BLOG SERIES - BLOG 1

Climate risk and technology: The state of the industry

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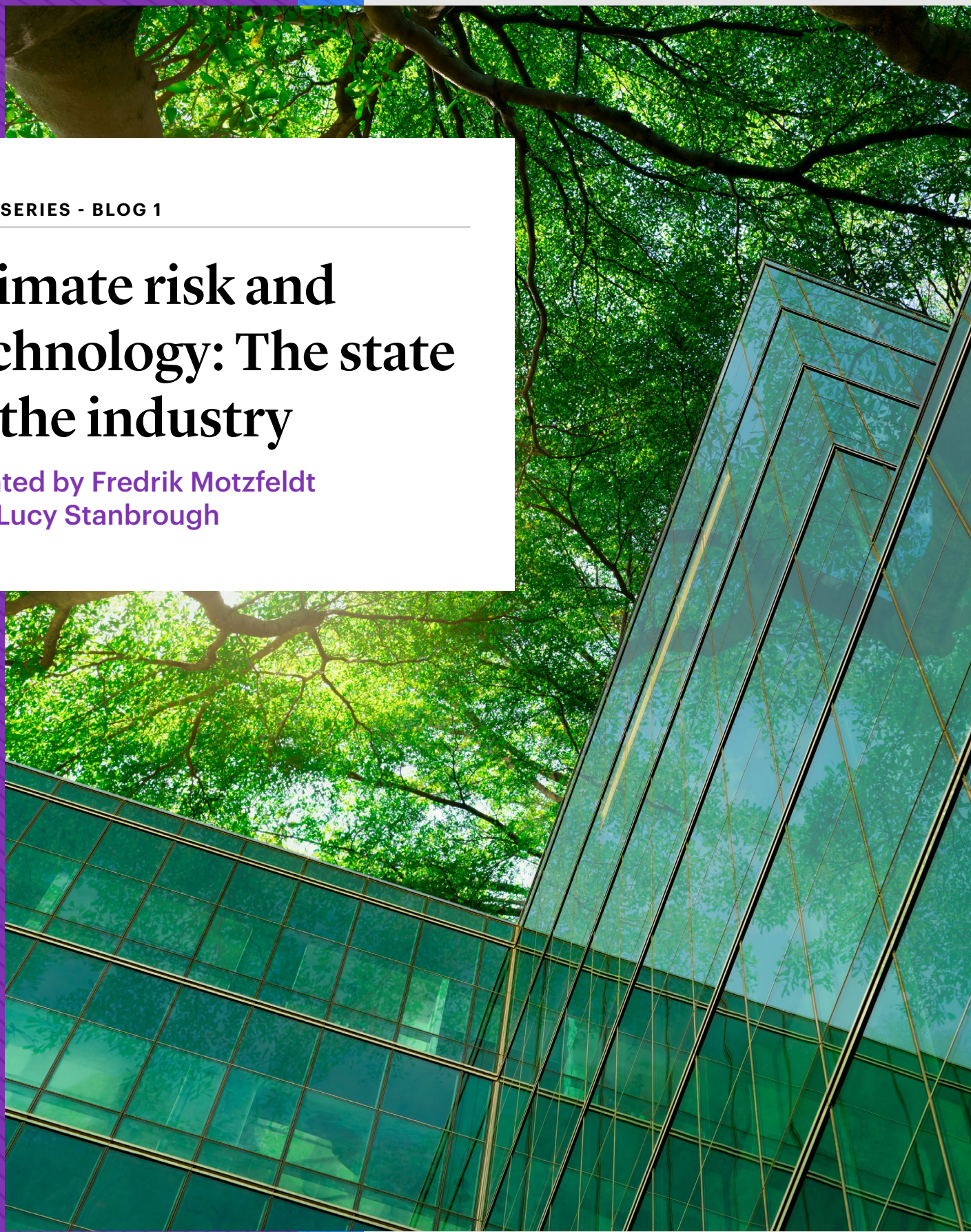


In our introduction to this series we described the juxtaposition of the TMT sector as both a contributor to climate change and as a key actor in driving and facilitating the solutions that could make net zero possible. This section examines that juxtaposition.

TMT as a climate risk contributor

With the need to transition towards net zero, focus has been around industries with the greatest potential to accelerate action such as smoke-stack industries, mineral extraction, energy generation and livestock production typically dominate the conversation.

That doesn't mean the challenges of reducing environmental impacts in the TMT sector are any less real given the growing pressure from regulators, consumers and investors around ESG (environmental, social, governance) factors as a whole, including all sources of emissions, on all industries.

In order to meet global warming targets and secure a sustainable and resilient way of life, all sectors and levels of society will need to take action to meet the ambition gap. The TMT sector has a key role to play with technology sitting at the heart of many of the solutions being explored.

In many ways, sustainability actions are not new to the TMT sector as actions are often focussed on operational efficiencies however, in our opinion, greater efficiencies are required and those who embrace it will have a competitive advantage in the years ahead.

Key drivers

Our joint 2022, research, conducted with the University of Pennsylvania, made it clear that, for TMT companies, there are three key drivers that executives need to be aware of to focus mitigation efforts (as illustrated below by some 'Industry action' examples):

- **Energy demand**
- **Technology redundancy**
- **Direct environmental impacts, including through the supply chain**

Scopes 1, 2 and 3 explained

Scope 1

Direct emissions resulting from business activities - facilities: transport: refrigeration etc.

Scope 2

Emissions resulting from purchased energy, heat, cooling etc. that relate to core business activity (mostly electricity).

Scope 3

All direct emissions in the value chain, either upstream (e.g., business travel, commuting) or downstream (e.g., investments, emissions resulting from customer product usage)

Figure 1: Key drivers and scopes 1, 2 and 3 explained

To illustrate the challenges faced by the sector in reducing emissions, we have chosen to focus on those areas highlighted in bold in Figure 2 below.

