Disruptive Tech for

CLIMATE CHANGE RESILIENCE

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echnology can offer new solutions to large, pressing problems — such as the potentially devastating effects of climate change, especially in poorer nations. Until recently, most technology solutions for climate-related problems have focused primarily on response to natural disasters, such as wildfires, floods and landslides.

But the overall approach to technology-enabled climate resilience is undergoing a major shift, focusing on disaster preparedness and planning, which entails `proactive risk management instead of only response. The goal is to prevent nations from losing ground in their efforts to emerge from poverty, so that they can continue to make progress despite the effects of climate change.

In December 2018, the World Bank announced that it will invest $200 billion over five years, starting in 2021, to help countries take action against climate change. This doubles the bank's previous five-year investment plan. This new funding primarily targets climate adaptation and resilience.

"There's a need for solutions that support people not only in surviving a disaster, but also in bouncing back better, so they don't irretrievably lose infrastructure, services or sink back into poverty," said Atishay Abbhi, disaster risk management specialist with the World Bank's Climate Change and Disaster Risk Management unit. "For instance, they need housing and infrastructure that is more resistant to damage from natural disasters. They also need better systems to gather and analyze information, and communicate timely warnings, so that vulnerable communities can take action to reduce their risk and accelerate recovery."

In addition to solutions related to increasingly frequent and severe natural disasters, resilience solutions also can address climate-related challenges and trends that unfold more gradually. For instance, technology can be applied to help ensure the reliability and safety of housing, water, food and power — even as the availability of local resources shifts with the climate. Similarly, technology can also help address migration and refugee issues fueled by climate change, as well as rising climate-related pollution and health risks.

Advanced technologies that are commonly labeled "disruptive" (especially 5G, artificial intelligence, blockchain, drones, cloud computing and the Internet of Things) can be applied and adapted to transform climate resilience solutions. In particular, they can be leveraged to help both technology developers and countries understand climate risks and resilience needs, and to support collaboration and design for solutions.

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The overall field of technology solutions for global climate resilience is currently ripe for five kinds of disruption:

1. **Disruption of the development process.** Forward-looking tech companies are starting to prioritize collaborative development (co-development) of technologies with universities, governments, manufacturers and populations in the nations most at risk. Too often, climate resilience solutions are developed with little or no direct engagement with these future partners and markets.

2. **Disruption of context.** So far, relatively few technology developers travel to, or spend much time in, the regions where their solutions could be deployed. Often, such travel is viewed as a difficult, risky and expensive — rather than an investment in product and market development. Substantial on-the-ground experience can deepen developers' understanding of both the challenges and opportunities for climate resilience solutions, paving the way for creativity and innovation.

3. **Disruption of pricing and market strategies.** Many technology companies are accustomed to earning relatively high profits from the world's more affluent customers. Expanding sales to non-government organizations (NGOs), as well as to national or local governments in emerging economies, will require technology companies to adapt their business and marketing processes. NGOs and governments, rather than consumers, are more likely to be their direct customers for climate resilience solutions.
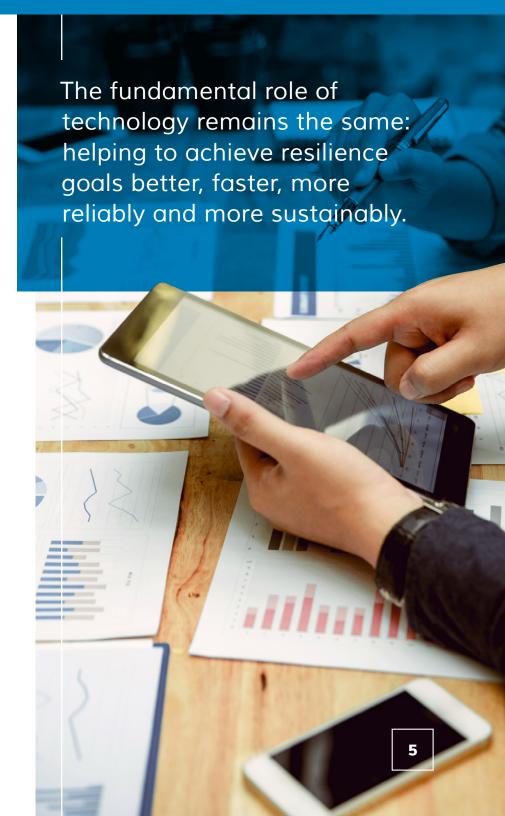
4. **Disruption of capacity distribution.** Vulnerable nations already possess considerable on-the-ground knowledge, but usually they can't rebound easily from disasters. This keeps them mired in the mindset of disaster response. When they're supported in progressing beyond disaster response, nations can adopt a risk-management mindset about climate resilience. That shift can spark the growth of in-country capacities to innovate affordable, practical solutions — which, in turn, yields better technology development partners and stronger markets.

