounting and economics are foundational disciplines for capitalism—and both will change profoundly. Emerging Sweet Spots include:

- *Growing experimentation with integrated reporting and accounting, led by organizations like the Global Reporting Initiative (GRI) and the International Integrated Reporting Council (IIRC)*
- *New accounting techniques like Environmental and Social Footprinting, and Environmental and Social Profit & Loss are struggling to find a foothold, but improved variants will ultimately go viral in the period through to 2025*
- *A coming switch from the traditional focus mainly on the negative social and environmental impacts of economic activity to how to produce and scale positive impacts.*

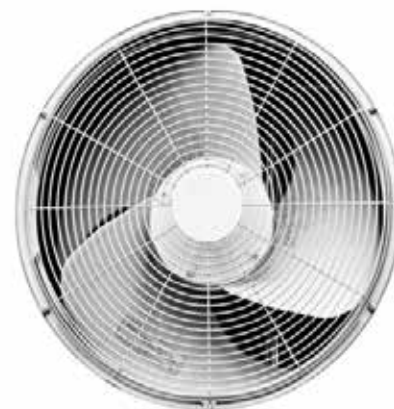
Flash Points

Some potential risks and challenges include:

- *The conservatism of the accountancy profession*
- *The capture of the integrated reporting process by traditional finance and big consulting interests*
- *The drowning out of ethical, social, environmental and governance factors that are not easily measured today.*

3. Air-Conditioning: The Cold Economy

Staying chilled in a warming world will be tough



In a Nutshell

Air-conditioning has become a major industry, with an energy appetite to match, plus a substantial environmental footprint.

Links to Breakthrough

New ways must be found to cool and chill our cities, buildings, and supply chains. Tackling this challenge involves not just mechanical and electrical engineering, but also new types of urban planning, design, management and landscaping.

Growth Points

As urbanization and global warming accelerate, rising temperatures will particularly impact the young, old and poor. Air-conditioning will be vital.

In 2013, the world air conditioning market was valued at \$91.6 billion, having grown more than 6 percent compared with \$86.8 billion in 2012. The biggest growth was seen in the Americas, which grew more than 8 percent by value. This was followed by Asia with 8 percent, Europe with 2 percent and the Middle East, India, and Africa also with 2 percent. Asia-Pacific is still the largest world region in terms of 2013 air conditioning sales with \$51.7 billion, or 56 percent of the world market.

Cooling consumes up to 14% of the UK's electricity, and the combined annual cost of electric and transport cooling in the UK is more than £5 billion. By 2030 global power demand for cooling could grow by the equivalent of three times the current electricity capacity of the UK. At the same time, however, vast amounts of cold are wasted, for example during the re-gasification of LNG at import terminals, which could potentially be recycled to reduce the cost and environmental impact of cooling in both buildings and vehicles.

More sustainable solutions are coming, says the Carbon Trust: "At first sight the potential of the Cold Economy appears large. Rapid growth in demand for cooling in the developing world, and the high environmental costs of meeting it with conventional refrigeration technologies, suggest a major global business opportunity for novel cooling solutions that are both cost effective and sustainable."

Sweet Spots

Air-conditioning and chilling are ripe for disruption. Among key trends:

- *The emergence of radically more energy-efficient technologies*
- *Greater use of Data to optimize systems*
- *Adoption of new styles of architecture and building design which minimize the need for heating and cooling*
- *Urban design and greening techniques that moderate ambient temperatures in cities.*

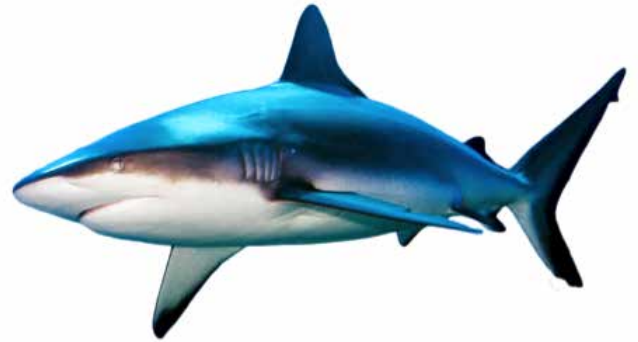
Flash Points

Some potential risks and challenges include:

- *There will always be a tension between human need in this area and the resource take and environmental footprint issues*
- *The pace of urbanization often means that older, less efficient technologies are used*
- *The availability of air-conditioners may blunt the appetite to create buildings and urban environments designed from the outset to minimize the need for air-conditioning.*

4. Biomimicry: Nature's Magic

From thistles to sharks, we must learn more of nature's secrets



In a Nutshell

The science behind biomimicry investigates how life has mastered a range of challenges over 3.8 billion years of evolution. The applications range from novel materials and processes through to radical approaches to urban form. For more information, visit the Biomimicry Institute's [website](#).

Links to Breakthrough

Nature has worked out how to run a circular economy—and we can short-circuit the process by tapping into the genius of biomimicry.

Growth Points

Research and development in this area have skyrocketed over recent years, with the number of peer-reviewed papers now over 3,000 annually. According to the *Da Vinci Index*, a database tracking scholarly activity, interest in biomimicry has increased tenfold since the millennium. Patents for biometric innovations are also up: 67 were issued in 2012 as compared to just 3 in 2000.

The best-known, and most commercially successful biomimetic design must be Velcro, the fastening system based on the structure of the cocklebur that is now incorporated into countless products including clothing, medical equipment and packaging worldwide. For more on the Velcro story, see [here](#).

There have been some notable successes in bio-inspired products in recent years. Self-cleaning paint incorporating the Lotus Effect. This is based on the ability of the structure of the lotus leaf to repel dirt and it came to the market as early as 1999. Today, world wide annual sales of products using the lotus effect are now over \$100 million with Degussa, Ferro and Sto some of the companies reaping the benefits.

Another example often quoted is that of the sharkskin swimsuit, famously banned from competition for giving unfair advantages to swimmers with its scale-mimicking technology. Calera, a company that specializes in converting carbon dioxide into green 'reactive cements' to replace traditional cement has developed a bio-inspired process for capturing CO₂.

Sweet Spots

Design, engineering, chemistry and biology are all still emergent disciplines when compared with the embedded wisdom in natural systems. Among the opportunities here:

- *New forms of inspiration for designers, engineers and decision-makers*
- *A vast resource of well-tested solutions to critical challenges, as indicated by Biomimicry's 3.8's AskNature databank*
- *Resource-efficient materials that are better adapted to an emerging Circular Economy.*

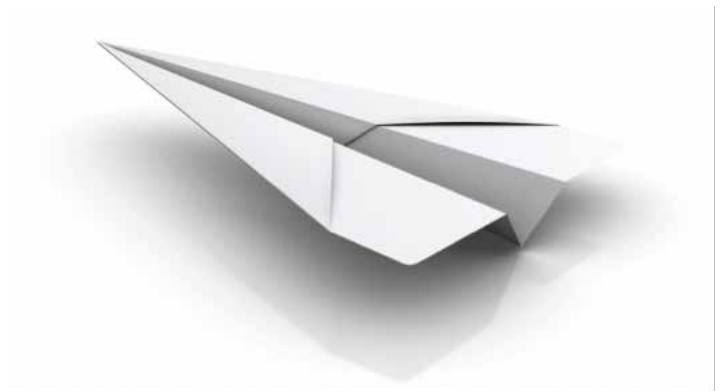
Flash Points

Some potential risks and challenges include:

- *One key issue is the natural and national equivalent of intellectual property: how can those who manage the wildlife and environments from which future solutions are sourced be properly compensated?*
- *Another concern is how long some of these technologies take to bring to market, though Velcro's success underscores the potential opportunities.*

5. Business Education: Breakthrough 101

In history's largest-ever economic experiment, education is key



In a Nutshell

Education is the biggest sweet spot of all. The dividends that flow from investments in sound, timely learning outweigh those from most other sectors. And getting business education future-fit will be make-or-break.

Links to Breakthrough

Every so often, a prediction jolts you into a different perception. One example: the launch of a [recent study](#) by the U.S. Department of Labor. This [concluded](#) that “the future of young people will center around solving problems that haven’t been identified, using tools that haven’t been invented yet, in careers that don’t yet exist. In fact, the study suggested, an estimated 65 percent of teens and 20-somethings will ultimately work in careers that don’t exist today.”

Growth Points

The global market for education is \$4.4 trillion, and poised to grow significantly over the next five years, according to an [analysis](#) by an international investment bank that advises companies on educational technology.

According to [Statista](#), the global mobile education market is projected to reach US\$37.8bn in 2020, up from US\$3.4bn in 2011. Further, according to [Ambient Insight](#), the worldwide market for self-paced e-learning (MOOCs) reached \$42.7bn in 2013, with revenues reaching \$53.0bn by 2018.

[Deloitte](#) predicts that most large educational institutions will experiment with MOOCs but are unlikely to disrupt education significantly in the near term. Instead, enterprise training and continuing education are the fastest adopter of MOOCs—

projected at \$130bn a year, compared with the for-profit and non-profit tertiary education market at \$400bn a year. An early sustainability experiment in this space is the Earth Institute’s [Sustainable Development MOOC](#).

Sweet Spots

Growing numbers of B-schools now offer options of one sort or another, but the relatively poor showing from most schools sells students—and the future—short. For more on key trends in this sector see [here](#) and [here](#).

