CEF Monthly Research Digest
An executive briefing on new & notable corporate sustainability research

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1. Corporate Strategy

**Carbon Pricing: Discover Your Blind Spots on Risk and Opportunity**
By S&P Dow Jones Indices, January 2018

**Objective**
- To explore the potential utility of carbon pricing scenario analyses to model a major element of corporate climate risk exposure.

**Background**
- In 2013, Trucost estimated that the cost of GHG emissions from business activities that were linked to reduced crop yields, flooding, disease, acidification of oceans, and biodiversity loss was $2.7 trillion.
- Pricing carbon provides an incentive to reduce GHG emissions and invest in low-carbon technologies.
- While current carbon prices average around $40/tCO₂, they are expected to increase in the near future, reaching up to $120/tCO₂ by 2030 in OECD countries (under a 2 degree Celsius scenario).
- Carbon pricing could affect companies directly, with regulatory costs imposed on their operations through energy and fuel price increases, or indirectly through costs passed on by suppliers.
  - Rising prices, along with the increased cost of using carbon-intensive products such as motor vehicles, may depress consumer demand.
- Understanding carbon pricing risk exposure is therefore essential to managing business risk and building resilience to intensifying global climate policies.

**Findings**
- Many companies measure their carbon footprint, which is a measure of carbon intensity and efficiency.
- Carbon pricing risk will vary over time according to the type of business activity and location.
- Relying on a carbon footprint as the only indicator of carbon pricing risk exposure could create a blind spot regarding the financial implications of carbon policies for companies and their investors.
  - Companies should look at how carbon prices affect the cost of global value chain impacts, as well as the net impact on profitability across different scenarios and time horizons.
- Trucost developed a Corporate Carbon Pricing Tool, which features a carbon pricing risk premium, representing the gap between current carbon prices and expected future prices under a two-degrees Celsius scenario.
  - By applying the carbon pricing risk premium to a company’s regional GHG emissions, it is possible to quantify the additional future regulatory costs that could materialize.
- Trucost analyzed nearly 100 companies across 16 countries and three industries: chemicals manufacturing, electric utilities, and automobile manufacturing.
  - Using publicly disclosed GHG emissions and financial data, Trucost quantified the financial implications of increasing carbon prices on corporate operating expenditures, revenues, and profitability.
- While carbon pricing risk for chemicals, electric utilities, and automobile manufacturing companies was minimal in 2017, it is projected to grow significantly over time.
• The **electric utilities** sector is likely to experience the most significant impacts from carbon pricing in the future.
  - The average profit at risk (change in earnings before interest and taxes) could reach close to **90% by 2030**, and exceed **150% by 2050**.
• The **chemicals sector** could be exposed to slightly less severe risks, with average profit at risk expected at over **30% by 2030** and **60% by 2050**.
• **Automobile manufacturing** could be subject to over **15% by 2030** and **30% profit at risk by 2050**.
• The difference in risk exposure across sectors is largely a result of the GHG intensity of **business activities** and the geographic distribution of operations.
  - Electric utilities have the highest operational carbon footprint, and tend to have physical assets concentrated in a few countries, leaving them with **limited flexibility with relocating** in response to rising costs.
  - In contrast, the chemicals and automobile manufacturing industries have lower GHG intensities and their operations and supply chains tend to be more widespread across regions.
• **Within-industry risk exposure varies significantly** and is projected to grow over time.
  - By 2050, it is estimated that the profit at risk for chemicals companies will range from 1% to over 300%, electric utilities from 1% to nearly 600%, and automobile manufacturing from 7% to 82%.
• Trucost’s analysis suggests that there is a positive correlation between GHG intensity and profit at risk across industry, but that **this accounts for just 30% of the variation in risk** between companies in the same industry.
  - Thus, GHG intensity represents only a **partial indicator** of a company’s likely carbon pricing risk exposure.
• Given the disparity of carbon price across regions, the total carbon pricing risk not only depends on **how much a company emits**, but also **where these emissions occur**.
  - Companies with similar carbon footprints could have different risk exposures due to differences in the location of their operations.
• Companies with **high resilience to increases in operational and supply chain costs** may be able to minimize carbon pricing risk.
  - In **vertically integrated** business models, companies have greater control over emission efficiency in their supply chain.
  - In **non-integrated** business models with flexible supply chains, companies could easily switch to suppliers with lower carbon pricing risks.
  - Market conditions also affect how much cost a company would have to absorb based on its ability to pass costs on to customers, taking into account changes in demand for its products and services due to higher selling prices.
• **Supply chain activities** often account for a larger share of a company’s carbon pricing risk exposure than operational emissions.
  - On average: 80% for automobile manufacturing, 53% for chemicals, and 29% for electric utilities.
• For industries selling carbon-intensive products and services, increasing carbon prices could mean higher costs for consumers, which could **reduce demand**, ultimately lowering revenue.
• Trucost estimated the increase in the cost of driving from carbon pricing for consumers and the effect it may have on the revenue of automobile manufacturing companies.
  - The profit at risk for auto manufacturers due to product emissions could reach 5-50% between 2025 and 2050, even exceeding operational and supply chain risks from 2030 onwards.
• Enhancing the traditional carbon footprint with a carbon pricing risk premium provides a forward-looking lens on policy risk exposure at a regional level.
  o Financial costs from operational, supply chain, and product-related emissions through different mechanisms, such as tax, supplier cost pass through, and changes in market demand, can be estimated by applying carbon pricing scenarios.