Increased Energy Demand

- Manufacturing-scope 3
- **Use of Digital Technology by consumenrs**-scope 3
- **Energy used in Data Centers**-scope 1

Technology Redundancy

- **Replacement rather than repair**-scope 3
- **Sofware Development Forces Hardware Upgrades**-scope 3
- **eWaste Problem**-scope 3

Direct Environmental impact

- Mining fro Rare Material
- **Carbon Footprint of Supply Chain**-scope3
- **Impacts of Renewable**
- Expanded Physical Infrastructure
- Profileration of Satellite Constellations
- Employee Travel & Goods Transportation

Figure 2: How the TMT sector contributes to climate change (Source: WTW/Wharton Business School)

Increased energy demand

The biggest issue facing TMT companies through 2023 will be inflation and high energy costs. Inflation has been high across the Euro area with Energy costs compounding the worst effects. Whilst the TMT sector does not generate large direct emissions, the electricity needs of the TMT sector are significant, accounting for an estimated 4-6% of global electricity use in 2022 according to research from the POST Research team at the UK parliament. Whilst high there is evidence to suggest that figure was as high as 10% in 2015 (Global Electricity Usage of Communication Technology: Trends to 2030) It is the opinion of the authors that, while the various statistics quoted may be debated, energy efficiency improvements are allowing the same technological tasks to be performed using less energy. Some stakeholders note that this has resulted from energy use of technology remaining relatively flat in the last decade despite the growth in demand. Others suggest that improvements in energy efficiency can themselves cause increased demand and hence a focus on future improvements in energy efficiency without additional regulation may not reduce energy use.

The 2015 figure was derived from an estimation of global electricity usage that could (then) be ascribed to communication technology between 2010 and 2030, including three scenarios (best; expected; worst case) for use and production of consumer devices, communication networks and data centres. The scenarios also include annual numbers of sold devices, data traffic and electricity intensities/efficiencies.

What is of note, regardless of scenario, is that wider processing and storage in the cloud is reducing electricity consumption from consumer devices. And for good reason: in the 2018 Microsoft-WSP collaborative study, the authors hypothesised that cloud computing can improve energy efficiency by 93%, and produces 98% fewer greenhouse gas emissions than on premises IT infrastructure. In 2022, Open Access Government revisited the topic, arguing that the cloud could help provide a greener government. These various studies illustrate that it is essential to understand where emissions are produced across the supply chain and how to properly account for them (see box: ‘Counting clouds: understanding emissions).

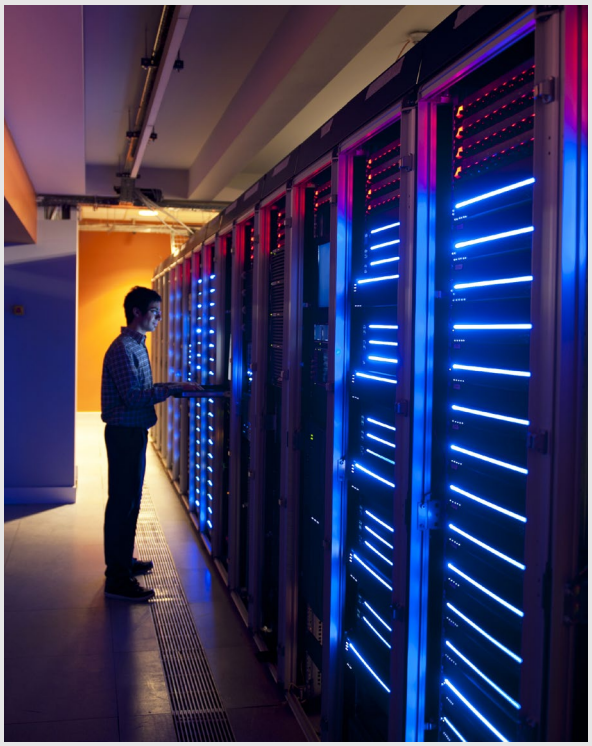
Consequently the key focus for energy transition is reducing electricity consumption across the supply chain of data centres (whose expected growth will drive increased demand), logistics processes and telecommunication equipment. There is a clear momentum within the TMT sector, driven by both companies and their customers, to shift existing and new electricity demands to renewable sources.

WTW insight:

Counting clouds - understanding emissions

Energy is a major component of the environmental footprint of data centres, alongside manufacturing of equipment and water consumption for cooling. Measuring and monitoring consumption and setting efficiency targets will help ensure that appropriate action is taken across all levels of the business to minimise environmental impacts. For example, this might involve the creation of new job roles or the inclusion of responsibilities within different teams, and most importantly – ensuring elevation of discussions to the key stakeholders for investment and action.

Technology companies are innovating across all these areas to understand how to make efficiencies and, as requirements on data collection increase, ensure they are ready to answer customers questions concerning their data footprint. The biggest cloud-computing companies are some of the largest purchasers of renewable energy, and are actively investing in more efficient hardware technologies, such as Microsoft's implementation of underwater data centres, Google's use of AI to reduce cooling costs by 40 percent, and Amazon's use of recycled water for cooling.



We cannot ignore geopolitical factors, such as the ongoing conflict in Ukraine which has been very disruptive to global energy markets, and therefore to an energy hungry TMT industry. The conflict is likely to continue to negatively impact the supply of natural gas and oil, and the cost of producing electricity – all through 2023 and possibly beyond. The increased costs of energy, coupled with reduced consumer purchasing power will continue to represent significant challenges to the industry.

TMT leaders continue to address the source of their energy supplies together with demand and usage. There is an increased recognition that the energy crisis is further accelerating increased stakeholder pressure for a greener and more renewable supply of end products. According to Ember, solar generation rose 23% last year, and wind by 14%. As a quantum, clean electricity sources generated 38% of the world's electricity in 2021, more than coal (36%).

The sector seems to have reached an inflection point in its response to the need for an energy transition.

WTW insight:

Industry action - The positive 5G effect

The introduction of new technologies like 5G is significantly reducing the power consumption per exabyte of data used. The improved energy performance of 5G networks over the period 2020-30 could reduce the cumulative footprint of mobile networks by 0.5 billion tonnes of carbon dioxide.

So, what are TMT sector companies doing to minimise the impact of their demand for electricity?

The role for renewables

Today's global economy runs on digital infrastructure and global tech giants would simply not exist without the digital networks that connect businesses all over the world and the TMT sector understands continued growth must not negatively impact global efforts to reduce the impact of climate change.

In response, the industry is prioritising the introduction of new and emerging 'green' technologies. Data centers are blazing the trail. European data centre operators and trade associations have committed to the Climate Neutral Data Centre Pact, which is steering the industry towards carbon neutrality by 2030.

There has been rapid progress, with companies ramping up investment in clean and renewable energy sources, limiting or redeploying waste by-products, and improving their power usage effectiveness. This is just the start, however and to meet the 2030 target, the industry must continue to develop new technologies and deliver long term sustainability practices. And all this in the face of the inflationary pressures weakening consumer sentiment we have highlighted.