- *A 2013 [study](#) by Corporate Knights built on earlier work by the Aspen Institute and WRI in this field*
- *A key focus for future effort must be the [executive education market](#)*
- *Another key area is [experiential learning](#), as offered by organizations like [Leaders’ Quest](#).*

Flash Points

Discussion of some of the potential risks and challenges can be found [here](#):

- *Some in the field worry that new technology, including massive open online course, or MOOCs, will undermine future demand for traditional –school and executive education services*
- *Certainly, traditional learning institutions are being challenged by online learning platforms*
- *According to [IBIS Capital](#), the e-learning market is projected to grow by 23 percent between now and 2017, making it the fastest-growing market in education.*

6. Calming: Stress Reducers

Yoga and slow food are part of a revolution in stress reduction



In a Nutshell

As the world population grows towards 8 billion people by 2025 and increasingly squeezes into cities, stress levels are likely to grow considerably. Some people will use pharmaceuticals, but a range of behavioral and design approaches will offer more sustainable solutions. Building and urban design will play central roles.

Links to Breakthrough

Stressed people and communities are less likely to think long-term or altruistically.

Growth Points

The global fitness equipment market is expected to exceed \$10 billion by 2018. But this fails to take into account the many forms of exercise, meditation and similar activities designed to reduce stress. The story of how yoga became a \$27 billion-a-year industry in the US can be read [here](#). Interestingly, in the US, 83% of yoga practitioners are women. If this sort of activity were to mainstream, the market sizes could be substantially greater.

As yet, this is an inchoate market, but links out to a number of other sectors covered here, for example the people-friendly design of streets. Over time, sectors like building and urban design could be included, alongside conflict prevention services. The levels of stress requiring management worldwide will be the ultimate driver of how big these markets grow.

A key trend is the spread of calm technology, explained as follow:

The idea behind calm technology is to have **smarter people, not things**. Calm technology is a people-centric framework for developing digital products and services.

It's not an acronym, so it doesn't stand for anything. It is a descriptor of how people should feel when they are interacting with technology. People shouldn't feel anxious, worried, stressed, oppressed, spied upon, disempowered, agitated, or any of the many other adjectives used to describe the plight of the digital citizen today. Instead people should feel liberated, confident, empowered, relaxed, and in control when it comes to embracing the connected world.

Wearable technology is often seen as a key element of calm technology, though this is disputed—and the low levels of sustained use of wearable products raises question-marks over at least some parts of this sector.

Sweet Spots

The demand for so-called calmtech seems guaranteed, with key trends including:

- *Expect to see the continued spread of mental and behavioral techniques designed to reduce stress, like yoga*
- *We will also see the improved use of signaling and signposting to make complex environments more navigable*
- *The design of built environments will aim to minimize disturbance and promote productive interaction*
- *There will be increased use of plants and water features in buildings and cities, including the use of vertical gardens and planting.*

Flash Points

No major issues identified as yet, other than how to make such services available to more people.

7. Clean Water: Thirst For The Future

H₂O will be a major headache for business



In a Nutshell

Water security and access to affordable, clean water are increasingly urgent issues. New types of water management, alongside new technologies like desalination, will become increasingly important.

Links to Breakthrough

Climate change is already implicated in major droughts hitting places like California—and water access and security issues will be critical 21st century challenges.

Growth Points

Key opportunities include:

- For a range of high-priced studies of water futures, see [here](#)
- A widely used estimate of the size of the global water market has been in the range of \$360 billion, with an annual growth rate of 4-5%, suggesting the market is currently in the range of \$375 billion.
- Within that amount, key segments break down as follows:
 - 50%, or approximately \$185 billion, is comprised of municipal utility services revenues an estimated 20-22%, or about \$40 billion, is revenues from private sector utility operators while the remainder is provided by government entities, usually local municipal government, around the world.
 - 26-27%, or \$100 billion, comes from consulting, engineering, construction, operations and other services
 - 21-22%, or \$80 billion, comes from the sale of equipment, technology, and treatment chemicals
 - 2-3%, or approximately \$9 billion, is residential water treatment equipment.

- Water management markets are growing rapidly in countries like China
- Seawater desalination is one of the most expensive sources of fresh water. One reason is the huge amount of energy required to push water through the membranes. Expect a spurt in innovation on new desalination technologies
- Israel is a leader here, with a major reverse osmosis desalination plant providing 20% of the water consumed by the country's households.

Sweet Spots

The growing number of droughts and floods will drive demand for improved water management technologies and systems. Among areas of potential overlap:

- *Data management systems to optimize water capture, treatment, storage, distribution, use and recovery*
- *New forms of energy-efficient and low impact desalination technology for areas where there is an acute need for water*
- *Much more important, ensuring that watersheds, aquifers, rivers and wetlands are managed sustainably, to optimize water yields for people and wildlife habitats.*

Flash Points

Discussion of some of the potential risks and challenges can be found here:

- *Water issues are outpacing carbon issues in some regions*
- *The emergence of water futures markets in countries like Australia suggest that water is now becoming a speculative commodity like oil*
- *Water security issues are widely predicted to result in water wars—see [here](#).*

8. Construction: Smart Cities

Bricks and mortar will meld with the Internet of Things



In a Nutshell

With over 50% of humans now living in urban areas and the proportion heading towards 70%, the importance of the smart building, smart grids and smart infrastructure movements is set to go off the scale.

Links to Breakthrough

Ensuring our cities are livable and sustainable is one of the greatest challenges we face. Useful information sources include C40, the Rocky Mountain Institute, VERGE and the World Green Building Council.

Growth Points

Based on the Construction Intelligence Center's Global 50, a grouping of the 50 largest and most influential markets in the world, the global construction industry is projected to grow from US\$7.4 trillion in 2010 to US\$8.5 trillion in 2015 and to US\$10.3 trillion in 2020, when measured at constant 2010 prices and exchange rates (real 2010 US\$).

Within the construction industry, the green construction market is surveyed separately in a report that says that 88% of industry respondents indicated that they will adopt green construction in their projects over the next three years. The highest percentage, 60% of survey respondents highlighted 'energy efficiency' as the main influencing factor for the implementation of green construction.

The above report was launched in 2015. Launched in July 2013, Global Construction 2025 forecast the volume of construction output would grow by more than 70% to \$15 trillion worldwide by 2025.

According to Siemens, between now and 2030 an estimated minimum of \$50 trillion in infrastructure investment will be required to fuel global development. "Buildings account for some 40% of the energy consumed worldwide. In Europe alone, 95% of the energy used to provide heat, hot water, air conditioning, lighting, and ventilation for buildings is consumed by structures that were built before 1980. Modernizing existing buildings—making them more efficient, more integrated, and more "smart"—therefore offers enormous savings potential."

Sweet Spots

Among the key trends:

- *Few sectors are more important in terms of the integration of different technologies, with new types of synergy possible between systems*
- *There is the opportunity to ensure that sustainability is built in from the start*
- *And there is the potential to engage the rising generation of talent.*

Flash Points

Some potential risks and challenges include:

- *This is a highly conservative industry, suggesting there will be tensions as it struggles to adapt to new needs and imperatives*
- *The buildings, infrastructures and cities we build effectively lock us in the particular energy-use patterns for decades and, in some cases, centuries*
- *For genuinely sustainable construction to take root, policy-making and planning regimes need to be much more effective.*

9. Data: Big & Little

The digital revolution is just beginning



In a Nutshell

Big Data is all over the Gartner Hype Cycle we mentioned in our Introduction, but will be crucial to managing complex systems in transition to sustainability. As will so-called Little Data, where citizens help monitor quality of life issues, with the results then aggregated. There will continue to be big issues, however, in relation to the implications for privacy, access and democracy.

Links to Breakthrough

Surviving the data tsunami will be a challenge, making sense of it an even greater one—but planetary management demands new forms of intelligence. Some thoughts on the role of data in implementing the Sustainable Development Goals can be found [here](#).

Growth Points

Research & Markets expects the Big Data market to almost double in the coming five years, from nearly \$39 billion in 2015 to more than \$76 billion in 2020. 70% of large organizations already purchase external data and 100% will do so by 2019, according to *Forbes*. Big data analytics tools will be the first line of defense, combining machine learning, text mining and ontology modeling to provide holistic and integrated security threat prediction, detection, and deterrence and prevention programs.

Sweet Spots

These may include the following:

- *As we work to manage the interfaces between multiple complex systems (e.g. cities, economies, the biosphere), the use of Big Data will be increasingly important*
- *Little Data techniques hold great potential to enable citizens to monitor key aspects of daily life and feed them back to those responsible for managing them*
- *Provided the issues of cybersecurity can be overcome, some of these new technologies have the potential to radically increase the democratic engagement of citizens around the world*
- *Expect Artificial Intelligence (AI) to play a growing role here, enabling forms of analysis virtually unimaginable today.*

Flash Points

Some potential risks and challenges include:

- *The Financial Times is among those arguing that there is too much hype and over-simplification in this field*
- *The Economist has argued that there is a developing backlash*
- *A range of privacy issues have surfaced*
- *There is an arms race under way between hackers and data owners and users, with major implications for data accessibility and ownership—for more, track down a copy of @War by Shane Harris*
- *Some see a move to a Big Brother future.*

10. Drones: Over Our Heads

Today's assassins will become tomorrow's everyday tools



In a Nutshell

Some say drones have a PR problem. That's putting it mildly. They have become notorious because of their use in targeting and killing distant enemies and, often, bystanders. It is virtually inevitable that this type of use will spread to other countries and movements. But drones will also increasingly find wider applications in areas like healthcare, crop protection, wildlife conservation and expanding the footprint of the Internet to base of the pyramid markets.

Links to Breakthrough

There is nothing automatic about this, but drones could potentially help tackle a number of our most pressing social, environmental and governance problems. These might include anything from delivery of urgently needed pharmaceuticals to monitoring missions to protect endangered wildlife populations from poachers and other threats.