The State of Corporate Energy & Sustainability Programs 2018
By GreenBiz and Schneider Electric, January 2018

Objective
• To survey corporate energy and sustainability programs, and provide guidance on how organizations can more tightly align how they buy and use energy.

Background
• The findings of this report are based on responses to an online survey completed by 236 energy and sustainability professionals.
  o Respondents were from diverse industries and companies with $100 million to $10 billion or more in annual revenue.
  o 60% of respondent organizations were at or above $1 billion in revenue.
• 63% of respondents were from N. America, 27% from Europe, and 10% in Asia-Pacific or other parts of the globe.
• The energy and electricity systems are on the brink of disruption: energy is becoming decentralized, and new technologies are enabling businesses to both produce and consume energy.
• Many companies are looking at these megatrends to find new ways to save money, meet sustainability goals, and build resiliency.

Findings
• Organizations that are actively managing and planning for climate change see 18% higher return on equity than peers, as well as 67% higher than companies that do not disclose on climate action.
• Nearly 80,000 emissions-reducing projects from 190 Fortune 500 companies reporting data showed almost $3.7 billion in savings in 2016 alone.
• This survey revealed gaps in how firms currently approach and execute energy and sustainability initiatives, and these gaps can limit ROI.
• This survey also showed evidence that the business community isn’t prepared for the seismic shift that’s reshaping the energy landscape.
• Change will only accelerate and intensify, presenting risks and competitive disadvantages for those behind the curve and opportunities for those ahead.
• There is a significant opportunity for improved coordination, but limited agreement on barriers that block progress.
  o 40% of respondents agreed that their organization’s energy and sustainability decisions were not well coordinated across relevant departments and teams.
  o 50% of C-level and board members felt that energy and sustainability decision-making was not well coordinated, while only 26% of senior vice presidents and vice presidents had the same view.
  o When respondents from commercial and industrial companies were asked to choose the top two obstacles to implementing energy and sustainability projects, financial barriers rose to the top.
    ▪ “Limited financial resources” and “ROI not attractive” were cited by 48% and 45%, respectively. “Decentralized programs” followed closely at 41%.
  o 44% of respondents noted that “lack of coordinated project/strategic planning” was an issue when asked about challenges in working across departments.
    ▪ 80% of C-level respondents cited coordinated planning as a challenge.
  o Improved energy efficiency pays dividends by trimming consumptions and costs.
  o To foster collaboration, consider:
    ▪ Creating cross-functional teams to work on energy and sustainability projects;
    ▪ Sharing budgets, best practices, and data across departments; and
    ▪ Centralizing functions to develop centers of excellence across all locations.
• Decentralized data management poses a significant challenge for integrated energy- and carbon-reduction efforts.
  o Companies are taking a proactive approach to collecting energy and sustainability data.
    ▪ 87% of education company respondents stated that related projects are planned or underway, followed closely by service providers and industrial companies. At 73%, healthcare respondents were the least proactive.
  o Respondents from larger companies had higher rates of data collection.
  o Only 41% of respondents noted that energy and sustainability data was shared globally across their enterprise.
  o Decentralized, local data can be helpful for individual facilities, but the absence of broader sharing limits the ability to pinpoint and capitalize on savings opportunities as well as manage programs in a coordinated, efficient fashion.
  o 55% of respondents agreed with the statement “over the next three years, my company will have the connected devices and software analytics to quickly react to energy and carbon-saving opportunities.”
  o Organizations looking to take full advantage of the data available should:
    ▪ Use Internet of Things-connected devices and enterprise-wide software to benchmark performance and find efficiency and savings opportunities;
    ▪ Centralize data globally for analysis and reporting; and
    ▪ Share data across departments to facilitate continuous improvement in all domains.
  o Case study: AEG has a GHG reduction target of 20% by 2020. They implemented an enterprise-wide management platform that tracks 53 different data streams across 120 venues. The company has already reduced GHGs by 14% and achieved a 63% waste diversion rate.
• Companies are confident they’re prepared for change, but action doesn’t match perception and intent.
85% of respondents agreed with the statement “over the next three years, my company is taking action that will keep its carbon-reduction plans competitive and industry leaders.”

To be competitive with leaders’ carbon-reduction efforts, companies will need to deploy a variety of projects including on- and off-site renewable energy, energy efficiency, energy storage, and demand response.

82% of respondents had initiated energy efficiency upgrades or planned to do so within two years.

