



Building Resilience in Businesses and Supply Chains in Asia

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EXECUTIVE SUMMARY

Typhoons, terrorism, the threat of war, tsunamis, earthquakes, and epidemic disease. These are but a few of the challenges Asian companies have confronted since the century began. The 2015 explosion at the Chinese port of Tianjin (pictured on the cover) illustrated how the scale of man-made accidents has increased in step with economic growth. Risk is not new. What's new is that ever-more-complex business models make companies vulnerable to risk as never before. What's new, too, is that we are running up against resource limits—especially with water and carbon—that put even simple business models at risk.

For their own corporate survival, companies need to assess risk and build in resilience both in terms of understanding their exposure to climate change and, at a more granular level, its impact on their supply chains. For the long-term health of the planet, this de-risking should be part of the global effort to move toward a low-carbon world. This briefing provides the tools for starting this process of minimizing risk and increasing resilience, looking at short-, medium- and long-term opportunities and challenges. It also considers how to reconcile short-term corporate needs with long-term planetary challenges, showing that de-risking and increasing efficiency often lead to cost savings.

Asia's success in export-oriented manufacturing has powered extraordinary economic growth in the past half-century. For good reason, East Asia is known as the workshop of the world. This manufacturing excellence has relied on increasingly complex and attenuated supply chains. These supply chains are inherently vulnerable to disruption. Even stand-alone companies face challenges in an uncertain world. Heightened worries about geopolitical risk in the region and Asia's unique vulnerability to climate change means that building resilience to disaster risk is a significant—and in some cases existential—business issue for virtually every Asia-based company.

The Asia Business Council's 2017 annual survey found that members are much more concerned about external uncertainties now than in previous years, especially unpredictable risks that disrupt business operations. This briefing explores the vulnerability of Asian supply chains to unpredictable risks that include natural disasters (which now are compounded by climate change), potential water and energy shortages, and geopolitical uncertainty.

Climate change is one of the key factors raising business risk in Asia. Mark Carney, the Governor of the Bank of England and Chairman of the Financial Stability Board (FSB), calls the threat of climate change “the tragedy of the horizon,” because the timeframe is beyond the time horizon of most management teams' tenure. He warned that policy responses to climate change, or the lack thereof, along

with technological changes, will greatly affect the core infrastructure of countries and long-run earnings potential of companies. Companies need to both build resilience into their current operations and keep in mind the need for the world to effectively decarbonize by mid-century. A good resilience strategy can achieve both the short-term goal of protecting operations and profitability while working with governments and others toward the long-term global goal of limiting the impact of climate change.

Geopolitical risks are difficult to predict; natural disasters such as earthquakes are somewhat random. But there is a strong scientific consensus that the atmosphere is warming as a result of human activity, and that Asia will feel these effects disproportionately. Asia is particularly at risk because of the increasing number of severe storms, the number of people in poverty, and because so many of its people—and companies—are near water and subject to sea water rise and floods. Climate change is also exacerbating the spread of infectious diseases, another risk which best-practice companies are, to the extent possible, preparing for.

High-profile failures to prepare for and respond appropriately to disasters, such as Fukushima operator Tokyo Electric Power Co. (TEPCO)'s failure to heed experts' warnings about the vulnerability of the nuclear plants to tsunami risk, and the subsequent lack of internal and external communication after the disaster, highlight all too clearly the importance of being prepared.¹

This briefing reviews a range of measures companies have taken to prepare for and respond to disaster risks in the short-term, as well as how they plan to improve resilience over the medium- and long-term. In the short-term, it is imperative that a company have robust plans for business continuity and disaster recovery. Medium-term actions include better understanding and managing suppliers, increasing resource efficiency, and systematically developing strategic foresight to plan for and analyze the potential impact of uncertain events.