5. **Disruption in how vulnerable nations seek solutions.** By building a presence in the global tech community, especially at key technology industry events, governments of at-risk nations or cities can appeal directly to solutions providers. Through direct interaction, they can explain their needs and provide clear options for how solution providers might do business with them.

Companies and governments that embrace all of these disruptions are most likely to benefit from being one of the first movers in this potentially vast emerging market.

The fundamental role of technology remains the same: helping to achieve resilience goals better, faster, more reliably and more sustainably. The difference is that today, new tools, combined with vastly more data, are supporting greater engagement with all stakeholders, as well as greater collaboration with technology developers.

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Price Tag Matters for

RESILIENCE TECHNOLOGY

Many climate resilience solutions can come at a hefty price tag, often making them out of reach for the limited budgets of nations who would benefit most.

At the same time, technology companies are finding it increasingly difficult to develop effective solutions at an acceptable price point for emerging markets.

"Poorer nations have many constraints, but constraints drive innovation," Abbhi said. "Migrating and customizing technology for poorer countries requires really understanding the challenges, including bringing down the price point. That allows productions and sales to scale up."

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How Co-Development Yields
MORE PRACTICAL AND AFFORDABLE RESILIENCE TECHNOLOGY

The co-development process benefits everyone involved. For tech companies, one of the more powerful, and perhaps surprising, benefits is a uniquely rich context for designing and marketing successful solutions. It's a form of iterative customer-focused development that many consumer technology companies practice.

"It's important to understand not just the scope and nature of disaster risk, but also the local context of that risk," Abbhi said. "If you haven't really experienced the environment where a solution will be used, many important design considerations might not automatically occur to you."

Using co-development to migrate and customize advanced technology results in useful products and can help all parties unlock creative potential and opportunities that might otherwise be undervalued or overlooked.

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Although consumers may be the end users, typically resilience solutions are purchased and distributed by humanitarian, relief and development organizations and by governments.
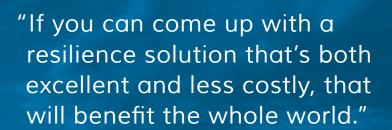
Collaborative development can also reduce the risk of entering emerging markets, where technology companies sometimes misunderstand their customers. Climate resilience technology is not a consumer market; impoverished or disaster-stricken individuals and families are usually not in a position to purchase technology retail.

Although consumers may be the end users, typically resilience solutions are purchased and distributed by humanitarian, relief and development organizations and by governments. Often, these entities are also partners in the co-development process. That pipeline mitigates a tech company's risk of financial return on a new product for a new market. It can also provide a higher level of access to emerging markets and to capital.
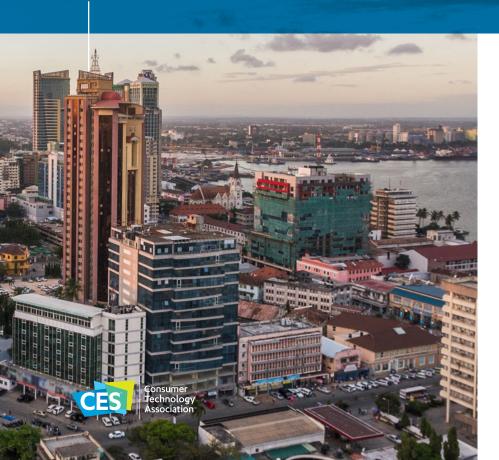
The co-development process typically doesn't end with a product launch. After a resilience solution is initially deployed in an emerging market, the co-development pipeline can provide rich and nuanced feedback on what's working and what needs improvement. This yields insight to iterate the solution quickly and more affordably.