51% of respondents noted they had already done or were planning to do renewable energy projects.

Only 31% of respondents reported planning projects related to energy storage, micro-grids, or demand response, which is necessary to take advantage of the resource and financial savings in a decentralized energy system.

When asked, “What are the primary drivers for strategically managing resource use and sustainability?” 69% cited cost savings, 60% reported meeting corporate goals, 47% reported improving the company brand, 46% said mitigating environmental risks, and 37% said meeting customer or shareholder expectations.

Case study: IMT University has a micro-grid connected to a local smart grid and monitors activity at the building level in real-time. The school has tested multiple energy management scenarios based on consumption, production, and storage, which it can apply to optimize renewable energy supply and energy usage in facilities.

Once inaccessible to many organizations, today’s renewable energy technologies make financial sense, and companies are taking notice.

Renewable energy is key to a decarbonized future.

A majority of respondents reported having renewable energy projects underway or planned.

This was true for over 60% of respondents in education, health care, financial services, and technology.

39% of industrial companies reported renewable energy projects, and 89% of them reported energy efficiency upgrade projects.

The movement toward renewables is likely due to C-level interest and support. 82% reported being involved at some level in sustainability and renewable energy initiatives.

The types of energy projects a company prioritizes are often determined by the needs of their sector.

When considering clean energy:

- Develop a multi-pronged strategy that will effectively meet CO₂-reduction goals and reduce costs;
- Present renewable energy strategies as a business case to engage C-suite executives and ensure alignment; and
- Look at pairing renewable and storage technologies to prepare for savings opportunities in a decentralized grid environment.

Case study: Sun Chemical has deployed onsite and offsite renewable energy to cut costs and meet targets. A recent PPA will reduce electricity costs at a production facility in NJ by roughly $400,000. Rooftop and carport photovoltaic arrays will generate more than 30% of the facility’s energy needs.

A longer-term, more comprehensive approach to energy and sustainability decision-making is becoming business as usual.

Financial return on investment has always been the obvious benchmark, but other criteria are now being widely considered.
When asked about drivers for energy and sustainability efforts, 69% of respondents identified cost savings, 60% said meeting internal and external goals, and nearly half cited improving company brand and mitigating environmental risks.

Different drivers are more prominent in influencing different industries.

- Education and government named activist pressure as a primary driver.
- 33% of health care organizations noted employee engagement as a driver, compared with just 24% of companies overall.

Drivers varied by geography, as well.

- Most frequently cited driver in North America: cost savings (72% vs. 69% global average).
- EMEA: competitive positioning (41% vs. 35% global average).
- APAC: regulations (33% vs. 24% global average).

CFOs play a prominent role in corporate sustainability efforts.

- 83% state they are always or frequently involved in setting sustainability strategy.
- 80% say they are always or frequently involved in executing sustainability strategy.

To develop a more inclusive approach to evaluating initiatives and outcomes, companies can:

- Use established methods such as scenario analysis to assess and disclose;
- Develop integrated energy and sustainability strategies and key performance metrics; and
- Calculate an internal carbon price for project review.

Case study: Rolls-Royce has reduced its global energy consumption by 17% since 2014. The company recognized that investments should be based on benchmarks going beyond simple payback. Key business decisions are now based partly on energy and carbon criteria.

2. Forests

The Business of Planting Trees: A Growing Investment Opportunity
By the World Resources Institute (WRI) and The Nature Conservancy (TNC), January 2018

Objective
• To highlight four promising investment themes in land restoration and provide snapshots of companies that are restoring land.

Background
• Population growth and expanding consumer demand are placing immense pressure on the earth’s natural resources.
  o Demand for food is likely to increase by 46 percent between 2017 and 2050.
• Signs of degradation can be found in almost every ecosystem in the world.
• There is a net annual loss in global forests of 3.3 million hectares (8.1 million acres).
• The dual issues of resource demand and environmental degradation – coupled with land’s inherently limited availability – make clear that the way we currently use land is unsustainable.
• This challenge offers an opportunity for businesses and entrepreneurs.
  o Companies that develop profitable and scalable business models for land restoration have the potential to grow substantially.
• Restoration is an activity that improves the ecological function of a degraded landscape.
  o Tree-based restoration can range from reforestation to agroforestry (establishing agricultural systems that incorporate trees).
• Restoration economy refers to the network of businesses, investors, and consumers that engage in economic activity related to restoring land.
• There are no official measures of the size of the global restoration economy.
  o Not surprising, since restoration spans a broad range of industries, ecosystems, and regions.
  o A 2015 study estimated that the US restoration economy generated $9.5 billion in annual economic output and created an additional $15 billion in indirect and induced output. The study also found the US industry employed 126,000 Americans in 2014.