Growth Points

Commercial drones are unmanned air vehicles operated without direct human control and guided by remote control. The commercial drones industry has witnessed significant technological developments over the last few years. The increase in demand in law enforcement applications and technological advancement have been key drivers propelling the growth of the market. By 2020 the commercial drones market valued at \$15.22 million in 2014 is expected to reach \$1.27 billion, according to the research company MarketsandMarkets (sic).

Sweet Spots

Drones come in many forms: aerial, terrestrial and aquatic. Among the emerging Sweet Spots for further development:

- *To get a sense of the potential use of drones for good, see [here](#)*
- *Drones have been used to spur action on deforestation by palm oil producers*
- *Possible applications include 'last mile' delivery of urgently needed medicines and urgently needed spares becomes a real possibility*
- *New types of radical transparency will be enabled for those involved in [investigative journalism](#) and campaigning against human rights abuses and bribery and corruption*
- *Community groups will benefit from property inspections, land and crop surveys, and community mapping applications*
- *Managing complex natural and environmental systems requires much more effective monitoring, including the great oceanic plastic gyres*
- *There will be applications in crisis situations, for example the location of earthquake victims and marooned refugees in regions like the Mediterranean.*

Flash Points

Some potential risks and challenges include:

- *The use of drones in counter-insurgency, see for example [here](#), raising a range of ethical issues*
- *There is a growing risk of collisions with aircraft*
- *From celebrity weddings to the radioactive drone that landed on the roof of Japan's Prime Minister home, there is growing concern about actual and potential abuses of privacy*
- *Drones are likely to cause noise pollution.*

11. Electric Vehicles: Charging Ahead

We will plug into zero emission mobility



In a Nutshell

Pioneers like Tesla now rivaled by the likes of BMW and GM. For an initial listing of electric vehicles, see [here](#). If the trend takes off, and history shows that other engine forms often evolve in response to competitive threats, there is also likely to be growth in battery and recharging technology markets—and in smart grids.

Links to Breakthrough

Public transport, walking and cycling should trump the private motorcar in sustainable transport systems, but given the global appetite for cars the electric and autonomous, or driverless, vehicle sectors will be crucially important.

Growth Points

The first growth market is for electric cars themselves. According to IDTechEx, the hybrid and pure electric cars market will triple to \$178.9 billion in 2024. They note.

A second growth market is for batteries. The 10 biggest battery manufacturers are identified [here](#). Navigant Research forecasts that the global market for Li-ion batteries in 'light duty consumer vehicles' will grow from \$3.2 billion in 2013 to \$24.1 billion in 2023.

Then a third growth market involves charging infrastructures. China is investing in this space. One emerging trend is for wireless recharging of electric vehicles.

And a fourth growth market focuses on autonomous vehicles, ultimately including aircraft. Here the market could reach nearly \$95 million in annual sales by 2035, according to Navigant Research. Three-quarters of the vehicles sold in 2035 are expected to have autonomous capability.

Sweet Spots

There are technologies that chime in with emerging zeitgeists—and others that help create them. Electric and autonomous vehicles are much discussed these days, not least because of the activities of Elon Musk and Tesla. Key Sweet Spots include:

- *Clean, zero-emission mobility*
- *Integration into new types of low carbon energy capture and storage systems*
- *If increasingly aligned with driverless vehicles, the result could be a radical reduction in the number of cars in use and parked in urban areas, progressively freeing up large areas of land (see final point below).*

Flash Points

Some potential risks and challenges include:

- *Some argue that electric cars can cause more harm than good*
- *Electric vehicles (EVs) require a different value chain and different processes to support them than traditional vehicles. Moreover, consumer perceptions of the practicality, functionality, and the potential advantages of EVs remain largely mixed in such areas as cost, savings, convenience, travel range, and charging infrastructure*
- *The pros and cons of autonomous vehicles are discussed [here](#)*
- *One of the most interesting perspectives we have seen on the astonishing potential impact of autonomous vehicles comes from Zack Kanter, [here](#)*

12. Finance: Following The Money

Capital will become multidimensional



In a Nutshell

Money is one of our most influential technologies—and it has been designed to be blind to most ethical, social and environmental issues. Potentially breakthrough trends include crowd-funding, microfinance and social impact investing.

Links to Breakthrough

If financial institutions and analysts adopted new mindsets and models the change process would proceed much faster.

Growth Points

According to the US Sustainable Investment and Finance Association, US socially responsible investments have grown substantially. US-domiciled assets under management using SRI strategies expanded from \$3.74 trillion at the start of 2012 to \$6.57 trillion at the start of 2014, an increase of 76%.

Meanwhile, the practice of social impact investing has grown into a \$36 billion market since the inception of the foundational term 'impact investment' in 2007—with \$4.3 billion worth of impact investments made in 2011, \$8 billion in 2012, a planned \$9 billion in 2013, and an estimated potential to advance to \$400-1000 billion by 2020.

Venture capital has passed its peak and has been shrinking. At the same time, the area of corporate venture capital (CVC) has been attracting growing attention.

Financial inclusion remains a huge concern, however, and also a huge potential opportunity. "With approximately 2.5 billion adults lacking a formal bank account, there is a long way to go to achieve financial inclusion," according to a 2013 Convergence study.

Sweet Spots

Among areas where great opportunities will be found are:

- *Starting from a small base, social impact investment will grow substantially through the period to 2025, aided by new market platforms like the UK Social Stock Exchange*
- *The growth prospects for microfinance look encouraging—and there is still vast market potential*
- *By 2025, the global crowdfunding market could reach between \$90 billion and \$96 billion—roughly 1.8 times the size of the global venture capital industry today, according to a 2013 study commissioned by the World Bank.*

Flash Points

Among potential risks and challenges are:

- *Levels of trust in bankers and other financial professionals took a massive hit in the post-2008 recession*
- *SRI funds often struggle in BRICS markets, as the Wall Street Journal pointed out: "Most investors lured by the glint of growth in markets like Brazil, South Africa and China accept the greater political, currency and liquidity risks in those markets, compared with more developed markets. But so-called socially responsible investors—who seek to marry long-term competitive financial results with social objectives—have to tangle with yet another risk in emerging markets: the relative lack of disclosure and universal reporting standards, which could make it harder to dig out unethical corporate behavior"*
- *Much will depend on how some of the biggest sources of capital in the world evolve, among them sovereign wealth funds.*

13. Food: Tomorrow's Menus

Expect a big shift in our eating habits



In a Nutshell

People will want more, better and cheaper food. But the farming, food and nutrition sectors will be under growing pressure from everything from climate change and water shortages to genomic testing (flagging a growing number of food sensitivities).

Links to Breakthrough

New types of traceability and certification scheme are emerging. New technologies include GPS-based management approaches, synthetic animal products (e.g. meat, eggs), and vertical farming.

Growth Points

Some 800 million people go hungry every day. But according to a recent bi-annual report by the UN Food and Agriculture Organization (FAO), global markets for most foodstuffs are characterized by abundant supplies and less uncertainty than in recent years, which is reflected in FAO's Food Price Index falling to a four year low.

Global fair trade food sales recently reached an estimated £4.4 billion. The global organic food market is significantly larger. Organic Monitor estimates the global market for organic products in 2013 to have reached \$72 billion (approximately €55 billion). The United States is the leading market with €24.3 billion, followed by Germany (€7.6 billion) and France (€4.4 billion). In 2013 official market data was for the first time ever published for China (€2.4 billion), making the country the fourth biggest organic market in the world. The per capita spending was in Switzerland (€210 euros) and Denmark (€163 euros).

Projected food shortages have fueled the development of synthetic meats, but consumer responses remain mixed. In the US a Pew survey found that only 20% of respondents said they would be interested in eating meat grown in a laboratory.

Obesity is a growing problem. The global weight loss management market is expected to reach \$206.4 billion by 2019 from \$148.1 billion in 2014. Major factors driving the growth of this market include the increase in obese populations, government funding, lifestyle changes, the increase in membership for health clubs, and technological advances.

Sweet Spots

Areas where breakthrough innovation is likely include:

- *Demand for water efficiency technology is likely to go off the curve*
- *As is demand for traceability in food supply chains*
- *We need more prevention in areas like obesity and chronic disease, rather than the sort of curative products and services that make up much of the above market assessments*
- *The area of overlap will grow between food, nutrition, exercise and health, a Sweet Spot that is the focus of new online platforms like Omada Health.*

Flash Points

Some likely areas of tension include:

- *Climate change will aggravate food production problems, via the spread of new pests, water availability, aridity and flash floods*
- *The disagreements between those who are pro and anti GM foods will continue, and in places intensify, but it may be that next generation technologies—and applications—will mean that by 2025 GM crops and products are more likely to be accepted.*
- *Applications like drought and disease resistance will help drive the wider use of GM techniques.*

14. Genomics: The Genius of Genes

Biotechnology will come of age



In a Nutshell

New forms of genetic testing will also have major implications for how we see quality in health and nutrition. And coming down the track fast is the new area of *synthetic biology*. Currently being tested in areas like algal biofuels, synthetic biology involves creating tailored organisms that are completely new to science.

Links to Breakthrough

Genetic science and biotechnology will provide a huge array of new solutions for many of our most critical breakthrough challenges, but they will also continue to throw up huge ethical, social, environmental and political challenges of their own.

Growth Points

The global biotechnology industry continues to be populated by many small companies, alongside a few giant pharmaceutical, chemical and agricultural firms. According to a 2012 *Key Biotechnology Indicators Report* by the Organisation for Economic Co-Operation and Development, the majority of firms have fewer than 50 employees. But their breakthrough potential remains strong.