For instance, in late 2018, the Tanzanian government and the World Bank held an event to explore how autonomous cargo drones might enhance the transport of supplies and products around the islands and shores of Lake Victoria. Academics, industry leaders, and East African government officials at the gathering attended presentations and watched drone flight demonstrations.

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>
> **Atishay Abbhi**

An IEEE article about the impact of this gathering noted, "A handful of European drone companies exhibited their machines: all of them very capable, all built with custom hardware and software and encased in sleek fiberglass and carbon fiber. But these drones are too expensive for East Africa. Here the drones need to be cheap, both to build and to repair — and that means bamboo and zip ties instead of fiberglass and carbon fiber."

The article went on to describe how Tanzanian inventor and entrepreneur Bornlove Ntikha demonstrated to attendees at the event a functional, small prototype cargo drone that his local team built from local materials, including bamboo. With controls, motors, receiver, power system, GPS, 3D-printed parts and free bamboo, total manufacturing cost was about $150 USD.

This sort of interaction between technologists from developed and developing nations can do more than spark creativity to show what's possible. It also indicates ways to reduce the cost and adapt the capabilities of technologies so that they are most appropriate and affordable for the nations and people who need them.

"If you can come up with a resilience solution that's both efficient and less costly, that will benefit the whole world," Abbhi said.

Key benefits of co-development for vulnerable populations, their governments and the NGOs working on their behalf include:

1. **Increased stability, safety and prosperity** for a greater share of humanity, even in the face of a more volatile, and often less hospitable, climate.

2. **More efficient and effective** allocation of scarce resources.

3. **Local capacity-building for technology development** and related business and economic activity, especially local tech entrepreneurship.

In recent years, the World Bank has been bringing together technologists with governments and organizations in the nations that face the biggest risks from climate change. Often, the first step in this process is introducing these nations to technologies that can address systemic problems that keep them stuck in poverty, particularly communication technologies.

"Last-mile communication is a huge challenge in many poorer nations," Abbhi said. "It's hard to deploy any advanced technologies to people in poorer or remote areas when simply getting information flowing back and forth is difficult."

While communications is not intrinsically about climate resilience, helping nations manage their transition to 21st-century communications infrastructure is an important step. It enables them to gather more information from the field, engage more citizens and help people make more informed choices. The importance of this initial step is illustrated by a conference session, "Peace Building and Technology," as part of the three-session Resilience Conference hosted by the World Bank at CES 2020.

By supporting more general infrastructure, then layering on top of that solutions that more directly increase climate resilience, the World Bank serves the dual goals of resilience and development.

"We want to do more than just help people prepare for climate change," Abbhi said. "We want to help them position themselves for the future of work."

Communication infrastructure can enable engagement in climate resilience across a vulnerable region. For instance, once sufficient communications infrastructure is deployed — especially affordable, reliable access to mobile data —local populations can actively or passively crowdsource vital data via apps on consumer-grade mobile phones for mapping, resource inventories, travel routes and more.

At the community level, participating in information gathering can lead to real empowerment. In a recent CES Tech Talk podcast, Senior Disaster Risk Management Specialist with the World Bank's Global Facility for Disaster Reduction and Recovery Emma Phillips Solomon explained, "People can be involved in the process of understanding their risks. That information and data can drive local decisions on how to prevent future risk. Where are our hazard zones, such as flood zones? Can we avoid building our infrastructure, schools and houses there?"

For more specialized information-gathering in the field, students and universities can be essential partners in technology co-development. They can use more sophisticated devices, sensors and tools to assess local resilience needs and resources in a more systematic way. This structured information can help local governments and aid organizations make strategic decisions on how to prevent future risks.

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2 TECHNOLOGY INNOVATIONS
for Climate Resilience

The World Bank is focusing on several technology areas that appear to have significant potential to support climate resilience through innovation:

- **5G and IoT.** Next-generation data communication networks can improve data collection and processing from a widely distributed array of sensors and devices. This can support more accurate modeling and predictions related to climate change and its effects, which can in turn guide strategies and tactics for climate resilience.