WHY ASIA MATTERS IN GLOBAL SUPPLY CHAINS

Asia's success in manufacturing makes it home to about half of the global total industry value-added.² When there is a supply-chain disruption in Asia, be it with Apple iPhones or Toyota automobiles, the effects are often felt worldwide. In recent years, Asia's supply chains have been evolving rapidly in response to several major trends, making them even more vulnerable to external shocks. The first is a significant shift of production and sourcing activities from China to lower-cost Association of Southeast Asian Nations (ASEAN) countries, bolstered by the 2010 China-ASEAN Free Trade Area agreement, which gradually eliminated import tariffs on most products. That has brought in many new companies, stretching out and fragmenting supply chains that were already attenuated. The second is increasing consumer demand in Asia due to growing disposable incomes and rapid urbanization, which shift manufacturing supply chains to serve domestic and regional markets.³

Supply chains in Asia range from the compact efficiency of China's Pearl River Delta (PRD), home to the largest electronics industry cluster in the world, to geographically extended supply chains in less-developed parts of China and beyond. Hon Hai Precision Industry Co. (Foxconn), the Taiwanese maker and exporter of electronics components best-known for assembling Apple iPhones, has expanded inland from Shenzhen to Chengdu and Wuhan and has plans for a significant investment in the American state of Wisconsin. In the electronics industry, the share of exports considered intra-Asian trade has risen from 53% in 2001 to 64% in 2016. Many of these exports are parts and components shipped within Asia before being assembled into a final product.⁴

This development benefits the economies of ASEAN nations, including Singapore, Thailand, Vietnam, Malaysia, and Indonesia, where production has moved in response to rising labor costs in China and elsewhere.⁵ But the benefit of cheaper wages often comes at the cost of reduced supply chain visibility (defined as the ability to track parts, components, or products from the manufacturer to their final des-

tinuation), lower productivity, and the lack of risk management infrastructure.⁶ In an analysis of sustainable supply chains globally, consulting firm EY found that lack of end-to-end transparency is particularly problematic in Asia, exacerbated by the high number of suppliers and subcontractors throughout the chain.⁷ Small and medium enterprises (SMEs) make up the vast majority of enterprises in Asia.⁸ A World Economic Forum (WEF) report found that in Asia, unlike in Europe and North America, building a culture of risk management across suppliers in emerging economies is less valued than growth opportunities are. The younger links in the supply chain are often viewed as commodity-like and interchangeable, rather than as long-term partners, and therefore less emphasis is placed on risk management.⁹

Infrastructure is a supply chain vulnerability, though it is beyond the ability of companies to change. At best, companies can prepare for problems and work to see that infrastructure improvements are made. The ability to move cargo quickly and efficiently is crucial to modern supply chains, but poor road and rail infrastructure in countries such as Indonesia and Vietnam have resulted in bottlenecks and shipment delays.¹⁰ In the World Bank's 2016 Logistics Performance Index global rankings, Singapore was ranked fifth and Hong Kong ninth out of 160 countries, while Indonesia and Vietnam were 63rd and 64th, respectively.¹¹ The Asian Development Bank (ADB) estimates that ASEAN alone requires infrastructure investments of \$60 billion annually through 2020, the majority of it devoted to the transport and energy sectors.¹²

WHY ASIA IS UNIQUELY VULNERABLE TO DISASTER RISKS

NATURAL CATASTROPHES

Japan's recent natural and man-made disasters show how difficult it is to be truly prepared when disaster strikes. The country's March 11, 2011 triple disaster combined two natural disasters with a man-made one: an earthquake which triggered a tsunami that in turn led to one of the most serious nuclear power plant accidents in history. The magnitude 9 Tohoku, or Great East Japan Earthquake, moved the earth's axis, shifted Japan's main island of Honshu eight feet, and created a tsunami that killed more than 15,000 people and led to a nuclear meltdown, an electricity blackout and an energy price supply-shock, as well as long-lived power shortages. It was one of the largest insured losses in Asia in recent history. Japan's Cabinet Office has estimated the direct economic cost at 16.9 trillion yen, or \$210 billion.¹³ The calamity highlights the complexity of human and natural systems and illustrates the importance of preparing for events that are considered low probability but are high severity if they occur. TEPCO, the operator of the Fukushima nuclear plants, repeatedly ignored warnings by experts of the vulnerability of its plants to just such an event.¹⁴ The disruption, and similar ones exposed after a significant earthquake in 2016, highlighted serious weaknesses in Japan's disaster preparedness. That even Japan, which has a history of earthquakes and other natural disasters, a wealthy nation that prides itself on doing the right thing and for meticulous attention to detail, saw its business sector so badly caught out by these disasters suggests how vulnerable Asia as a whole remains.