A key emerging discipline is genomics, including personal genetic testing. According to Grant View Research, the global market for genomics is expected to reach \$22.1 billion by 2020, growing at an estimated CAGR of 10.3% from 2014 to 2020. Genomics based diagnostics dominated the overall market in terms of revenue at 36% in 2013, due to rapidly growing molecular diagnostic tests to manage and guide disease treatment, increasing awareness regarding the benefits of gene based diagnostic amongst a lot of doctors and medical practitioners and accuracy of gene based diagnostics diseases.

Genomics-based personalized medicine segment on the other hand is expected to grow at the fastest CAGR of over 12% from 2014 to 2020, due to increasing demand for population based therapeutic solutions and subsequent increase in R&D initiatives.

Sweet Spots

Upsides of the genomics revolution include:

- *More powerful tools and models for those working at the leading edge of biological innovation*
- *Potentially, a greater public understanding of the potential and issues associated with genetic and genomic technologies across a wide range of application areas.*

Flash Points

Among the potential risks and challenges:

- *The implications for the health insurance, food and nutrition industries are considerable, as people begin to explore their genetic sensitivities to particular foods, medicines or pollutants*
- *Regulatory issues and education are amongst the biggest concerns, according to the Personalized Medicine Coalition. "We need regulatory guidelines that adapt to and encourage the coupling of diagnostics and medicines that target genetically defined populations. And professional education must be modernized to prepare the next generation of doctors and other health care professionals for personalized medicine. Momentum is building, but much remains to be done to keep up with ever-evolving developments in science and technology."*
- *There are concerns that techniques like Crispr could move from genome-editing to bolder forms of human engineering.*

15. Geoengineering: Planetary Medicine

Climate change is spurring interest in megaprojects, hard and soft



In a Nutshell

Geoengineering involves deliberate, large-scale interventions in the Earth's natural systems to counteract climate change. There are serious—and legitimate—concerns about the impacts of such technologies as space umbrellas and ocean alkalinity adjustments. Some speak of *planet hackers*. Lower tech approaches include urban design, reforestation, soil carbon capture, wetland restoration and ocean health.

Links to Breakthrough

Our planet is increasingly stressed. Like a human patient, it needs diagnosis and treatment. While prevention is the best option, the scale of change driven by demographics, globalization, urbanization and environmental change suggests that curative solutions will also be needed.

Growth Points

A 2015 report from the US National Academy of Sciences says inaction on greenhouse-gas emissions makes resorting to geoengineering more likely. Some techniques will be hard to turn off once in place, whereas the *Silver Lining* approach of cloud seeding could be switched off quickly. Bill Gates was an early investor.

Forest regeneration tends to be less controversial, though it has its issues, including land rights. About 13 million hectares of forests are lost each year, but restoring degraded forest lands around the world is now regarded as one of the *surest* ways to reduce climate change emissions, as well as to improve farming and eliminate poverty.

Eight Latin American countries have pledged to combat deforestation and restore an area of land twice the size of Britain by 2020. The move is part of a global plan to plant hundreds of millions of trees and save over one billion tonnes of CO₂ a year.

There are growing calls for the testing of some of the technologies, without any commitment to full-scale deployment.

Sweet Spots

However fast such technologies are developed, it makes sense to engage with the more thoughtful pioneers to explore the potential and limits of at least some of these approaches:

- *Rather like personal genomics helping us engage with biological science, so the debate about geoengineering could help millions of people get a better sense of Earth System Science, or Gaia Theory*
- *Efforts are already evolving to help bridge between the science community and the worlds of business, finance and economics*
- *We should build out from the Oxford Principles on geoengineering.*

Flash Points

Among the issues raised to date are these:

- *Besides more obvious concerns about tampering with Earth's climate, many scientists and environmental organizations argue that diverting attention and research funds towards geoengineering will mean that people will take their eyes off the more important tasks of reducing greenhouse gas emissions and adapting to climate impacts*
- *Others argue that it will lower the incentives to cut emissions amongst politicians and the public who will see geoengineering research as a get-out-of-jail free card*
- *More seriously, some of the proposed forms of geoengineering could have significant system-level effects on the atmosphere and biosphere.*

16. Internet of Things: Everything's Connected

What will be noise, and what signal, as billions of objects talk?



In a Nutshell

This is the global network of physical objects or 'things' embedded with electronics, software, sensors and connectivity, generally sold on the basis that it will help create a smarter world.

Links to Breakthrough

Better connected buildings, vehicles, infrastructures and cities will help boost their resource- and energy-efficiency. There are real risks of breakdown, as in the area of cybersecurity, but the push towards smart built environments can only accelerate.

Growth Points

There has been a notable uptick in the number of NGOs and think-tanks focusing in on the Internet of Things (IoT), including the IoT Council. Hardly surprising, given the size of the predicted markets. According to GE, the 'Industrial Internet' has the potential to add \$10 trillion to \$15 trillion to global GDP over the next 20 years—and by 2025 it could be applicable to \$82 trillion of output or approximately one half of the global economy”.

According to a Business Insider study, the IoT will result in \$1.7 trillion in value added to the global economy in 2019. This includes hardware, software, installation costs, management services, and economic value added from realized IoT efficiencies.

The wearables trend will enormously boost the number of IoT-enabled things. As the wearable electronics business powers from over \$14 billion in 2014 to over \$70 billion in 2024, according to IDTechEx, the dominant sector will remain the healthcare sector which merges medical, fitness and wellness.

Sweet Spots

Huge fortunes are going to be made in this area, while a variety of incumbent businesses are severely dented—or even swept away. Among early evidence of emerging Sweet Spots were the following announcements:

- *In April 2015, Intel reported that it had made more than half a billion dollars from the IoT in the previous quarter, “the latest sign that the heavily hyped market is starting to become a significant revenue driver for tech companies,” as the Financial Times put it*
- *Intel said the IoT was already a \$2 billion-a-year business as far as it was concerned*
- *Designed, programed and operated in the right way, the IoT could massively boost efficiencies and help reduce the environmental footprint of people, organizations and economies. For more on the trends in this space, see [here](#).*

Flash Points

Discussion of some of the potential risks and challenges can be found here:

- *A growing range of concerns have been expressed*
- *There are growing concerns about the privacy implications*
- *Research shows that there are major potential security issues in a large proportion of the objects making up the Internet of Things*
- *As a result, there are calls for greater regulation.*

17. Materials: Tomorrow's Building Blocks

New chemistries and materials will make the impossible possible



In a Nutshell

Green chemistry aims to create new generations of chemical processes and materials better adapted for a sustainable future. One recent study forecast a \$100 million market for green chemistry by 2020. At the heart of this key sector are new materials like carbon fiber and graphene.

Links to Breakthrough

All sectors spotlighted in the Forecast depend on new forms of chemistry and materials technology to enable them to shrink their environmental footprints, boost their contributions to health, and help tailor their designs and operations to the requirements of increasingly circular economies.

Growth Points

Materials like polyurethanes play into the growing global market for energy efficiency. They are key to pushing the construction industry towards net zero buildings, for example. A growing market segment, valued by MarketsandMarkets at over \$3 billion, is made up of “green and bio” polyols, used to make polyurethanes.

The need for light-weight aircraft and road vehicles is spurring market appetite for materials like carbon fiber. A major sweet spot continues to be wind energy, with carbon fiber used to make rotor blades. It is also fundamental to emerging generations of electric vehicles, like BMW's i series.

The most notable new material has been graphene. In a study published in June 2015, IDTechEx forecast that markets for the material would total \$200 million by 2026 in terms of the sale price of materials.

“The graphene industry experienced a massive hype in the past 4-5 years,” notes IDTechEx, “although the hype is beginning to die down and elements of the industry have now

even entered the valley of despair. The number of companies supplying graphene has dramatically increased and now more than 35 suppliers exist. The first batch of companies formed in 2006-2007 are the furthest ahead as the majority of the new companies have little capital or revenue today.”

Part of the difficulty of predicting future market values is that current graphene commercialization strategies focus on substituting existing or incumbent solutions. This requires a more-for-less value proposition, but things would change dramatically if one or more ‘killer applications’ were identified. IDTechEx observes: “The versatility of graphene as a material, as well as the sustained multi-billion-dollar R&D investment, suggests that an application will be found.”

Sweet Spots

With accelerating urbanization, the appetite for materials looks set to grow. Given the life expectancy of buildings, it is crucial that we make them as energy-efficient as possible.

- *A range of existing materials already play into the global energy efficiency market.*
- *Materials like graphene will find new ‘killer’ applications offering radically new types of energy and environmental benefits*
- *Biomimicry (see Sweet Spot 4) will bring novel materials and applications.*

Flash Points

Discussion of some potential risks and challenges can be found here:

- *One critical issue will be to work out how to recycle materials like polyurethanes and carbon fiber at scale*
- *And, more generally, future materials will need to play into the Circular Economy.*

18. Robotics: Live-In Machines

The Japanese love them—and the rest of the world may follow suit



In a Nutshell

Like it or not, robots will be a key feature of tomorrow's economy. Track progress through new services like the [Robot Report](#).

Links to Breakthrough

A bit of a stretch, perhaps, but robots have applications that bring social and environmental benefits, from elderly and hospital care through to the clearance of minefields and the detoxification of old industrial sites.

Growth Points

The demand for robots is growing, with about 70% of the total robot sales in 2013 taking place in Japan, China, the United States, Korea and Germany. [Business Insider](#) notes that: "Robots have been a reality on factory assembly lines for over twenty years. But it is only relatively recently that robots have become advanced enough to penetrate into home and office settings."