Findings
• Companies are adopting a wide range of approaches to restore land.
• Four themes in particular are prominent in the emerging restoration economy: technology, consumer products, project management, and commercial forestry.
• Technology: companies that develop and deploy technology to facilitate restoration, often by improving efficiency and lowering costs.
  o Case study 1: BioCarbon Engineering: Uses specialized drone technology to reforest remote landscapes.
  o Case study 2: Land Life Company: Patented a product that enables trees to grow in dry and degraded land.
  o Case Study 3: TerViva: Plants pongamia on distressed agricultural land.
  o Case study 4: F3 Life: Enables access to credit for smallholder farmers in Kenya.
• Consumer products: Companies that sell products to the end consumer, often using materials from their restoration activities or sponsoring restoration projects.
  o Case study 1: Guayaki: Sells beverages made from yerba mate grown in restored Atlantic rainforest.
Case study 2: Tentree: Apparel company; plants 10 trees for every product sold.

Case study 3: Ecosia: Online search engine; uses its profits to plant trees.

- **Project management:** Companies that develop, implement, and manage restoration projects from start to finish on behalf of their clients. Often driven by government pledges or policies.
  - Case study 1: Brinkman and Associates: Manages large government projects in Canada and tropical plantations in Latin America.
  - Case study 2: Fresh Coast Capital: Does large-scale urban revitalization in US cities.

- **Commercial forestry:** The management and harvesting of trees for timber and wood fibers. Only those plantations that plant trees on degraded land are considered restorative.
  - Case study 1: New Forests: Manages sustainable timber plantations and conservation investments.
  - Case study 2: The Lyme Timber Company: Acquires and manages working lands under working forest easements.
  - Distributed plantations: Companies that aggregate supply through trees grown by smallholder farmers on the farmer’s land.
    - Case study: Komaza: Works with smallholder farmers to plant and process trees for timber.
  - Bamboo plantations: Plantations that grow bamboo, a non-timber forest product comparable to trees in its potential uses that can be highly productive.
    - Case study: EcoPlanet Bamboo: Establishes bamboo plantations as alternative timber and fiber sources.
  - Mixed-species plantations: Plantations consisting of more than one species planted in the same area, improving biodiversity.
    - Case study: Symbiosis Investimentos: Manages and restores Atlantic rainforest with native species.

3. Risk Management

By the World Economic Forum (WEF), January 2018

Objective

- To review the greatest risks facing humanity in 2018 (as part of the Global Risks Perception Survey) and to focus minds on the need for systems thinking and new ways of collaborating globally and involving all stakeholders.

Background

- Last year’s report called for “fundamental reforms to market capitalism” and a rebuilding of solidarity within and between countries.
- This year, a global economic recovery is under way, offering new opportunities for progress that should not be squandered.
- While humanity has become adept at understanding how to mitigate conventional risks that can be relatively easily isolated and managed, we are much less competent when it comes to dealing with complex risks in the interconnected systems that underpin our world.
- When risk cascades through a complex system, the danger is not of incremental damage but of “runaway collapse” or an abrupt transition to a new, suboptimal status quo.
- Acceleration and interconnectedness in every field of human activity are pushing the absorptive capacities of institutions, communities, and individuals to their limits.

Findings

- Top 5 global risks in terms of likelihood:
  - Extreme weather events;
  - Natural disasters;
  - Cyber attacks;
  - Data fraud or theft; and
  - Failure of climate change mitigation or adaptation.

- Top 5 global risks in terms of impact:
  - Weapons of mass destruction;
  - Extreme weather events;
  - Natural disasters;
  - Failure of climate change mitigation and adaptation; and
  - Water crises.

- Inequality and unfairness
  - This year continues a trend where economic risks feature less prominently.
    - Recovery is underway in all of the major economies, leading to a sharp improvement in sentiment.
  - Does the swing to optimism suggest the possibility of complacency and developing a blind spot around economic risks?
    - Even without another crisis, economic risks can be hugely disruptive.
  - The International Labour Organization recently highlighted that worldwide earnings growth has been decelerating since 2012, and called for increased collective bargaining to reverse the trend.
  - While global inequality is down, within-country inequality is an increasingly corrosive problem.
According to the IMF, over the past three decades, 53% of countries have seen an increase in income inequality, with this trend particularly pronounced in advanced economies.

High levels of personal debt, along with inadequate savings and pension provisions, are one reason to expect that frustrations may deepen in the years ahead.

Rising income and wealth disparity ranks third as a driver of global risks over the next 10 years.

Automation is another potential driver of inequality. For the foreseeable future, automation and digitalization can be expected to push down on levels of employment and wages, and contribute to increases in income and wealth at the top of the distribution.

The global gender parity gap across health, education, politics, and the workplace widened for the first time since 2006.

Risks of conflict

Economic and cultural forces are converging in some cases, with economic pain having been sufficiently concentrated among groups and geographies for those groups and regions to begin to assert themselves politically.

As highlighted by elections in Germany and Austria in late 2017, far right parties continue to grow in strength and influence in many European countries.

Polarization between groups with different cultural heritages or values looks set to remain a source of political risk in Western countries in 2018 and beyond.