Mitigation efforts to date have largely focused wider use of renewable energy sources with many of the larger sector players, such as Apple, Microsoft and Facebook quick to highlight that their operations are powered by 100% renewable energy sources. In fact half of the top 10 global technology companies by market capitalisation make that claim. Notable outliers are Samsung and TSMC, the two largest consumers of electricity by megawatt hours who have the lowest renewable energy usage shares.

Despite the reporting inconsistencies the question remains; How can TMT firms meet or reduce their electricity needs through greater use of on-site generation facilities and energy efficiency measures?

Is measurement possible?

Once a solar or wind farm produces electricity, it goes to the main grid, where it mixes with electricity produced from other sources. This renders the green energy supplied to buildings essentially indistinguishable from other sources of electricity.

Taking the US as an example, given that roughly 80% of U.S. energy demand is met by fossil fuels, it's highly likely that many of the companies that claim to use 100% renewable energy are, in fact, drawing from a grid powered by fossil fuels. After all, data centers are running 24/7 while the availability of wind and solar energy is intermittent.

Another factor the Wharton research notes is important to consider from a renewables impact perspective is the growing influence of China in the TMT market. China housed 23% of the world's data centers in 2019, but only 13 of the 22 biggest Chinese tech companies had begun to use renewable energy by 2020 – albeit that was up from only eight in 2019. Even then, usage was mainly through power purchasing agreements rather than direct investment. Given energy consumption is expected to grow by 66% (between 2019 and 2023) there is clearly much for China to do to catch up with progress likely to be hampered by economic uncertainty and falling sector profitability.

WTW insight:

Industry action – Google and energy efficiency

Google is creating energy efficient data centres, which it claims are twice as efficient as typical enterprise data centres. Artificial intelligence (AI) chips and high-performance servers eliminate energy waste, while smart temperature, lighting, and cooling controls reduce energy consumption. Most data centres use almost as much non-computing or 'overhead' energy (like cooling and power conversion) as they do to power their servers, but Google has reduced this overhead to 11%.

Offsetting strategies

TMT companies have been among those to seek to offset carbon by supporting the planting of trees and other carbon capture activities. For example, Apple's pledge to be net zero by 2030 was 25% based on funding reforestation projects and improving energy efficiency in its operations.

Laudable as such pledges are, as WTW's Tony Rooke expressed in his 2021, pre-COP 26 blog, the danger is that they externalise the route to net zero.

He said:

"In reality, there is no alternative to taking making tough decisions about decarbonising future operations, supply chains and products and services from the inside out.

Firstly, there are practical considerations, such as carbon storage taking up too much of the land that will be needed for other life-preserving activities, including food production. Another reason is the longevity of the storage involved. This is illustrated by what happened to a large swathe of trees that offered a commercial carbon offsetting program on the West coast of the U.S. but that went up in smoke in forest fires. This impacted a number of companies that had invested significant sums of money, including tech giants."

On the wider offsetting point, the Science Based Targets initiative (SBTi) has been consulting on the relative mix of decarbonisation/offsetting/carbon capture activities that will be needed to achieve net zero emissions in different industries. Basically, this says that companies will have to decarbonise their activities by between 90% and 97% before offsetting and carbon capture can help them achieve net zero status.

Technology redundancy

While there is a growing effort to recycle and reuse technology components, including for example rare earth metals, and a growing mobile phone and digital repair sector emerging in many poorer countries, the sector is still innovating to attract people to buy the latest new technology, rather than to build technology that can be re-used.

The second factor we want to highlight in the TMT sector's contribution to climate change is its role in encouraging a 'throw-away society'.

Redundancy and unsustainability have been historically hard baked in to the digital technology business model with most of the sector business models based on the fundamental concept of replacement rather than repair. The hardware-software development cycle forces users to upgrade their equipment on a regular basis. Innovation in the digital technology sector means that hardware developments often make old software unusable on newer devices, and new software (particularly operating systems) requires newer hardware on which to run.

> **"I have long understood that climate change is not only an environmental issue – it is a humanitarian, economic, health, and justice issue as well."**
>
> Frances Beinecke, former President of the Natural Resources Defence Council

The result, is that the world is facing a growing e-waste problem, highlighted by the figures shown in the table below.

A significant e-waste problem

57.4 Mt (Million Metric Tonnes) of e-waste was generated in 2021. The total is growing by an average of 2 Mt a year.

China, the US, and India produce the most e-waste.

Estonia, Norway, and Iceland have the highest e-waste recycling rates.

Only 17.4% of e-waste is known to be collected and properly recycled.

The e-waste recycling market was valued at $49,880 million in 2020.

If we used every phone sold **for 1/3 longer,** we would prevent carbon emissions equal to Ireland's annual emissions

347
METRIC TONS

There is over 347 Mt of unrecycled e-waste on earth in 2022.

120
METRIC TONS

E-waste expected to reach 120 million tonnes by 2050 if consumers don't change their habits.

£370
MILLION LOST ANNUALLY

Without e-recycling, it's estimated that £370 million is lost annually in valuable raw materials via e-waste, including copper and gold.

Figure 6: A significant e-waste problem. **Sources:** 1) HMRC Sustainability Report 2020 to 2021 2) The Roundup

E-waste (electronic waste) includes most of the technology products we are all familiar with. Common sources of e-waste include televisions, computers, mobile phones and any type of home appliance, from air conditioners to children's toys. When broken or unwanted electronics are dumped in landfill, toxic substances will leak into soil and water whilst valuable non-renewable resources including gold, silver, copper, platinum, aluminium and cobalt are lost. What has become abundantly clear is that TMT companies should be:

1. Tracking their manufacturing output (and some would say localising production closer to home).
2. Keeping a better handle on where materials are within particular products.
3. Designing products so they are more readily recyclable.
4. Improving labelling and construction which would allow componentry to be more readily reused and precious minerals, rescued from landfill

WTW insight:

Industry action - Apple and e-waste

Apple started creating material impact profiles in 2014 so that it can focus on high impact materials that reduce its carbon footprint. Apple iPhone 12, for example, is made with 99% recycled tungsten. The iPhone 14 improved upon this picture by using 100% recycled gold in the wire of all cameras and in the plating of multiple printed circuit boards as well as 100% recycled rare earth elements in all magnets. In April 2022, Apple announced that it was expanding the use of recycled materials across its products and that the company was also advancing new disassembly technology as part of closed-loop goal. For the first time, the company have introduced certified recycled gold, and more than doubled the use of recycled tungsten, rare earth elements, and cobalt in its products.

By 2021 nearly 20% of all material used in Apple products was recycled, whilst the company also announced its newest recycling innovation, Taz, a machine that uses a ground-breaking approach to improve material recovery from traditional electronics recycling.