They estimate that there will be a \$1.5 billion market for consumer and business robots by 2019. The market for consumer and office robots is expected to grow at a CAGR of 17% between 2014 and 2019, seven times faster than the market for manufacturing robots. The consumer/office robot market is currently led by three categories: home cleaning and maintenance, 'telepresence' (i.e., telecommuting to events or remote offices), and advanced robots for home entertainment. Other applications, such as robots that assist people with handicaps, are still nascent.

Sweet Spots

The benefits of using robots will continue to vary by sector and by geography, but their rise seems likely to continue.

Among the upsides:

- *The sweet spots for robots in manufacturing will continue to reflect the **cost of labor** in the relevant host countries.*
- *Some potential benefits of robots are indicated [here](#), including the longer term of robots to share what they know via the Internet, or similar.*
- *The use of robots in alternative energy sector, where they are said to be critical to cheaper renewable energy—with [Sunpower](#) acquiring [Greenbotics](#), a firm that makes solar-panel cleaning robots*

Flash Points

Discussion of some of the potential risks and challenges can be found here:

- *The increasing use of robots in manufacturing industry has huge **implications** for companies and employees alike*
- *The implications for employment have only just begun to be addressed. Think of those robots on wheels, driverless (or autonomous) cars, and [Zack Kanter](#) predicts the loss of 10 million jobs by 2025*
- *Would-be robot vendors still face major obstacles, according to [Business Insider](#). One is the "well-studied revulsion that most people feel toward robots that are too humanoid in appearance, and another is the high price demanded for key technologies that power robot mobility and object manipulation. There is also a brewing potential for the kinds of intellectual property battles we've seen in the smartphone space."*
- *For a critical review of robotics, see [Martin Ford](#), *Rise of the Robots: Technology and the Threat of a Jobless Future*, Basic Books, 2015*
- *Growing attention is being paid to the ethics of using robots, with some talking of roboethics: in 2012, the subject actually got a front cover on [The Economist](#).*

19. Solar Panel: The Big Switch

Prices tumble as solar follows its own version of Moore's Law



In a Nutshell

Solar power is on a roll, with solar photovoltaics sector following its own version of Moore's Law, Swanson's Law. Inevitably, there are dissenting voices. But there is no disputing the extraordinary fall in solar PV prices, driven by global competition (particularly China's rise as a solar player), government policy (as in Germany) and new technology.

Links to Breakthrough

We are close in to an extraordinary tipping point in the evolution of the global energy system. As the International Renewable Energy Agency (IRENA) reports: "The cost of generating power from renewable energy sources has reached parity or dropped below the cost of fossil fuels for many technologies in many parts of the world."

Their report, *Renewable Power Generation Costs in 2014*, concludes that biomass, hydropower, geothermal and onshore wind "are all competitive with or cheaper than coal, oil and gas-fired power stations, even without financial support and despite falling oil prices. Solar photovoltaic (PV) is leading the cost decline, with solar PV module costs falling 75 per cent since the end of 2009 and the cost of electricity from utility-scale solar PV falling 50 per cent since 2010."

Growth Points

According to the International Energy Agency wind, solar and other types of renewable power will overtake coal to become the world's top source of electricity in just 15 years if the 2015 COP21 process is a success. The IEA concludes that renewable power could soar from just over a fifth of global electricity generation today to nearly a third by 2030—a bigger share than coal, gas or nuclear plants.

Fatih Birol, IEA chief economist, argues that today's energy companies make a "major fatal error" if they assume climate action won't impact their businesses. "That would be like assuming interest rates will stay the same for the next 25 years," he told the *Financial Times* in an interview.

Despite recent success stories, however, the IEA has warned that clean energy progress is falling well short of the levels needed to limit the global increase in temperatures to no more than 2 degrees Celsius. In *Tracking Clean Energy Progress 2015*, the IEA examines progress in the development and deployment of key clean energy technologies. It tracks each technology and sector against interim 2025 targets.

Sweet Spots

Key information sources include Bloomberg Energy and New Energy Finance, the Climate Group and the now-allied Carbon War Room and Rocky Mountain Institute. Among key trends:

- *Renewables are a central part of the push to decarbonize the global energy system, which is attracting growing interest, among others from the World Economic Forum*
- *Frost & Sullivan's Annual Renewable Energy Outlook 2014 concluded that global installed renewable energy capacity would double by 2025*
- *Solar energy may have its ups and downs, but the underlying market growth trajectory is clear.*

Flash Points

Discussion of some of the potential risks and challenges can be found here:

- *The biggest risks are probably to energy incumbents, as we have seen with EU energy utilities like E-ON, forced into a painful restructuring*
- *The Economist flagged the risks back in 2013—and things have only got worse for energy utilities since*
- *McKinsey argues that other sectors will also experience growing disruption.*

20. Space: Reaching Escape Velocity

Leaving the planet can help us appreciate and value it



In a Nutshell

Science fiction is full of stories about our species leaving Earth when we have made conditions here intolerable. But space flight also brings economic, social and environmental benefits—and, with due care and attention, these could grow over time.

Links to Breakthrough

There will be significant environmental, socio-economic and political implications, but some applications could represent real breakthroughs. Most obviously, the images of Earth brought back by early astronauts helped create the modern environmental movement, while satellite remote sensing has helped us see our planet through new eyes.

Growth Points

The space industry is often bundled in with the wider aerospace industry, which is experiencing growing pressures to address concerns around carbon emissions, noise and other environmental problems. One big growth sector in recent decades has been the satellite market. According to a Euroconsult study, 1,115 satellites will be built between 2014 and 2023.

According to Euroconsult: “Governments all over the world will be responsible for more than 75% of the \$248 billion in revenues expected from the manufacturing and launch of these 1,155 satellites. Governments’ dominance of the space industry continues to increase as established space countries replace and expand their in-orbit satellite systems and more countries acquire their first operational satellite systems, usually for communications & broadcasting or for Earth observation & imagery intelligence.

“Nearly 90% of the government market value will remain concentrated in the 10 countries with an established space industry, but growth in the government market will derive from new satellite systems in 35 nascent space countries, creating a market of \$2 billion on average per year to be provided principally by foreign suppliers as local industry capabilities develop simultaneously.”

Meanwhile, interest in private space operations is growing. As the *Financial Times* has noted, investment in commercial space flight has become a big trend among the super-rich. According to Liam Bailey, head of global research at Knight Frank, more than 70 ultra high net worth individuals (people with at least \$30 million in net assets) have been investing in commercial space travel. A list of private companies interested in this field can be found [here](#).

Sweet Spots

Among existing and emerging sweet spots:

- *Satellite remote sensing, projected to exceed \$12 billion in value by 2019, helps inform sustainable (sometimes) development down here on Earth*
- *Forecast International predicts that some 200 satellites will be produced for this purpose over the next decade.*
- *The trend towards nanosatellites and micro-satellites suggests that the involvement of non-state actors could grow substantially*
- *One way space technology may help: when multi-millionaires and billionaires ride private sector rockets into near-space and come back transformed, as were many early astronauts and cosmonauts.*

Flash Points

Discussion of some potential risks and challenges can be found [here](#):

- *Environmental impact studies of space launches by organizations like NASA have shown a spectrum of negative effects*
- *Then there is the growing problem of space junk. As NASA reports, “There are more than 20,000 pieces of debris larger than a softball orbiting the Earth. They travel at speeds up to 17,500 mph, fast enough for a relatively small piece of orbital debris to damage a satellite or a spacecraft.”*
- *New issues will emerge, like that of black carbon in respect of space tourism.*

21. Visualization: Seeing is Believing

A crucial fundamental area in opening out the Sweet Spots spotlighted in the Forecast



In a Nutshell

“Talent hits a target no one else can hit,” said Arthur Schopenhauer. “Genius hits a target no one else can see.” Well and good, but for most of us it helps to visualize at least some elements of the future before we start building it.

Links to Breakthrough

Anyone who has seen films like *Minority Report* or *Avatar*, and more recently, *Jurassic World*, will have caught a glimpse of the future of visualization—itsself a key factor enabling us to evolve other Sweet Spots.

Partly it’s a matter of seeing is believing. But breaking through to more sustainable forms of value creation will require new visualization technologies, products and services. For a sense of where this may be headed, take a look at this TED talk by *Minority Report* science advisor John Underkoffler. Economics and user expectations continue to act as barriers to the spread of such techniques, but their future seems assured.

Growth Points

Most of us grow up with visualization techniques that we end up taking for granted. Consider Venn diagrams. That was then. More recently, novel visualization techniques have become virtually endemic in TV news and sports coverage. A related growth area has been infographics. Magazines like *Wired* now run listings of the best science visualizations of the year.

An early visualization pioneer was IBM, with its Smarter Planet and Watson platforms. In recent years, Google Earth has been a rapidly emerging player. An early backer of our Breakthrough Capitalism work was Autodesk, which encourages users of its software and visualization systems to “shape the world for the better.” The company explains, “the design-led revolution is a movement to use design to reinvent how we work, create and respond to our most pressing

social, environmental, and economic challenges”.

Other companies in this space include Tableau, Roambi and Zoomdata. But we must look beyond the technology—for example, there will be a growing need to expand the focus from tech platforms and invest in the people who can make sense of them.