Nearly all (93%) respondents expect a worsening of political or economic confrontations/frictions between major powers this year.

Geopolitical risks are exacerbated by the continuing decline in commitment to rules-based multilateralism.

The erosion of institutions of multilateral dialogue and decision-making damages the prospects of reaching new global agreements at a time when the need for cooperation looks more urgent than ever.

The World Trade Organization (WTO) in particular, and its ability to resolve trade disputes, is at risk.

The US has been blocking appointments to the WTO’s seven-member appellate body – since December 2017, only four seats have been filled, and in theory, the body could cease functioning in 2019.

The possibility of trade tensions spilling over into increased geopolitical strains should not be dismissed.

Our planet on the brink

All five risks in the category are this year in the top-right quadrant of The Global Risks Landscape 2018, indicating higher-than-average perceptions of both likelihood and impact.

Among the most pressing environmental challenges facing us are: extreme weather events and temperatures; accelerating biodiversity loss; pollution of air, soil, and water; failures of climate-change mitigation and adaptation; and transition risks as we move to a low-carbon future.

The truly systemic challenge here rests in the depth of the interconnectedness that exists both among these environmental risks and between them and risks in other categories.
2017 saw unusually frequent and intense Atlantic hurricanes, and was the most expensive hurricane season ever. September 2017 was the most intense month on record, according to the Accumulated Cyclone Energy (ACE) index.

- 76% of the 31.1 million people displaced during 2016 were forced from their homes as a result of weather-related events.

When the data are finalized, 2017 is expected to be among the three hottest years on record (2016 was the hottest), and the hottest non-El Niño year ever.

- In the first nine months of the year, temperatures were 1.1°C above pre-industrial levels.
- There are also increasing localized extremes: during 2017, record high temperatures were experienced from parts of southern Europe to eastern and southern Africa, South America, and parts of Russia and China.
- California had its hottest summer ever, and by the end of November, wildfire burn was at least 46% above the 10-year average.
- Chile had its most extensive wildfires ever, and in Portugal, over 100 wildfire-related deaths were recorded.

- More than 75% of the world’s food comes from just 12 plants and five animal species.
- There is now a one-in-twenty chance per decade that heat, drought, and flood events will cause a simultaneous failure of maize production in the world’s two main growers: China and the US.

Biodiversity loss is now occurring at mass-extinction rates.

- The populations of vertebrate species declined by an estimated 58% between 1970 and 2012.
- Globally, the primary driver of biodiversity loss is the human destruction of habitats including forests.

Indoor and outdoor air pollution are together responsible for more than one-tenth of all deaths globally each year.

- More than 90% of the world’s population live in areas with levels of air pollution that exceed WHO guidelines.

The Lancet Commission on Pollution and Health estimates the overall annual cost of pollution to the global economy at $4.6 trillion, equivalent to around 6.2% of output.

- Many associated risks are not fully understood. For instance, plastic waste in the world’s water is finding its way into humans: people eating seafood could be ingesting up to 11,000 pieces of micro-plastics every year. Micro-plastic fibers are found in 83% of the world’s tap water.

In 2017, emission of CO₂ rose for the first time in four years, bringing atmospheric concentrations to 403 ppm, compared with a pre-industrial baseline of 280 ppm.

- Having absorbed 93% of the increase in global temperatures between 1971 and 2010, the world’s oceans continue to get warmer and studies suggest their capacity to absorb CO₂ may be declining.
- Research also indicates that tropical forests are now releasing rather than absorbing CO₂.

**Cyber-defenses are being tested**

- This year, cyberattacks and massive data fraud both appear in the list of the top five global risks by perceived likelihood.
- In 2016 alone, 357 million new malware variants were released.
- Cybercriminals have an exponentially increasing number of potential targets, since the use of cloud services continues to accelerate and the Internet of Things is expected to expand from around 8.4 billion devices in 2017 to a projected 20.4 billion in 2020.
In 2016, companies revealed breaches of more than **4 billion data records**, more than the combined total for the previous two years.

A 2017 study of 254 companies across seven countries put the **annual cost of responding to cyberattacks at £11.7 million per company**, a year-on-year increase of 27.4%

- The **cost of cybercrime** to businesses over the next five years is expected to be **$8 trillion**.