Source: https://www.apple.com/uk/newsroom/2022/04/apple-expands-the-use-of-recycled-materials-across-its-products/ & https://www.apple.com/environment/pdf/Apple_Environmental_Progress_Report_2022.pdf

Increasingly, industry players are likely to be forced to minimise e-waste. In the same way that auto mechanics fought for the "right to repair" cars, the WTW and the Wharton team has found that computer techs are doing the same and starting to gain some traction. Geopolitical and cost concerns (it is becoming more cost effective to recycle), while disruptive to the industry, are also influencing industry behaviour for the better here.

And one must not forget the consumer sentiment' factor – consumers are increasingly voting with their wallets, opting for products that can show strong green credentials (please refer back to the Apple story above).

Europe's 'Right to Repair' laws are an indication of increasing legislative sympathy for that view, which appears to be shared by Joe Biden's administration in the US. Although the European regulations are currently limited, they encourage manufacturers to make products more durable and easier to repair. In 2024, this scheme is slated to evolve into one that scores the overall durability of products, with repairability being one component.

It is also worth mentioning that in December 2022, the EU become the first leading economy to legislate for 'green tariff' on imports. The carbon border adjustment mechanism (CBAM) means that countries which fail to green their industries will soon face a new threat: an effective carbon tax that will penalise those hoping to profit from high-carbon activities and force them to clean up. It is the opinion of the authors that the new legislation is also likely to impact initiatives for better recycling and possible also encourage additional 'Right to Repair' legislation across the world.

WTW insight:

Industry action - CEP

The Circular Electronics Partnership (CEP), published in 2020, is a collaboration among various electronics hardware manufacturers to create a pathway for circular electronics. According to its website, the partnership sees the biggest names in tech, consumer goods and waste management working together for a circular economy. The CEP blueprint for action establishes a common understanding of what we mean by "circular electronics" and the system needed for change at scale, providing a framework where products will be designed for circularity and manufactured using recycled materials and for educating consumers about the importance of the circular economy. Its key focus is on improving recycling rates from 17% by using measures such as a product as a service model, convenient drop off locations and rewarding product returns.

Direct environmental impacts

The third and final factor we want to consider for this blog is the sector's direct impact on climate change. According to Ericsson research, the carbon footprint of the ICT sector is about 1.4% of the global greenhouse gas emissions, including the whole life cycle for all parts of the sector. In real numbers, that's approximately 730 million tonnes CO2-eq. Having increased until 2010, the footprint has since remained fairly constant despite increasing numbers of ICT users worldwide and the exponential growth in data traffic. The statistics quoted are not always consistent though: In April 2021, one estimate of the total carbon footprint of the internet, for example, put emissions at 3.7% of the global total, on a par with the airline industry. Emissions from data centres alone are estimated to be approximately 1% of the global energy request.

Beyond energy usage and the lack of a circular economy for technology, several other direct environmental impacts of the TMT sector can be hard to quantify, and further work is needed.

The current paucity of information on the climate impact of technology supply chains is a prime example. Back in a 2019 McKinsey study of the Forbes Global 2000 list of technology companies, reported GHG emissions from supply chains were around 50% of the actual figure. The study estimated the reporting discrepancy to be at a level comparable to the annual GHG emissions of Australia. Other data collaborates the McKinsey findings – there is a gap between what tech companies are thinking about vs. actually doing in this area, as illustrated by a 2020 piece by KPMG's Tim Zanni.

In our opinion, the main barriers to closing this reporting gap include a lack of universal carbon accounting foundations, reticence, and lack of understanding from supply chain partners related to emissions data or, where data is provided, variation in the industry averages, factors, and assumptions that different companies use. TMT companies may not be able to directly influence carbon accounting methodology but able to they can contribute – and they can certainly do more to encourage their supply chain partners to properly assess and manage emissions (e.g. more accurate reporting) The Harvard Business Review (HBR) "Accounting for Climate Change" (Nov-Dec 2021), views measurement of the supply chain impact as key to any effective system of greenhouse gas (GHG) accounting. Furthermore it suggests visibility and incentivisation to help partners make more climate-friendly product-specification and purchasing decisions. The article argues that the current dominant system for carbon accounting, the GHG Protocol, misses this critical point by allowing companies to guestimate upstream and downstream emissions.

WTW insight:

Industry action - Stripe support for carbon removal technologies

In October 2020, Stripe launched a product that allows customers to direct a percentage of a transaction towards scaling carbon removal technologies. This hybrid of climate product, funding avenue and reputational enhancement for participants aims to provide research and development support for technologies that help reverse climate change. The investment also lays the groundwork for entry into the carbon offset market, positioning Stripe to broker offsets for other technology companies.

> **"I believe that customers want to know how companies can help them live more sustainably. That means greening the supply chain."**
>
> Social Impact Manager, global hardware manufacturer.
>
> **Source:** WTW 2022 research findings

Tracking of the Consumer Technology Association's membership between 2018 and 2020 suggested a 2.1% decrease in worldwide scope 1,2 and 3 emissions between 2016 and 2018. Having said that, the majority of analysts surveyed by WTW and Wharton agree that ICT emissions will not reduce without major concerted political and industrial efforts. In fact, it is possible that an ICT emissions are actually going to increase without concerted intervention. It is also our feeling that not all ICT carbon pledges are ambitious enough to meet climate targets, and that better policy mechanisms for enforcing sector-wide climate target will be needed. Without a global carbon constraint, sector-wide regulations, forcing ICT's carbon footprint via regulation in order to align with the Paris Agreement, will be a real possibility. With a global carbon constraint, ICT would be a greater enabler of productivity and utility, creating opportunity for the sector to be financially successful as a critical part of a global net zero society.

As we speak there is some evidence to support the view that progress is being made. Significant players in the industry have embedded sustainability as a core aspect of operations, and investment has started to demonstrate notable returns and competitive advantages for many TMT organizations. Verdict, siting material from WEF (with contributions from tech vendors and research institutes) show a path of how 'digital technology' can reduce global carbon emissions by 15%. The hypothesis presented is that connectivity is a key enabler helping many industries achieve their sustainability goals. Some of the major high-impact innovations, largely driven by internet of things (IoT), include:

- **Smart Buildings:** The digitization of energy management systems is making improvements in energy efficiency. Sensor and data-driven technology is helping to predict, measure and monitor real-time energy performance, adjust on the fly, to align with current requirements, such as present occupancy levels.
- **Industry 4.0:** The integration of ICT across manufacturing is driving energy efficiency, productivity, and cost-reductions. This includes the reduction of unplanned downtime with predictive maintenance, reducing waste and number of defective products.
- **Smart Cities:** Cities are 2 per cent of the Earth's surface, yet now home to half of the world's population. They consume 75 per cent of the world's energy and emit 80 per cent of carbon emissions. Over 150 cities now have a smart city strategy.