Sweet Spots

- *A useful review of potential applications in ‘visualizing sustainability’ can be found [here](#)*
- *Some people are using related tools to help us see sustainability-related information in new ways, whether in book form or on-screen, for example with property owners encouraging tenants to share their energy data—and to then compete to improve their energy productivity*
- *One intriguing attempt to get related information through to consumers at the point of purchase has been the [GoodGuide](#) app*
- *Retailers have also been experimenting with visualization techniques, among them the [Sustainability Consortium](#).*

Flash Points

As to potential risks and challenges:

- *Some strengths of data visualization could prove to be its greatest weaknesses, says one data journalist. He notes: “... part of the problem with the automatic attachment of credibility to data visualisation comes about because of the way we encounter different forms of information presentation during our education. While text is frequently presented to students for critique, diagrams and data visualisations are overwhelmingly used simply as a medium of displaying final results.”*
- *Anyone interested in the do’s and don’ts of data visualization should dig into the work of Edward Tufte. His analysis of the visualizations used to decide whether or not to launch NASA’s Columbia Shuttle in January 2003 is a powerful forensic study of the perils of misusing an earlier visualization tool, PowerPoint.*

Breakthrough Interviews

This section of the Forecast provides contextual information, drawing on some of those who we interviewed as the project evolved. Our overall conclusion: the Breakthrough Decade (2016-2025) could see unparalleled breakthroughs in mindsets, technologies and business models. The goal now must be to turn the Stretch Agenda into the default setting in the Global C-Suite, in finance ministries and in business schools.

1. Capitalism will drive Breakthrough outcomes

Increasingly, we have to plan for—and push towards—breakthrough outcomes. Capitalism is our best means to this end, though industries, investors and communities anchored in the fading economic order will resist change with increasing vigor. They must be helped to see new realities—and to embark on their own economic transitions.

Key conclusions from our interviews were that:

1. Breakthroughs often follow breakdowns
2. The paradigm is shifting, but we need to accelerate the process
3. The spotlight must shift from risk to opportunity
4. A clearer link needs to be made with jobs, tax revenues and other positive outcomes
5. Insurgents need to counter incumbent propaganda more effectively.

Key leverage points for breakthrough change are identified in our Sweet Spots analysis. And here are some of the things that the experts told us:

'Breakdowns drive breakthroughs.' Her question: 'How big the shock needs to be to drive the paradigm shift?'

Hazel Henderson, Ethical Markets and Green Transition Scoreboard

'There has to be a concerted effort to move from risk to opportunity. The world needs hope. When you're mainly dealing with risk, you have to pivot with opportunity and innovation. And when you drive opportunity, you drive the things that go with it, jobs, tax revenues, etc.'

Mindy Lubber, President, CERES

"Old economy" business interests, such as the US Chamber of Commerce, National Federation of Independent Business and National Association of Manufacturers spend hundreds of millions lobbying for policies that deter the economy from becoming more innovative, equitable and sustainable.

'While claiming to represent the will of American businesses, especially small companies, these and other business organizations favor large, multinational firms that support a financial profit at all costs. To date, these business interests have been treated as the monolithic representative of business on Capitol Hill, in state houses and in the media. This is now changing.

'This conventional narrative needs to be challenged—aggressively and unrelentingly—until it breaks down. We need to get the media to frame the contest as a between "old business" and "new business"; between extractive industry and innovative industry; between prosperity for a few and prosperity for many; and between short-term exploitation and long-term stewardship.

'The media need to hear from, and report on, a new generation of businesses that move past the stale "either/or" debate and are building a world in which both profit and broad prosperity are achieved.'

David Levine, CEO and Cofounder, American Sustainable Business Council

2. Top teams will lead—or be replaced

The Stretch Agenda shows a corporate top team engaging the transformational change agenda, but most top teams are still struggling. Key conclusions from our interviews were that:

1. There is a paradigm shift beginning in boardrooms and C-suites
2. But there is a huge gap between business leaders and laggards
3. CSOs, or Chief Sustainability Officers, are seen as increasingly necessary
4. But CFOs may be in pole position to take on the key elements of the agenda longer term
5. Other world regions are way behind the curve.

Here are some of the things that the experts told us:

'The new paradigm shift starts in the boardroom. The C-Suite should be a team of sustainability champions that understands both the challenges and the business opportunities—a team that knows how to communicate and cooperate with government, NGOs, and social networks. But the Number 1 CSO should be the CEO.'

Guilherme Leal, co-founder, Natura, and member of The B Team

'I think the only way that we are fundamentally going to get business involved in sustainability, and therefore improvement of the state of the world, is when the C-Suite integrates sustainability into every decision and every discussion.'

'We should strive for a situation where a separate CSR or CSO officer is no longer necessary, and where the Environmental Profit & Loss and Social Profit & Loss approaches are built into the accounting rules. In this world, the CFO becomes responsible for all forms of capital, not just financial capital—and then we don't need a separate CSO.'

Peter Bakker, President, World Business Council for Sustainable Development (WBCSD)

'CEOs must reclaim their title as leaders, both in thought and in practice. We must demonstrate that C-Suite leaders are not selected based on seniority, but on their ability to think differently and to change things for the better that would have otherwise not been changed. This is the true definition of a leader.'

Paul Polman, CEO, Unilever and member of The B Team

'CSOs are needed to translate wider agenda into terms C-Suite can understand and engage with. CSOs tend to say they mean to do themselves out of their jobs, but likely to be around for 100 years.'

'Many companies are still in the process of scaling up their sustainability engagements. Many sectors are increasingly interested, with consumer products among the most active, but there are massive disparities between leaders (such as Unilever) and the rest. Carbon and sustainability/energy agendas are usually strongly linked.'

Rodolphe d'Arjuzon, Managing Director & Co-founder, Verdantix

'I remember at a World Economic Forum meeting of the "Arab business council" I presented a sustainability vision that they needed to adopt to show leadership and commitment. I was told it was too "sophisticated" for "our region"—that it is too early to think about it. A year later the financial meltdown happened.'

We need to bring the private and citizen sectors into the sustainable development solutions paradigm. To date, things are heavily tilted in most countries in the Middle East toward the public sector, which is neither adequately equipped nor capable of shouldering this responsibility alone. This practical monopoly is clear in the legislative hurdles for those wanting to register not-for-profit organizations. At the same time, the capabilities of the private sector and citizens sectors are mostly neutralized, either by choice or by politics. So a huge resource is wasted, kept on the sidelines at a time of dire need.'

Fadi Ghandour, Founder and Vice Chairman, Aramex

3. Tomorrow's bottom line will track new forms of value

Our thinking on this agenda is laid out in *The Breakthrough Challenge: 10 Ways to Connect Today's Profits With Tomorrow's Bottom Line*. Experiments with the Triple Bottom Line, Shared Value and the Environmental Profit & Loss accounting have been early indicators of a coming revolution in accounting. Key conclusions from our interviews were that:

1. Market transparency is a super-trend.
2. Natural and social capital accounting are evolving, but progress, ironically, is hard to track because much of the work is held confidential
3. Leading companies have picked low-hanging fruit, but are making slow progress in relation to tougher challenges
4. Among interesting experiments, confidence accounting
5. New types of modelling are being developed to track stranded assets.

And here are some of the things that the experts told us:

'The move towards greater corporate transparency is a super-trend, an inevitable consequence of globalization and technological advances that make it easier for investors, employees, consumers and other stakeholders to gain access to data and information that reveals how businesses are run. This has not been easy for businesses to respond to, because their instincts are competitive and their fiduciary duties are to their shareholders.'

Paul Druckman, CEO, International Integrated Reporting Council (IIRC)

'There is growing interest in the business community to understand more about valuation. Externalities are increasingly beginning to be measured, to answer the question, "What does this mean for the business?" But there is still quite a lot of scepticism on how much more valuation can tell you and if there is additional value in the new financial numbers.'

'We have the information, but not yet in the right language and not set in the right business case context. Academic research is incredibly important, but shot through with ecosystem services jargon and hardly understandable for the business communities. The majority of business users to date are the sustainability champions in their respective organisations.'

'One hopeful trend is spotlighted by the work of WAVES (Wealth Accounting and the Valuation of Ecosystem Services), developed by the World Bank, and looking at shadow pricing.'

Dorothy Maxwell, CEO, Natural Capital Coalition

'Companies have now picked the low-hanging fruit but have not yet gotten to the harder stuff. They haven't figured out which of the harder cases to get permission to act upon and tackle first. Harder means more expensive, longer payback periods, complexities are greater (for example in the supply chain), larger number of players.'

Joel Makower, Chairman and Executive Director, GreenBiz

'To date, Trucost has analyzed 4000-5000 listed companies, with a 10-12 year record of analyzing the environmental impacts of companies expressed in economic terms. We use natural capital accounting, with some 45 projects done to date. But we have not gone public with most of them. The shame of it is that where it really starts to matter, companies find it difficult to discuss what they have done. All the best cases that Trucost has done are now unpublishable because they are private and confidential.'

Richard Mattison, CEO, Trucost

'Confidence accounting is a key area where Long Finance and the London Accord have been working. The idea here is to use distributions, rather than discrete values, where appropriate in auditing and accounting. In a world of Confidence Accounting, the end results of audits would be

presentations of distributions for major entries in the profit & loss, balance sheet and cashflow statements. The proposed benefits of Confidence Accounting include a fairer representation of financial results, reduced footnotes, more measurable audit quality and a mitigation of mark-to-market perturbations. The landmark, free-to-download report was published on 5 July 2012.

'Andy Haldane, Executive Director for Financial Stability at the Bank of England welcomed the proposal and wrote in the foreword. He said: "My hope is that this proposal moves our thinking a step closer towards a set of accounting standards for major entities that put systemic stability centre stage. In the light of the crisis, anything less than a radical re-think would be negligent."'

Michael Mainelli, Chairman of Z/Yen, and Emeritus Gresham Professor of Commerce and Fellow at Gresham College

Professor Paul Ekins of UCL is developing a new computer model with a PhD student from Northern Ireland to help deflate the Carbon Bubble. It is based on a modeling of 7,000 oilfields globally, with further gasfields work now in progress.