The damage suffered by major Japanese auto makers during the 2011 disaster ricocheted through supply chains around the world, with double-digit percentage declines in auto output in China's Guangdong province, Thailand, and the U.S. in the following quarter. In the second quarter of 2011, Japan's GDP dipped 2.1% from the same period in 2010, while industrial production and exports dropped 7% and 8%, respectively.¹⁵

Several lessons emerged in the aftermath. Single-supplier vulnerability was exposed in the auto industry when Renesas Electronics, the world's largest supplier of micro-controller units for specialized microchip circuitry in cars with a 40% market share, experienced flooding at its Naka facility as a result of the tsunami. Renesas's design and manufacturing processes were not easily replicable, and were custom-tailored for each large client, making quick substitutions impossible.¹⁶ The Naka plant did not resume pre-disaster production levels until September of that year. In its annual report for 2011,

Renesas recorded a 65.5 billion yen loss from earthquake damage. Renesas shared its disaster-recovery lessons, pledging to make its factories earthquake-resistant and develop the ability to quickly switch output to alternate sites, building redundancy into both assembly sites and inventories. Renesas also highlighted the importance of managing information about risk with both primary and secondary suppliers, opening lines of communication about risk management, and business continuity planning.¹⁷

History does not repeat, but often rhymes. 2016's most destructive event, the magnitude 7 Kumamoto earthquake that struck Kyushu Island in southern Japan in April, exposed serious supply chain vulnerabilities remaining in Japan, even after lessons supposedly learned from the earlier quake's impact, emphasizing the enormous challenges inherent in the task of de-risking the supply chain. A statistic from Japan's National Association for Small and Medium Enterprises, published after the quake, revealed that only 15.5% of small and medium-sized companies have business continuity plans, up from 12% after the Great East Japan Earthquake of 2011, showing that even in Japan, a rich country which has suffered disproportionately from natural disasters, small businesses are still not properly prepared to ensure business continuity.¹⁸ Economic losses from the quake were \$25-30 billion, according to Swiss Re.¹⁹ Over-reliance on key suppliers was once again an issue. For example, the Aisin Seiki factory in Kumamoto, damaged in the quake, was responsible for 75% of the group's domestic door part output for Toyota vehicles. Its shutdown caused Toyota assembly lines to halt nationwide.²⁰ Renesas Electronics, which, as discussed, had played a major part in the shutdowns of auto manufacturers in the 2011 Tohoku quake, was again damaged, causing negative ripple effects across multiple auto manufacturers. Honda, Mitsubishi, and Nissan also experienced supply-chain related shutdowns.

Asia is home to roughly 60% of the world's population. So, it should come as no surprise that from 2012 to 2016, Asia suffered both the highest loss of life and worst economic impact from natural and man-made disasters of any region on the globe.²¹ The trend is not friendly: Munich Re and other sources in the reinsurance industry chart a steady increase, since the 1980s, in the number of natural catastrophes in Asia, led by floods, typhoons, and tsunamis.²² This is in line with the trend of an increasing number and severity of major weather events that allows scientists to conclude that there is a causal link between the warming planet and the more frequent and severe natural catastrophes and to predict that there will be more and more severe weather-related catastrophes in the future.²³

The ADB, in *A Region at Risk, the Human Dimension of Climate Risk in Asia and the Pacific*, predicts an average temperature rise for Asia of six degrees Celsius by century's end if greenhouse gas emissions remain unchecked (versus the estimated world average of about four degrees and the aim of the 2015 Paris climate agreement that the temperature rise be limited to two degrees). More extreme tropical storms, more frequent and intense flooding, decreased agricultural productivity, and a potentially lethal combination of heat and humidity, the report predicts, argue for focusing on how to defend corporate assets from hostile environmental changes.