From our and the Wharton team's perspective, future sector impacts will involve weighing up different priorities as part of the bigger climate transition risk picture. Whilst the adoption of renewable sources of energy would undoubtedly reduce the carbon impact of digital technologies, their corollary effects must also be taken into consideration. For example, digital technologies are a crucial enabling element for smart motorways and self-driving electric cars. But unless electricity for these cars and communication networks is produced from renewable sources the replacement of petrol and diesel cars by electric ones will have little impact on carbon emissions.

Similarly, the shift to renewable production will lead to a very significant environmental impact through the construction of wind turbines and solar farms. One article uncovered in the Wharton research noted that Scotland would need to be entirely covered by wind farms in order to power all of Britain's electric cars.

WTW views and observations

For the TMT sector to make significant emission reductions as part of a transition to net zero, key areas to address will include:

Energy usage and sourcing – data centre expansion continues to raise the energy demands of the sector, putting greater pressure on the need to source energy requirements sustainably. While the industry still relies too heavily on power purchasing agreements and renewable energy certificates, thereby drawing from power grids that are still heavily reliant on fossil fuels, progress has so far been encouraging with companies continuing to ramp up investment in clean and renewable energy sources, limiting or redeploying waste by-products, and improving their power usage effectiveness.

Change from within –TMT companies' pathways to net zero make significant use of carbon offsetting. These offsetting funding efforts are well-intentioned but often inadequate, as they do little to actually change and redefine internal company systems. Pursuing offsetting to the detriment of change from within would allow emissions to grow when they should be halved by 2030. To meet climate related targets, the industry must maintain a momentum of investments in actual (greener) solutions and continue to innovate and develop new technologies and deliver longer term sustainability practices..

Replacement versus repair – As was discussed back in 2020, the 'throw-away' economy is unsustainable and, increasingly, coming under attack. The Wharton team's investigations in 2021 suggested that the right to repair movement is gaining traction and that companies are also likely to come under further pressure from the public and governments to use more sustainable and recyclable materials in their products. On November 17, 2021, Apple announced Self Service Repair, allowing customers to repair their devices with Apple Authorized Service Providers (AASPs) and independent repair providers. It will be available in early 2022 in the US and expand to more countries throughout that year. In 2022, we have observed that the Right to Repair Movement has gained momentum globally, and especially in key economies such as the U.S. Moreover, President Joe Biden has signed an executive order to promote competition in the American economy, which aims to make it easier to repair items on your own. Other TMT companies would do well to get onboard and ahead of the curve.

Carbon footprints of supply chains - carbon is a new currency: in mid-December 2022, European carbon futures were trading around the €85 a tonne mark. Chief financial officers and other business leaders will, we believe, are looking for more accurate, granular, and timely emission transparency from across the supply chain to run the business in the future. They also need to take account of burgeoning climate risk reporting requirements (such as those in the Taskforce for Climate-related Financial Disclosures (TCFD) framework) and greater public and investor scrutiny of ESG (environmental, social, governance) practices.

WTW insight:

TCFD and climate risk for leaders – an illustration of early engagement and impact

TCFD requires organizations to have a view on the physical impact of climate change as well as the risks and opportunities associated with transitioning into a net zero or below net zero economy. With TCFD approaching, a proactive risk manager would be very well-positioned to demonstrate their achievements to financial investors in building longer-term physical climate change resilience, and their capabilities in testing future risk profiles of the organization.

Benefits of better disclosure:

Risk assessment: More effectively evaluate climate-related risks to your company, its suppliers, and competitors.

Capital allocation: Make better-informed decisions on where and when to allocate your capital.

Strategic planning: Better evaluate risks and exposures over the short, medium, and long term.

Public-private collaborations – TMT businesses need to work together with governments and other bodies to build effective frameworks to measure and report emissions. In 2022, WEF called for the doubling of the size of the circular economy in ten years, highlighting that, with the production and consumption of goods a root cause of climate change and biodiversity loss, it will be imperative that the world transitions rapidly to a circular economy, which keeps products and goods in use for as long as possible. Industry specific collaborations like CEP can play an important role in pooling the sector's resources to deal with the climate challenges it faces and in educating customers about the role they can play in creating a more circular economy.

The greening of the internet (scope 3) – conscious of trends in how consumers use digital technology, the greening of the internet is the next endeavour in our hyperconnected era. Improving energy efficiency in data centres, as mentioned above, is a significant factor but companies will need to look further at how their use of the internet and technology in general affects the environment. For example, WebFX has estimated that, with 4.9 billion users, the internet is responsible for yearly CO2 emissions close to 40 billion tons. With these figures in mind, individual consumers should also realise that their internet habits are not as clean as they think.

> **"Any investor today will want to see your ESG credentials. You need to demonstrate them not just superficially but show you're doing real things in the business."**
>
> Venture capital investor in the technology sector.
>
> **Source:** WTW 2022 research findings

TMT as a climate risk solutions provider

The flip side of the TMT sector's own part in contributing to climate change effects – and its efforts to improve its own sustainability credentials - is that technology in various guises is generally seen, if not unanimously, as a beacon for hope in achieving net zero and stabilising global warming.

To expand on that, technology and telecoms companies features prominently in a recent ranking of publicly traded companies that are leading the way with solutions for the transition to a clean energy future. But it is also fair to say that not all pundits share the view that the TMT industry is setting the standard when it comes to preventing climate change. As a significant contributor to global energy usage, emissions and e-waste the industry, many feel that the industry is as big a part of the problem as the solution.

We see this spectrum of thought giving rise to two questions about the role that TMT companies can play as climate risk solutions providers. Firstly, will leaders, entrepreneurs and engineers be able to invent enough technologies to mitigate climate impacts? And secondly, how will they be seen as trusted partners to deploy and scale such solutions?

The WTW and Wharton team's analysis/research explored three principal routes that in our collective opinion are emerging for companies to address these questions and to seize the opportunity to differentiate themselves as providers of solutions to climate change:

1. Upstream and downstream technology solutions that increase productivity, reduce waste and alleviate climate impacts
2. Mining of precision data to minimize climate risk and allocate resources effectively
3. 'Pelican gambits' to lead shifts toward sustainable solutions and reduce systemic risk

Let's consider these with some examples of how they are taking shape.