**Economic storm clouds**

- Headline indicators suggest the world is finally getting back on track, but they mask numerous concerns.
- Stocks have been on a long bull run, raising concerns that the **lessons of the most recent crisis have gone unlearned**, and that a **deep correction** may follow.
- **Bond valuations** are even more dramatic, with around $9 trillion worth of bonds trading with a **negative yield** in mid-2017.
- The IMF’s index of **global house prices** is close to its pre-crisis peak again, and signs of **stretched valuations** are evident in cities such as Hong Kong, London, Stockholm, and Toronto.
- Innovations in financial assets and asset management — for instance, ETFs — have **yet to be tested in crisis conditions**.
- Prior to the 2008 crisis, the world was awash with cheap loans.
  - **Remarkably, there has been no aggregate deleveraging since**. In fact, the total global debt-to-GDP ratio is higher now than it was before the crisis.
- If major central banks’ interest rates were to move significantly higher, lower-income emerging market economies would take a direct hit from the combination of higher rates and worse exchange rates, increasing the cost of borrowing US dollars or other hard foreign currency.
- Another long-standing risk is the **health of the global financial system**, even though much has been done to restore the banking system to stability after its near collapse in 2008.
- **Serious questions remain about the ability of policy-makers to adequately address another financial crisis**.
  - For instance, the Fed has responded to past US recessions by cutting its benchmark policy rate by an average of 5.5 percentage points. However, that benchmark rate currently stands at just 1.5%.
- Concerns about the **economic impact of new technologies** were prominent in this year’s Global Risks Perception Survey.
  - Although technological advances have provided many benefits in emerging economies, the associated risks are arguably most pronounced in these countries too.
- Given current market dynamics, it may not be rational for any single market participant to price in rising political and geopolitical tensions. **The risk is that we will hit a tipping point at which point everyone prices in these tensions, with a rush to the exits that hits asset prices, strains the resilience of the global financial system, and tests whether policy-makers retain the firepower to prevent deep and long-lasting impacts on the real economy.**

**Future shocks**

- As the world becomes more complex and interconnected, easily managed incremental change is giving way to the instability of **feedback loops, threshold effects**, and **cascading disruptions**. Here are 10 potential future shocks.
Simultaneous breadbasket failures threaten sufficiency of global food supply.
- Extreme weather, political instability, or crop diseases could result in a simultaneous blow to output in key food-producing regions, triggering global shortages and price spikes.
- Widespread fear – let alone death on a large scale – could lead to devastating spillover effects.
- Even on optimistic climate-change trajectories, food supply risks will remain elevated.
- Among the changes that could help improve sustainability and resilience are: increasing crop diversity, establishing stress tests of ‘choke points’ and other national and regional vulnerabilities, reducing waste along supply chains, reaffirming humanitarian principles and commitments, and establishing early warning indicators.

Artificial intelligence “weeds” proliferate, choking off the performance of the internet.
- What if the adverse impact of AI involves not a super-intelligence that takes control from humans, but “AI weeds” – low-level algorithms that slowly choke off the internet?
- The development of overarching norms, regulations, and governance structures for AI will be crucial.
  - Without a robust and enforceable regulatory framework, there is a risk that humans will in effect be crowded out from the internet by the proliferation of AI.

Bilateral trade wars cascade and multilateral dispute resolution institutions are too weak to respond.
- Against a backdrop of deepening protectionist sentiment, trade disputes could spread rapidly by triggering adverse impacts and retaliatory moves along global value chains.
- A breakdown of the global trade system would roil supply chains and reduce overall economic activity.
- A period of de-globalization may be seen by many as a welcome corrective, but rejecting current frameworks in favor of binary nationalistic approaches would cause significant disruption.
- Securing durable and worldwide support for globalization would be made easier by an increased domestic policy focus on cushioning the impact on individuals and regions affected by transitions in economic activity.

A new wave of populism threatens the social order in one or more mature liberal democracies.
- If an evenly divided country sees polarized positions harden into a winner-takes-all contest, the risk increases of political debate giving way to forms of secession or physical confrontation.
- A spiral of violence could begin, particularly if public authorities lost control and then intervened on one side with disproportionate force.
- The more that can be done to boost the resilience and responsiveness of democratic institutions, the less likely they will be to buckle under pressure.
- We also need to better understand the democratic fissures currently being caused by the economy, by social media, and by changing patterns of national identity.