- **Artificial intelligence and machine learning.** Algorithms that adapt and improve themselves based on the data input can help spot emerging patterns, problems and opportunities that more conventional means may miss. From early warning systems for disasters; to planning for housing, agriculture and transportation; to management of decarbonized and decentralized renewable energy systems, the myriad applications of artificial intelligence and machine learning can augment almost any climate resilience effort.

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- **Blockchain.** Distributed ledger technology can support climate resilience by bolstering analysis and accountability within supply chains, environmental compliance and energy systems. In emerging markets, corruption often breeds a lack of trust that can undermine the expansion of sustainable distributed systems. Blockchain can provide coherence and consistency to the transactions that comprise delicately interwoven systems for resilience, helping them to be flexible during disruption.

- **Drones.** From airborne sensors to flying agricultural robots to airlifting emergency relief supplies, drones can provide intelligence, visibility and action in hard-to-reach locations.

- **Cloud computing**. All of the technologies above require more processing power than can be found locally in many emerging nations. Leveraging cloud computing services allows technology companies to quickly deploy and iterate data- and algorithm-intensive solutions, scaling processing power up and down as needed. This cost-effective approach is especially appealing to resource-constrained governments and organizations.

Climate resilience technology with viable applications for emerging nations will be showcased at CES 2020.

Climate change is creating heat waves that increase energy demands for cooling, which can lead to power outages or unaffordable costs to maintain safe temperatures for humans and perishable products.

For instance, climate change is creating heat waves that increase energy demands for cooling, which can lead to power outages or unaffordable costs to maintain safe temperatures for humans and perishable products. Additionally, chemical refrigerants can be difficult to acquire in poorer nations. Oxicool offers an air conditioner that uses water as a refrigerant: a molecular sieve cools air by extracting water without requiring electricity. OxiCool has also demonstrated an on-demand liquid cooler that instantaneously reduced the temperature of potable water from 115°F to 60°F using no electricity.

Climate change is also causing arable land around the world to shrink or deteriorate in productivity, which can contribute to food supply crises. Indoor agriculture can help address this growing problem. Groviv technology from Growgenix provides automated, controlled-environment agriculture using data and robotics to perfect and increase production. This sustainable approach to farming uses significantly less water and land resources, and it requires no pesticides or herbicides.

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CONCLUSION:
Matching Tech Innovation with Resilience Needs at CES

For technology providers to gain insight into climate resilience opportunities, making connections with leaders from nations seeking climate resilience solutions is key.

CES 2020, taking place January 7-10 in Las Vegas, offers a unique opportunity to bring these two groups together, and the World Bank is presenting several climate resilience events at CES.

"Our main motivation for being there is to bring a perspective that's not very well known in the tech industry," Abbhi said. "So far, it's mostly been the responsibility of the public sector to work on climate resilience. We want to do some matching of needs and solutions. We're bringing representatives of governments with climate resilience needs to present their challenges and use cases, to create or enable partnerships to develop solutions."

To get these partnerships off the ground, tech companies will have to explore funding models that are different from what is customary in Silicon Valley. Foundations and NGOs can be good

funding sources for pilot projects, but tech companies often have less experience working with these funders.

However, once a pilot project has generated some success and learning, more traditional tech funding sources, especially venture capitalists, could be helpful for scaling up production and deployment of resilience technology.

Face-to-face encounters between technologists and leaders from nations in need of climate resilience solutions supports more creativity and collaboration that can help address some of the most pressing threats in the history of humanity — and perhaps also create opportunities for new partners in climate resilience.

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The Consumer Technology Association is the trade association representing the $401 billion U.S. consumer technology industry, which supports more than 18 million U.S. jobs. More than 2,000 companies – 80 percent are small businesses and startups; others are among the world's best known brands – enjoy the benefits of CTA membership including policy advocacy, market research, technical education, industry promotion, standards development and the fostering of business and strategic relationships. The Consumer Technology Association also owns and produces CES® – the world's gathering place for all who thrive on the business of consumer technologies. Profits from CES are reinvested into CTA's industry services. Visit CTA.tech to learn more.

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