One set of outputs, built around scenarios, will be market forecasts. Big companies fail to see what is coming up on the inside track. Once the Bubble is punctured, there will be a stampede (e.g. away from coal and other climate-intensive fossil fuels).

Professor Paul Ekins, UCL

4. Financial markets lag badly—but will transform

With some honourable exceptions, most parts of the financial markets have not yet properly engaged with the system change agenda, even in the wake of the self-evident and systemic failures of capitalism in recent years. Key conclusions from our interviews were that:

1. Too often, the system is measuring and valuing the wrong things
2. The numbers are seen as key—and still do not properly embrace ESG imperatives
3. There is a narrow time window for capitalism to crack the sustainability challenge
4. Entrenched interests are fighting back against necessary change initiatives
5. Many CEOs still struggle to tell the relevant stories to investors and financial analysts
6. The market intelligence available to investors is still patchy, but future consolidation may provide greater resources.

The financial markets are beginning to shift their thinking in such areas as *stranded assets*, so we may yet see a paradigm shift happening on Wall Street and in London's City, for example. But such changes will have to be fought for. One key way to engage investors and financial analysts is to introduce some of the market opportunities spotlighted in *The Breakthrough Forecast*. Here are some of the things that the experts told us:

'The system is systematically financing the wrong things. The investment time horizon is around 6-7 months, at the maximum 36 months. This isn't just a case of market inefficiency, but of market failure.'

Steve Waygood, Chief Responsible Investment Officer, AVIVA

'For financial analysts, if it's not in the numbers, it doesn't count. They tear out the explanatory sections of annual reports, rip the reports in half and focus on the numbers.'

Michael Mainelli, Chairman of Z/Yen, Emeritus Gresham Professor of Commerce and Fellow at Gresham College

'The long and short of it is that we have five years, and maybe it's eight, to fundamentally change incentive structures, to promote understanding of climate risk and what that means for investment portfolios, and in understanding more holistically what we mean by growth.'

'We've made big progress in ten, but we've got to triple or quadruple the rate of progress. If this problem were a generational problem, to be tackled in 40 years, I would feel great, but it's not. So we really have to find our voice.'

'The entrenched interests are both the traders in capital markets, and the carbon-based businesses and their allies. And it's a fight to the death, literally actually, probably. We're not going to win by appealing to the polar bears, because polar bears don't vote. The only way we are going to do it is to crack through the fiduciary requirements and responsibilities of long-term asset owners and economies.'

**David Blood, Co-Founder and CEO,
Generation Investment Management**

'Too few CEOs can properly tell the story of a better business model to their shareholders and the financial community. It took us a while, but now our investor base understands it. The story is about our risk aversion, our closeness to society, our reach, how we energize our employees, and finding new business opportunities. Few CEOs are good at this new form of storytelling. We normally have not been trained for that.'

**Paul Polman, CEO, Unilever
and member of The B Team**

'Public disclosure by companies has come a very long way in the past 20 years. A lot of information has come into the public domain in a very short period of time. But much of the data is spotty. Companies are cherry-picking. Of the top 3,000-4,000 companies, you might find that 20% have information on diversity, 45% serious emissions data.'

'Equity analysts focus on the upsides. Fixed income analysts focus on the downsides. Sustainability analysts focus on wider system conditions that could impact the other two. But it's very difficult to attract analysts who are fluent in both mainstream finance and sustainability. You can find financial analysts who know a few sentences in sustainability, and you can find sustainability analysts who don't know what a discounted cash flow model is—and don't much care.'

'There will be consolidation in this market. It's a natural tendency. On the upside, this could provide bigger resources and help clean up the standards mess, and also lead to more standardised data sets.'

**Chris(topher) Greenwald, Head of
Sustainability Investing, RobecoSAM**

5. Market research will be rebooted

Market research helps shape top team thinking around risks and opportunities, although it is not always quite as influential as some of its practitioners would like. Nor are the assumptions it bases its forecasts on always well founded. Like accounting and business school education, it is overdue for a major overhaul. Key conclusions from our interviews were that:

1. Market research is a key input for most businesses
2. But forecasting has had some major ups and downs in the past decade
3. There is a complex mix of actors in the market research field, from journalists through to true experts
4. Some analysts are using pattern recognition techniques to extract useful intelligence from new media, including in China
5. New tools are emerging, as in those available on Bloomberg terminals, but they still need further development
6. The Green Transition Scoreboard reached \$6.22 trillion in April 2015.

The likelihood of a pan-market *Breakthrough Forecast* is seen to be relatively low within the Breakthrough Decade—though when things are seen to be unlikely or even impossible, entrepreneurial eyes begin to glint. And here are some of the things that the experts told us:

'Forecasting is always complex—and most firms got their forecast wrong ahead of the 2008 downturn.'

'There is a pyramid of information providers, with the mass media at the bottom (offering wide reach, but shallow analysis), up through trade journals, market research, business analysts and consultants.'

**Rodolphe d'Arjuzon, Managing Director
and Co-founder, Verdantix**

'The key question is whether analysis/market research has predictive capacity—if not, it's just journalism. In the end, predictive capacity is what distinguishes journalism from investment advice. Investment advisors have been woeful at being predictive, hence why they're largely treated by management as marketing and publishing, and by clients as mostly CYA ("cover your ass") for their decisions. Almost all "buys" have some CYA research to justify the decision. For more on this, see [here](#).'

**Michael Mainelli, Chairman of Z/Yen,
Emeritus Gresham Professor of Commerce
and Fellow at Gresham College**

'The carbon market has been a rough ride, especially after the financial crisis. The EU scheme was flawed from the outset, thanks to an error of design. Its champions didn't foresee the risk of a contraction in demand.'

'These are early stage markets, and the lack of market data is quite frustrating. The data on environmental markets at this stage is too aggregated to be of value, even whimsical. We go client by client to obtain the relevant data. We know the people, can challenge and get a better sense of underlying reality.'

'The quality varies considerably. Some "analysts" are little more than journalists, their firms little more than media companies. We need people who can crunch the data, make the right assumptions, use feedback to improve their game.'

'There is no single report on the relevant market dynamics—and probably won't be for 15-20 years.'

**Jonathan Shopley, Director,
Carbon Neutral Company**

'The Cleantech Group has always avoided future casting, because they had a strong sense that there was a huge impending discontinuity in this space. All research measures the past in the present and puts things into categories that may not longer matter. Forecasters have been constantly wrong in the past. Research is flawed, as it's backwards looking and the quality is often questionable.'

'Still, people want to know what's over the hill and what are the models that are emerging, i.e. how the collaborative economy will impact them or how to structure trade with China. As an investor, we spend a lot of time on the ground listening to what people have to say.'

'But then we do pattern recognition and data analyses, most of it focused on new media. Despite the great firewall, the Chinese are ferocious social media users and this can generate lots of information on market opportunities.'

'There is an ongoing shift in our awareness and consciousness, an internal journey. The crisis in China is a crisis of the soul. The Chinese don't know what they are meant to be. A bunch of consumers controlled by an authoritative government? The next generation will seriously start to question that. And the same trend is observable all over the world. We are asking, What does it mean to be human? We can talk about this way more intentionally and openly than ever before. The tools of mindfulness and what some call Wisdom 2.0 are becoming more mainstream.'

**Nicholas Parker, Chairman and Executive Director,
Global Acceleration Partners (GAP) and
founder of Cleantech Group**

'This area started as an operational efficiency task (e.g. FSC-certified paper across the board, energy efficiency, recycling, composting), then in 2008 moved to an ESG product on Bloomberg terminals. Bloomberg have developed a "first cut" tool, but it is not yet decision-useful. It needs to go through versions 2.0 and 3.0.'

**Andrew Park, Head of Sustainable Finance
Programs, Bloomberg**

'We rarely buy market research for our investments. We have a standard subscription to Bloomberg Energy and Finance. But we rarely buy specific industry information—and the only reason we would is to convince investors and be more credible. Typically, we look at a number of visionary things that are going to happen in the future and then look at the price point in the present. For example, 3-4 years ago we concluded that a combination between solar systems and batteries in homes would be cheaper than buying power from the utility.'

Samer Salty, Founder & CEO, Zouk Capital

'Market research is critical. If you cannot think like your customers, there is no way to convince them to buy your products. Market research helps not only to know what they like but what they could like or need in the future. Corning's glass was an example: It had been sitting in data banks for a long time since the Sixties, but the market wasn't ready for its introduction until it was identified by Steve Jobs as one of the key components of the iPhone.'

**Brian Chabowski, Marketing Professor,
University of Tulsa**

The Green Transition Scoreboard topped \$5.3 trillion in 2014. With \$5.3 trillion in private investments and commitments since 2007, the green economy is on track to reach \$10 trillion in investments by 2020 to effectively scale innovations and reduce costs in green technologies as the world transitions to the Solar Age.'

**Hazel Henderson, Ethical Markets and Green
Transition Scoreboard**

6. Science & Technology will be make-or-break

We are in the early stages of a technology-driven economic transformation, of the sort that Joseph Schumpeter flagged and studied. Some of the technologies driving change are spotlighted in this first edition of *The Breakthrough Forecast*, but they represent the tip of as much larger iceberg, both of technologies and of evolving connections between them.

Key conclusions from our interviews were that:

1. Science is getting to grips with planetary boundaries—and the necessary economic, social and political transformations that will be needed in the Breakthrough Decade
2. Earth Systems Science and Gaia Theory are at the forefront
3. Traditional forms of clean technology will not move the needle on their own
4. Sustainability factors will be key drivers of tomorrow's markets
5. The companies—and countries—that benefit most from the trends will be those that can innovate most quickly and effectively.