AI-piloted drone ships wipe out a large proportion of global fish stocks.
- A third of all fish consumed in the world are already caught illegally.
- AI and drone technologies are increasingly commonplace.
- Add to this the automation of illegal fishing, and the impact on fish stocks could be devastating, particularly in **international waters**, where oversight is weaker.
- A rapid collapse of fish stocks could engender **cascading failures across marine ecosystems**.
- Communities dependent on fishing for income might struggle to survive, leading to **fiscal pressures and/or displacement**.
- A sufficiently large surge in the supply of illegal fish might **distort global food markets**.
- Targeted schemes such as **genetic markers to track fish** throughout the supply chain might limit demand for illegally caught fish.
  - So might **better vessel observation**.
  - **A cascading series of economic/financial crises overwhelm political and policy responses**.
    - A systemic collapse of the sort that was averted in 2007-2008 could push countries, regions, or even the whole world over the edge and into a period of chaos.
    - If financial systems go down, contemporary economies and societies cannot function.
      - Scarcity would become pervasive, and this would threaten to upend the political and social order.
    - More can be done to **enhance the resilience of the financial system**.
      - **Stress-testing methodologies** could be strengthened by assigning greater weight to tail events and unexpected consequences.
      - Societies might want to **prepare more actively for worst-case scenarios**.
  - **Bioengineering and cognition-enhancing drugs widen the gulf between haves and have-nots**.
    - Drugs for **human enhancement** are in their early stages, but scientific advances may well be exponential.
    - In a world of entrenched inequality, many people might choose to disregard potential health risks in order to maintain or elevate their status.
    - If the price tag is significant and benefits strong, the result could be ever-deeper and more entrenched inequality.
    - Early **regulation of enhancement technologies** may be more successful than an outright ban.
      - New **workplace equality legislation** might require employers to confirm that all staff are compliant with enhancement rules.
  - **State-on-state cyberattacks escalate unpredictably owing to a lack of agreed protocols**.
    - Offensive cyber capabilities are developing more rapidly than our ability to deal with hostile incidents.
    - **Miscalculations could trigger a spiral of retaliatory responses**.
    - Questions of speed and attribution heighten the risk of unpredictable consequences.
    - In conventional warfare, **agreed norms and protocols provide predictability and slow the emergence of crises**.
      - If governments accelerated current efforts to establish similar ground rules for cyberwarfare, it would help to prevent conflict erupting by mistake.
- Familiar concepts like transparency, proportionality, and non-proliferation could be re-codified for cyber purposes.
  - **Self-determination around contested borders sparks regional conflict.**
    - At a time of global geopolitical uncertainty, the twin forces of national identity and self-determination are growing in disruptive capacity.
    - A deepening of disputes over cultural and political borders would trigger widening clashes, potentially causing regional domino effects as states and sub-state actors mobilize in defense of or opposition to the status quo.
    - Stronger promotion and protection of equal cultural and political rights within states would help defuse tensions about national identity.
      - Drawing on successful examples of constitutional innovation – such as multilevel and cross-community forms of governance - might help guide the administration of internally divided polities.
  - **Regulatory, cybersecurity and protectionist concerns lead to the fragmentation of the internet.**
    - There are quite a few potential drivers that could lead to a government-led breakup of the internet into national or regional “walled gardens.”
    - Fragmentation of the internet could involve interruption of technical internet functions or barriers to the flow of content and transactions.
    - Resistance would be likely, as would the rapid growth of illegal workarounds.
    - Advances in cybersecurity governance and technology ought to mitigate the risk of worsening cyber disruption and theft that would trigger the imposition of firewalls.
  - **Geopolitical power shifts**
    - There is no longer any assumption that norms and institutions exist towards which the world’s major powers might converge.
    - International relations now play out in increasingly diverse ways: beyond conventional military build-ups, these include new cyber sources of hard and soft power, reconfigured trade and investment linkages, proxy conflicts, changing alliance dynamics, and potential flashpoints related to the global commons.
    - Four related developments stand out as potential sources of disruption over the short and medium term:
      - The intensification of strong-state politics is affecting both large and small states;
      - Global norms are eroding and tensions growing between major powers;
      - Increasingly aggressive geo-economic agendas; and
      - Mounting pressures faced by small states.
  - **Hindsight**
    - Looking at three risks previously identified, in order to trace the progress that has been made in the intervening years.
    - **Antimicrobial resistance (AMR)**
      - 2013’s report noted two underlying drivers of antimicrobial resistance:
        - The overuse and misuse of antibiotics, in both human health systems and livestock management; and
        - The fact that no new classes of antibiotics had been invented since the 1980s.
      - The costs associated with antimicrobial resistance are high and continue to rise.
• In 2017, the World Bank estimated that resistance would drag down global GDP between 1.1 and 3.8 percentage points between now and 2050.

  - **Resistance is spreading.**
    • In 2017, research showed that bacteria resistant to colistin (the antibiotic of last resort) had spread around the world within **18 months** of first emerging.
  
  - There are some encouraging signs of action to counter AMR, although **most are still at the planning stage**.
  
  - There is still a **stark lack of new drugs in the development pipeline**.

  o **Youth unemployment**
    • The 2014 report highlighted the risk that the global financial crisis would create a “lost generation”.
    • Globally, youth unemployment has been broadly static since 2014.
    • Global averages mask big underlying differences.
      • Despite rapid improvements in Europe since 2013, the region remains particularly exposed. On average, young people in Europe remain much more likely to be unemployed than their counterparts in North America or in most emerging regions.
    
  ̵ Positive headline trends can mark structural challenges.
    • Youth unemployment rates are, on average, significantly lower in developing than advanced economies.
    • Structural factors, such as **bulging youth populations** and the **prevalence of low-quality and informal-sector work**, continue to challenge developing regions.
    
  ̵ Youth employment schemes have their limits, unless accompanied by education and workplace reforms.

  o **Digital wildfires**
    • The 2013 report warned of **misinformation being spread by social media**.
    • The prevalence of online misinformation has surged, but its impact is difficult to gauge.
      • Studies show that people have a hard time distinguishing between accurate and fake headlines.
    