Upstream and downstream technology solutions

The transition to a low carbon economy is, we would argue, the biggest economic change (and challenge) since the industrial revolution; technological innovation is, as we see it, the frontier. The recognition that technology will play a key role in fighting climate change is growing exponentially. For example, to help tackle air pollution from wildfires and the harmful wedding of charred habitats and lingering smoke poses a significant danger to human and environmental health (causing over an estimated 33,000 deaths annually) the United Nations Environment Programme (UNEP) is working with partners to find technology and innovation solutions to help tackle air pollution and to further promote major structural transformations that will enhance environmental sustainability, climate action and pollution prevention.

Inadvertently almost, perhaps the prime recent example of that frontier shifting has been the impact of the COVID-19 pandemic on how and where work is done. When we, back in 2020, wrote about how the pandemic was affecting the workplace we did not realise how much of shift would become permanent. Who would have thought just over two years ago that hybrid or remote working would become so prevalent and accepted so quickly, changing the way that many of us use technology in the workplace and reducing in an instant the climate effects of commuting and business travel?

What does that mean for the TMT sector going forward on climate risks? A number are targeting downstream usage of their products and services, including technology giants like Microsoft and Google, who are investing in technologies that can help customers quantify their energy consumption. This is not altruistic; such companies believe it provides a competitive advantage for the products they offer.

More widely, TMT companies are well positioned to help other sectors reduce carbon emissions through digitization, taking advantage of smart phones and smart devices connected to the Internet of Things (IoT). Research found that, while the mobile industry was responsible for around 0.4% of carbon emissions globally, it had the potential to enable carbon reductions in other sectors that were 10 times that.

One example of how that could play out is that mobile connectivity, along with cloud services and platforms to create smart energy systems, will be essential to manage the constant availability of renewable energy that will rely on battery storage. Examples of products that could be in the pipeline include smartwatches and health trackers that self-charge by harnessing body movement.

> **"While the world will need to reach net zero, those of us who can afford to move faster and go further should do so."**
>
> Microsoft Vice Chair and President, Brad Smith
>
> **Source:** https://www.microsoft.com/en-us/corporate-responsibility/sustainability

WTW insight:

Industry action - Minimising waste

According to a 2019 article in National Geographic, an estimated 30% of produce that leaves a farm never makes it to consumption. Apeel Sciences developed a plant-based layer for the surface of fruits and vegetables that is tasteless and odourless and leads to grocery produce lasting twice as long. Since 2019, Apeel says it has prevented 42 million pieces of fruit from going to waste at retail locations in eight countries.

Jumia Kenya is the leading ecommerce company in Africa and an example of the growth of demand driven e-commerce logistics operations in Africa. Accenture estimates that the last-mile supply chain made possible by local fulfilment centres could lower last-mile emissions between 17 and 26% through 2025.

Both are among the many examples of how the technology industry can innovate for the betterment of our planet.

The use of precision data

Data is a crucial enabler in the fight back against climate change. Experts say, in the years to come, a digital ecosystem of data platforms will be crucial to helping the world understand and combat a host of environmental hazards, from air pollution to methane emissions. “Various private and public sector actors are harnessing data and digital technologies to accelerate global environmental action and fundamentally disrupt business as usual,” said David Jensen, coordinator of UNEP’s digital transformation task force. disrupt business as usual,” said David Jensen, coordinator of UNEP’s digital transformation task force. “These partnerships warrant the attention of the international community as they can contribute to systemic change at an unprecedented speed and scale,” he added.

It is the view of the authors of this blog that you can’t manage what you don’t measure. TMT companies are the main architects, custodians and analysts of the superhighways around which data flows in today’s interconnected world – thereby giving the sector a vital role to play in terms of ensuring that accurate data is available. The global accounting industry has recognised this, and an example of this is the CFA Institute’s 2020 published calls for improving knowledge and understanding about how climate risk can be applied to financial analysis and portfolio management.

As Matthew Foote, a senior director in WTW’s Climate and Resilience Hub, argued in a pre-COP 26 blog about the importance of data availability and openness, “the goal should be a global, consistent source of ‘real’ assets data, such as locations of industrial plants and energy transmission facilities, or natural resources, which can be used for both public good and to enable organizations to augment the data for commercial applications using proprietary data and intellectual property.”

WTW insight:

Industry action - Kettle

Kettle is building a smarter reinsurance model for protecting today’s globalised world from the catastrophic effects of climate change. It uses proprietary machine learning algorithms that use more than seven billion lines of weather and ground truth data.

While the leading Rothermel Wildfire Model’s average time to compute one wildfire (as projected in 2018) is four hours, Kettle shortens the computational time to approximately 20 seconds for a typical wildfire. By training deep convolutional neural networks on factors influencing wildfires and creating ensembles to predict wildfire propensity, Kettle has a sophisticated and scalable model to insure wildfire risk.

In scanning the data usage horizon, our research with Wharton picked out some interesting examples (see below) of how precision data (and innovative technology) is now being used in applications aimed at more sustainable food and textile production and reducing waste in general.

The need for such applications in the food value chain appears particularly acute. As climate change disrupts supply chains that provide food to communities across the world, our basic ability to nourish families will continue to be challenged. The global water supply is expected to fall 40% short of global needs for water by 2030 and the dual pressures of both catastrophic weather events and consumer demand for more responsible and sustainable farm practices makes profitable farming, at any scale, more difficult. It is worth mentioning here the 2022 Lloyd's and WTW report highlighting the protection gap in food and drink supply chains. The report focuses on the critical threat to the global food and drink industry due to the growing interconnectedness and complexity of global supply chains, which has increased the sector's vulnerability to both natural perils, such as the effects of extreme weather, and manmade threats, like the ongoing conflict in Ukraine.

WTW insight:

Industry action - the food value chain

Smallholder farmers produce over 30% of the world's food supply, and (in 2021) over 400 agri-tech solutions were used in sub-Saharan Africa alone. Examples include businesses like Farmerline - a voice services and SMS platform that provides advice, weather forecasts, market prices and financial tips to over a million small growers.

Blue River Technology (acquired by John Deere in 2017 for $305M) is using machine learning to build more intelligent on farm machinery to help farmers make data driven decisions in the field, improve their profitability, and respond to changing environmental and consumer trends.

The textiles sector is another important target because fashion accounts for up to 10% of global carbon dioxide output—more than international flights and shipping combined.