If you want to change the system, change the genetic coding of tomorrow's science and technology. Move upstream. And here are some of the things that the experts told us:

Part way through researching *The Breakthrough Forecast* we took part in a session organized by Future Earth, a science-based initiative designed to develop knowledge to understand, implement and evaluate these transformations. This might include significant shifts in political, economic and cultural values, changes in institutional structures and individual behaviours, large-scale systems changes and technological innovations that reduce the rate, scale and magnitude of global environmental change and its consequences.

Among the questions addressed:

- *'What do we know about past transformations of the Earth System, as well as in ideas, technology and economy and how can the knowledge and lessons learned guide future choices?'*
- *'Can our present economic systems, ideas and development practices provide the necessary framework to achieve global sustainability and if not, what can be done to transform economic systems, measures, goals and development policies for global sustainability?'*
- *'Can technologies provide viable solutions to global environmental change and promote sustainable development? What are the opportunities, risks and perceptions associated with emerging technologies such as geo-engineering or synthetic biology? How can technology and infrastructure choices be combined with changes in institutions and behaviours to achieve low carbon transitions, food security and safe water?'*
- *'What are the longer-term pathways towards sustainable urban futures and landscapes, successful and sustainable "blue" societies, and a green economy?'*

Interviewees included Professor Frans Berkhout (interim Director, Future Earth), Sir Anthony Cleaver (Chairman, NERC), Prof Corinne Le Quéré (Tyndall Centre for Climate Research), and Professor Tim O'Riordan (UEA)

'Traditional green and clean technologies will not move the needle. It will be the Internet of Things and smart technologies of all kinds. Data and analytics will be key, leading companies into such areas as the Sharing Economy and Pareto efficiencies on energy and resources.'

Joel Makower, Chairman and Executive Director, GreenBiz

'Sustainability is part of future market drivers, so has to be part of the market analysis. Our aim is to bring sustainability to same level of ignorance as other factors!

'TSB doesn't aim to save the planet, but raises the question: When the planet is saved, what will the markets look like and how can UK ensure its companies are in a leading position in providing solutions?

'The world faces major challenges—from climate change, to resource use, to changing age demographics—which are creating global market opportunities for entirely new solutions.

'The countries most likely to benefit from these opportunities will be those which can innovate most rapidly. Innovation contributes to higher productivity and economic growth, and is core to our competitiveness. But many factors hamper innovation. Companies can struggle to find finance for early-stage development, the returns can be hard to predict, and the innovation 'landscape' can be complex and confusing.

'The Technology Strategy Board [now Innovate UK] tackles these barriers and supports business-led innovation. We work across business, academia and government - supporting innovative projects, reducing risk, creating partnerships, and promoting collaboration, knowledge exchange and open innovation.'

**Richard Miller, Head of Sustainability,
Innovate UK/Technology Strategy Board**

7. Business leaders will learn to do the politics

For decades, business was encouraged to stay out of politics, not that it paid much heed. Too often, its lobbying was designed to level market playing fields down. Now the time has come to level them up. Even the most courageous business leaders know that they cannot drive the transformation on their own. Transformative change needs political leadership, effective governments and well-designed public policy frameworks.

Key conclusions from our interviews were that:

1. Politics has long struggled to embrace the need for breakthrough innovation to tackle issues like climate change, though recent initiatives like the China-USA climate pact suggest the tide is turning
2. CEOs and other business leaders still feel very exposed if they take a lead on such issues, though there are a growing number of B2B platforms that enable them to speak out
3. Leadership is unlikely to come from the traditional bastions of business influence, suggesting a need for businesses to critically review the platforms and initiatives they back
4. The language of politics needs to change, with unsustainable industries clearly identified and discussed as such
5. There is an emerging science of social movement development, from which business could learn a good deal in terms of promoting a positive social change agenda
6. City mayors and urban administrations are taking an early lead.

Business has always done the politics, via lobbying and other forms of influence. The time has come to make those activities transparent—and to align them with the wider sustainability agenda. And here are some of the things that the experts told us:

'I wish we had been able to convince economists that they must help us work out a system that lets us combine the social and environmental concerns we need to address, as part of measuring sustainable development, a type of economic growth that incorporates these values in a consistent, workable, measurable manner. This, so far, has not been possible to achieve!'

**Gro Harlem Brundtland,
twice Prime Minister of Norway,
Deputy Chair of The Elders, and former
Chairman of the Brundland Commission
on Sustainable Development**

'A lot of people are discussing these topics, but CEOs feel very exposed in taking a lead. There's a real problem of scale ... We are at the point, both for humanity and for future generations, where we urgently need to create projects that have impact at that scale. We must invite politicians and NGOs to participate, but we cannot wait for them.'

**Paul Polman, CEO, Unilever and
member of The B Team**

'True markets, in which the competition is honest, robust and operates without unfair advantages and subsidies, are part of the solution. Our current market system must be adjusted to account for externalities, including the human health and environmental costs that are passed on to the general public and to government to address. Our system also must include a variety of ownership mechanisms such as cooperatives, community and social enterprises, Benefit corporations and employee-owned businesses.'

'There has been a tremendous growth of business organizations that believe in a new economic framework, one in which we find the correct balance between people, planet and profit. However, the improvements within these businesses are not enough to create the systemic change that is needed.'

'While voluntary corporate sustainability initiatives are essential, they are insufficient to bring about a new economy that values equity as much as profit; protects public and worker health, recognizes the value of natural resources for future use; and creates healthy communities with vibrant economics. What we need are specific laws and regulations that guide our economy toward sound, long-term decision-making

and a rewards system that take into account social and environmental externalities. Such policies need to be adopted in every sector, so that businesses are incentivized to adopt the triple bottom line.'

'One of the barriers to change is that to date, business has only been partially tapped as a political force. It is essential to bring together business organizations, companies, and business leaders working for sustainable solutions to engage in the policy discussions and push for the necessary systemic change.'

'Triple bottom line business leaders need to step up and change the national dialogue and outcomes on policies, and build the business voice, presence, and power for an economy based on the principles of sustainability.'

'Leadership will not come from traditional business groups like the U.S. Chamber of Commerce. Such powerful organizations continue to represent unsustainable business practices, ill suited for the global 21st century economy. To level the playing field, a national business-oriented policy advocate for sustainability is required. There is a need for another business voice. A voice capable of matching the US Chamber issue by issue, that makes the business case for the value of building a sustainable economy.'

'This is why we have built the American Sustainable Business Council (ASBC): it is a growing coalition of business organizations and businesses committed to advancing a new vision, framework and policies that support a vibrant, just and sustainable economy. Founded in 2009, today, the organizations that have joined in this partnership represent over 165,000 businesses and more than 300,000 entrepreneurs, owners, executives, investors and business professionals. These diverse business organizations cover the gamut of local and state chambers of commerce, trade associations, microenterprise, social enterprise, cooperatives, green and sustainable business groups, local and community-rooted business, women business leaders, economic development organizations and investor and business incubators.'

**David Levine, CEO and Cofounder,
American Sustainable Business Council**

'I believe there is an emergent science of movement building, in the sense of a field that is advancing, with practical goals, tools, practitioners and successes.'

We are clearly better at mobilizing social change than we were 50 years ago, in part because of people deliberately studying how to do it.

'Take the anti-war movement, for example. Opposition to the Iraq War was already at scale in 2003 before the war started, with millions of people in the streets around the world, in contrast to the years it took for the anti-Vietnam war movement to reach any measure of influence after that war began. The rapid progression of gay marriage is another great example: it went from radical / unthinkable (to use the Overton Window framework) to being official government policy in 5-10 years. The Occupy movement and Arab Spring uprisings also caught people by surprise in terms of how quickly they grew.

'So we're getting better at movement building, in my view, because we understand better how to do it, and have better tools and technologies to deploy that can make us more effective. The field of political and community organizing (studied and practised by people like Marshall Ganz) is really the center of this. It's come a long way, but in fact many of the principles and tactics were already being used as far back as the late 1700s abolitionist movement—arguably the first global movement.

'There are really two dimensions here. One is the axis of authentic, popular grassroots movements versus astroturf/"manufactured" campaigns; the other is fast versus slow. I don't think the correlation between those two axes is strong, since we do see fast-emerging, bottom-up movements, like the ones mentioned above, and also slow-emerging manufactured movements, e.g. it took the gun lobby generations of corrupting the political process in the US before their extreme interpretation of the 2nd amendment became policy.

'On authenticity, there's a long and sordid history of astroturf front groups all around the world. At the Kyoto climate conference I remember the Global Climate Coalition, a registered NGO, whose denialist position on climate change was spookily similar to that of the oil businesses like Exxon that funded it.

'Those groups will always try to exaggerate their popular support, and there are lobbyist firms on K Street in Washington DC who happily write fake letters to newspapers and circulate petitions on their behalf. The thin veneer of popular legitimacy of these

groups is clear when it's possible to get any visibility into the basic facts of their membership, funding and operations. They are nothing like a real movement.

'Some movements, however, form alliances with existing (or emerging) power structures in ways that seem legitimate to me. For example, the environment movement sees the renewable energy industry as a natural ally. The Sierra Club, for example, has commercial revenue-sharing agreements with renewables businesses. People on the other side will criticize this.

'Al Gore gets accused of supporting carbon reduction just so he can get rich on cleantech investments. It's absolutely true that he is financially aligned with those firms. Still, none of that is sufficient to suggest that the climate change movement is 'manufactured' by these industries, because it enjoys a very wide base of support in the community, measurable by the numbers of people involved and the actions they take.'

James Slezak, co-Founder, Peers

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It is time for leaders in all sectors to stretch themselves and their organizations way beyond their comfort zones, way beyond change-as-usual as we move into the **Breakthrough Decade (2016-2025).**

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