  ̵ **Efforts are underway** to bolster safeguards.
    • **Facebook** has partnered with fact-checking organizations and a network of researchers. A Yale study found that these types of warnings reduce the likelihood of stories being shared, but have limited effect on users’ perceptions of accuracy when stories are shown repeatedly.

4. Sustainable Development

Moving Forward with SDGs: Metrics for Action
By Trucost and S&P Dow Jones Indices, November 2017

Objective
• To review various sustainability frameworks and propose a new framework for measuring risk and opportunity based on region, value chain stage, and SDG.

Background
• Corporations are looking for ways that SDG-aligned institutions can give a true measure of shareholder value.
• Financial institutions are voicing their support and creating investment opportunities, companies are identifying business value and reporting their contributions, and a multitude of frameworks are emerging to fill the gap between ambition and attainment.
• The appeal of the 17 global SDGs (Sustainable Development Goals) lies in their harmonization of the three dimensions of sustainable development: social inclusion, environmental protection, and economic growth.
• As of August 2017, there were market participants with $4 trillion in assets making SDG commitments, from Dutch leaders APG and PGGM to US heavyweights CalPERS and State Street.
• The World Business Council for Sustainable Development reported that 50 of its 163 member companies surveyed from 2016 communicated SDG progress in their non-financial reports.
• Recent research suggests that none of the SDGs will be met in all regions of the world by 2030, and not even one-half of the 17 SDGs will be met in any region.

Findings
• The private sector still needs to determine which of its impacts are material and measure them, optimize business strategies to align financial value with social value and avoided risk, and set context-based targets for benchmarking and scenario analysis.
• Many companies that are engaging with the SDGs are simply mapping existing programs to SDGs, with few companies publically setting targets.
• Lack of standardized reporting is identified as a barrier to effective reporting for market participants.
• Robust metrics are also important to avoid “greenwashing,” in which reporting only on positive contributions to SDGs may be seen as a means of masking the negative impacts associated with financial value creation.
• Market participants require a practical toolkit of fit-for-purpose metrics and analytics.
• Trucost proposes the following set of best practice criteria for private sector SDG alignment, which they believe are foundational for more widespread adoption based on credible, robust disclosures:
  o Total value creation: metrics and frameworks incorporate financial, social, and environmental value creation to assess materiality and quantify impacts.
  o Material: programs focus on the narrow set of SDGs that are financially relevant and where the business has potential to make the most significant positive or negative impact.
  o Quantifiable outcomes: frameworks include specific metrics that can be measured.
Measurable against targets: metrics are context based, taking into account geographic differences, and quantifiable in a way they can be compared to SDG global targets.

Market context: frameworks are mapped to current responsible investment and ESG reporting frameworks already in use in different sectors.

Value chain: SDG alignment considers the full range of positive and negative activities across a corporate value chain.

Comparable: allowing market participants to compare performance within and across industry sectors as well as across asset classes.

Trucost surveyed major asset owners and fund managers, as well as researching academic thought leadership to identify leading SDG frameworks.

Frameworks identified included: Cambridge Institute for Sustainability Leadership (CISL), the Dutch SDG Investing (SDGI) Agenda, the Global Reporting Initiative (GRI) and UN Global Compact, Earth Security Group with HSBC, and the Sustainable Development Investment (SDI) framework.

The frameworks vary, ranging from general approaches without precise metrics to detailed approaches with indicator-specific metrics, yet they are missing the connection between economic value and new market development.

Frameworks oriented to private sector value creation struggle to address SDG 16 (promote just, peaceful, and inclusive societies) and SDG 17 (revitalize the global partnership for sustainable development).

The CISL bridges the gap between social and environmental impact and economic value creation through economic inflows and outflows to connect SDG themes to the private sector.

Earth Security Group and HSBC map SDGs to countries to connect country risk that is material to the private sector specifically for sustainable growth of both developed and developing countries.

The GRI advises using an assessment of a company’s value chain to understand social and environmental impact throughout the process.

Financial institutions working toward SDG-aligned strategies are focusing their efforts by turning the SDGs into a measurable investment framework (SDI) and viewing investment strategies through a spectrum of capital for SDG investing: responsible, sustainable, thematic, and impact-first investment (the Dutch SDGI Agenda).

Recent estimates suggest that achievement of the SDGs could create over $12 trillion per year in business value across sectors.

Realignment of corporate strategies with the SDGs will require capital, and better corporate disclosure will be key to enabling investors to efficiently direct capital toward those companies that are best aligned with sustainable development.

Conventional accounting captures the financial implications of a sustainable investment decision, but fails to capture progress toward the SDG targets.

Trucost created a SDG Total Value Reporting Framework to provide a holistic consideration of social value, incorporating risk and opportunity. The graphic below presents an example of a computer manufacturer assessing the risks and opportunities associated with its business activity, which in this case is the production of IT equipment.
The SDGs provide an opportunity for financial institutions and companies to enhance current ESG analysis with emerging goal-aligned analysis to gain a better understanding of the sustainability risks and opportunities, as well as the impacts of their strategies.