In one initiative, major fashion brands are currently jumping on board with the circular economy by uploading data about their products to Eon's Connected Products Platform, an IoT solution that tracks items throughout their life cycle in order to increase reuse and maximise recycling.

Looking at waste in general and the rationale and opportunities for further technology intervention to make a significant impact, landfills are the third largest anthropogenic source of methane across the global, accounting for over 11% of estimated global methane emissions or nearly 799 million metric tonnes carbon dioxide equivalent. In addition to more effective recycling, and therefore better (re) use of e-waste, generating actual power from waste is one of the major technology- enabled innovations is an area worth watching. Digesters produce the biogas from different sorts of waste, such as food, agriculture, etc., and transform that into the energy utilized on-site. Therefore, advanced landfill technology enabling more effective energy recovery, is becoming an important waste management tool and important for the circular economy transition. This is an area of green technology we believe that the tech industry would benefit from focusing on.

Pelican gambits

For those unfamiliar with the term, pelican gambits is a concept developed by Wharton Professors Paul Schoemaker and Thomas Donaldson to describe strategic moves towards cooperation in competitive environments that limit systemic risk to a company, industry and society in general.

In other words, this requires companies to acknowledge that climate change is a such a systemic, interconnected risk that they cannot go it alone and hope to manage its effects. Instead, they must abandon customary competition in order to work together with competitors and other bodies to spot and manage the risks.

The Taskforce for Climate-related Financial Disclosures (TCFD) reporting framework is an extension of this line of thought with over 3,000 organizations in more than 90 jurisdictions now supporting a common drive for better climate metrics and reporting through its four pillars – Governance; Strategy; Risk Management; and Metrics and Targets.

WTW insight:

Industry action - Amazon and The Climate Pledge

The Climate Pledge is a cross-sector community of companies, organizations, individuals, and partners, working together to crack the climate crisis and solve the challenges of decarbonizing our economy. Bringing together those that are prepared to run the furthest and fastest, The Climate Pledge called on signatories to reach net zero carbon emissions by 2040—10 years ahead of the Paris Agreement. Amazon co-founded the Climate Pledge with Global Optimism in 2019 and became the first signatory of the pledge.

As a leading technology company, Amazon set an important precedence by leveraging its credibility and share of voice to catalyse progress across industries toward ambitious climate goals given the high degree of systemic risk to Amazon's global business and its multi-faceted business units. The Climate Pledge Fund, started with $2 billion from Amazon, will invest in companies creating products, services, and technologies to protect the planet. By taking these steps, Amazon is minimizing future risk by influencing industries and helping to shift the probability distribution of climate change induced catastrophic events.

WTW views and observations

It is evident to us that technology, and the TMT sector companies behind those technologies and their applications will be key, if not essential, players in tackling climate risks over the coming decades. The previously cited examples demonstrate some of the good work already taking place, but there is a need – and an opportunity – to do a lot more.

> **"We have the knowledge and the technology to reduce our impact on the climate, and ease the pressures on the world's most vulnerable places, people and wildlife. We just need to make it happen."**
>
> **Source:** https://www.wwf.org.uk/what-we-do/climate-change-and-energy

Support for a global economy in transition – net zero may be the holy grail on climate change but the transition towards it will be complex and involve difficult climate, political and economic trade-offs in the interim. Understanding the different transition scenarios developed by the likes of the Intergovernmental Panel on Climate Change (IPCC) will be an essential component in contemplating commercial and innovation strategies that address the risks and opportunities. Technology has a key role to play in ensuring that the challenges with measuring, quantifying and reporting are simplified and made cost effective especially for small and mid-tier businesses.

Ramping up the power of precision data – the use of precision data is already proving powerful in the more sustainable use of resources and in reducing waste, as per the examples previously cited. Technology companies will or should be the enablers of many of these kinds of solutions. As such, we believe TMT companies should be leaders in the drive for common standards and metrics in the way that data is used.

WTW insight:

Industry action - Climate Quantified

As early as 2011, the World Bank came out with the following statement: "We need observations of weather, climate, water resources and agriculture and other sectors. We also need to analyse the links between these and human and ecosystem development. We need to provide model projections of the future for all these elements". More than a decade later, recognising that climate change is complex, costly and have long-term implications – and that effective decisions must be based on the best available evidence (e.g. accurate data and analytics) - WTW is focusing on the fact that climate change and the transition to a net zero economy pose new challenges for all organizations and governments. With that in mind, as we enter 2023, we have continued to strengthen our WTW Climate Resilience Hub, a global and a multi-disciplinary team of experts, working closely with a cross section of clients to help them manage today's climate risks and to develop a strategic response for the long term.

Powered by our proprietary tool, Climate Quantified™, our climate colleagues provide analytics, advisory and implementation services to help our clients identify, measure and respond to climate-related risks and opportunities.

Public-private collaboration – It is the opinion of the authors of this blog that public-private collaboration is essential to combat climate change. While the insurance industry and capital markets can mitigate some of the physical impacts of climate change related risks (via risk transfer or risk financing solutions), greener infrastructure investment and regulation to drive this will be critical in reducing the underlying risk. Governments and businesses need to work together more effectively (and more so than has been the case in the past) to ensure that the guidelines and frameworks to measure and report emissions are effective.

As a key player in the climate future of the world, the TMT sector has a key role to play, including being a role model in terms of green technology innovations (e.g. using their substantial balance sheets for the betterment of the planet) and in the effective reduction of its recycling and reuse and helping to educate consumers on the part they need to play. Leading technology players.

More specific climate expertise – we expect demand to grow within TMT companies for people whose main job is to think about product adaptation and production in the face of climate risks or to respond to changing customer needs that are going to happen as a result of climate transition.

Beware marketing greenwashing – one of the TMT industry executives we interviewed commented on the fact that marketing dollars can distort environmental benefits. Government, regulatory and consumer attention on ESG will increasingly call out any such instances. The European Union's taxonomy for sustainable activities is a step towards providing companies, investors and policymakers with appropriate definitions for which economic activities can be considered environmentally sustainable.

WTW insight:

Owning the climate agenda

In 2022 WTW experts published Owning the climate agenda, which explored why and how risk managers can lead their organizations' climate action strategy, leading to these five suggested action points

1. If climate is a risk issue, then the risk manager must step up in understanding and managing it; they are the professionals with the expertise to transform the wide range of climate-related risks some colleagues may deem intimidating and unknowable into the fungible, the measurable and that able to be packaged.
2. If the organization is in the early stages of developing a climate strategy, this represents an opportunity to introduce 'risk management 101', identifying, assessing, and managing risks drawing on traditional enterprise risk management approaches.

   If the organization is looking to evolve its approach, the risk manager's role may be more focused on engaging stakeholders in other business units, seeking their data and also their buy-in on the strategic importance of viewing climate through the prism of risk, working in tandem to set goals and key performance indicators.
3. Risk managers should work to align the risk management strategy with the Taskforce for Climate-related Financial Disclosures (TCFD) framework. If a company is operating in a territory where TCFD isn't mandatory, our current experience suggests that even where regulators aren't asking for compliance, many investors will.
4. Risk managers should ensure their organizations are talking to markets the right way in the light of climate-related risk, working to understand what insurers need to know about the organization's ESG strategy to optimize risk financing.
5. The onus is now on risk managers to step up to the climate risk challenge, to both position their organizations in light of insurers' deepening scrutiny of climate risk and to get ahead on the answers to tomorrow's climate risk-related questions. Part of this will be leading workstreams with external stakeholders to create the insurance solutions we'll need for the new economy.

The 28th session of the Conference of the Parties (COP 28) will convene in the United Arab Emirates from 30 November to 12 December 2023. While the agenda has yet to be finalised, we believe that Risk Professionals should and will increasingly be called upon for their expertise and contributions. Drawing on WTW's global expertise, we will be present at COP 28, providing analytics, advisory and implementation services to help our clients to identify, measure and respond to climate-related risks and opportunities.

This work will include an exercise to refine the data (improve accuracy and clarity) that defines the organization's value chain. In other words, organizations should have an accurate overview of the exposures and related data linked to the people, assets, suppliers, critical products, revenues and profits at each location. Insurance and risk managers can help to 'connect the dots' by developing time sensitive scenarios and a catalogue of solutions, and also by linking up in-house models with methods to understand the opportunities of economics of climate adaptation (we will discuss this further in one of our upcoming blogs).

With the accelerated pace of climate change, it will be important for TMT companies to think ahead and to monitor as well as regularly update their risk horizon when it comes to relevant scenarios and climate-related exposures.

A key part of the climate related risk management effort over the next decade will/should be 'following the science' to ensure that market solutions purchased from the commercial insurance market are suitable for a rapidly changing risk landscape.

A topic worthy of debate

This and the upcoming blogs in the series are all opinion based. Each blog concludes with our views and observations that are based on extensive background reading, the research findings and supporting data, interview feedback and the experience and expertise of both academics and WTW experts working within the TMT sector and the company's dedicated Climate and Resilience Hub.

Opinions, of course, are open to be debated. Indeed, we welcome this on a subject that transcends the TMT sector as a generational challenge.

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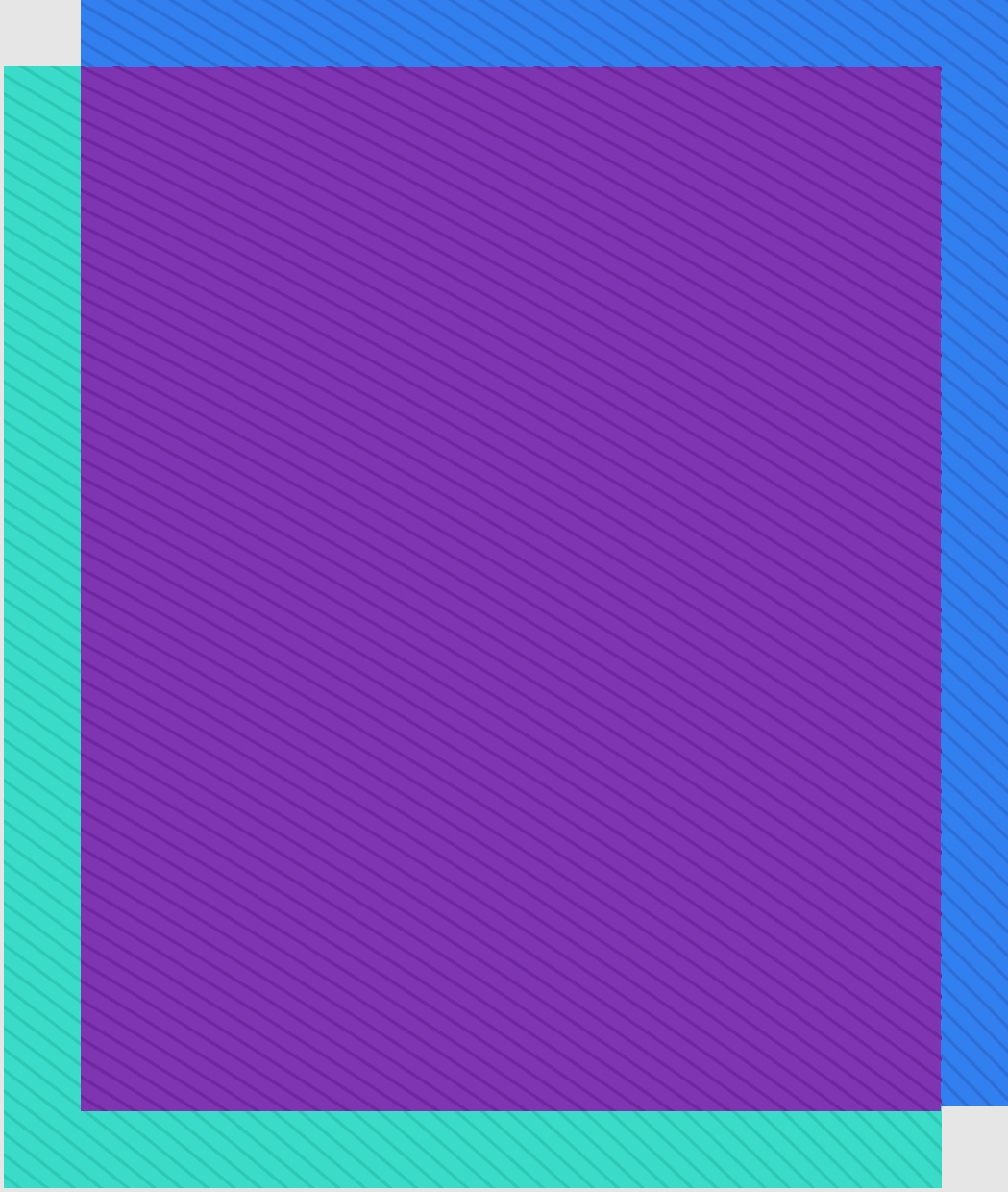

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