Sea-level rise, and accompanying flooding and storm surge, pose a serious economic threat to Asia. The ADB report projects the global cost of flooding will rise from roughly \$6 billion per year in 2005 to \$52 billion by 2050. Thirteen of the top 20 cities with the largest predicted increase in annual losses, including Guangzhou and Shenzhen in China's PRD region, are in Asia.²⁴ In terms of population-at-risk to storm surges, the PRD and Shanghai top the list, according to Swiss Re's *Storm Surge* indicator, which finds that Asia is by far the most exposed region, with Asian cities occupying eight slots out of the top 10.²⁵

The PRD, the site of Asia's most sophisticated supply-chain cluster, had a GDP of more than \$1.2 trillion in 2015, amounting to 9% of China's GDP and 27% of its total exports.²⁶ Sea levels in the PRD are expected to rise almost four times as much as the global average by 2030, 30 centimeters at the estuary mouth versus an 8-centimeter average rise globally. This would jeopardize much of the southern part of the PRD, which sits just 30 to 40 centimeters above sea level.²⁷

Key energy and infrastructure assets are among those in danger in the PRD. The climate risk analysis firm Four Twenty Seven uses data analytics to parse raw climate change data released by the National Aeronautics and Space Administration (NASA), combining it with asset-level company data, to analyze the business sensitivity of corporate assets. Looking at the NASA projections to determine expectations of future exposure to extreme rainfall, water stress, or sea-level rise, Four Twenty Seven, in a joint report with Deutsche Asset Management, highlighted the vulnerability of companies in the PRD. Under a two-meter flood scenario (which could represent any combination of sea level rise, tide, and storm surge) plant, property and equipment at risk includes CNOOC's petroleum refinery and natural gas transmission lines, as well as Sinopec's retail and wholesale gasoline and petroleum facilities.²⁸

Flooding and storm surges are not new in the PRD, but have been exacerbated by urbanization, landfills, and the dredging of major rivers.²⁹ About 70% of the mangrove swamps in Shenzhen, which served as natural storm barriers, have been paved over.³⁰ Flood water could also create conditions that exacerbate the spread of infectious diseases, notably mosquito-borne diseases.³¹ Given the supply-chain sophistication and value-added manufacturing situated in the PRD, Swiss Re estimates losses from major flooding there could be as high as \$35 billion.³²

WATER SECURITY

Water risks in Asia center on contamination and supply shortages. Deteriorating water quality, the potential for rising water costs, and the inability to treat water if it is already too polluted, can interrupt production, force businesses to relocate, and restrict growth opportunities.³³ The availability of adequate clean water supply is crucial for many industrial processes, from brewing to textiles to semiconductors. Alarming, Asia ranks worse than both Africa and Latin America in terms of severe water pollution—approximately 80-90% of wastewater in Asia is released without treatment, infiltrating ground and surface water and coastal areas.³⁴

Companies that lack adequate planning can face unforeseen capital expenditures and higher operating costs to purify contaminated water or simply to procure adequate supplies for their production processes. The business case for long-term planning is often obscured by systemic underpricing of water. CDP (formerly the Carbon Disclosure Project), an organization that facilitates environmental disclosures by corporations, notes that only a small number of companies cite higher water prices as a potential risk to their operations or along their supply chain.³⁵ China is expected to see economic losses totaling nearly \$40 billion per year by 2030 as water demand exceeds supply. Yet only one-third of Chinese firms report even measuring their water usage, while 82% of multinationals do. Only 41% of Chinese firms report conducting water risk assessments, compared with an average of nine in ten among their multinational peers.³⁶

Water insecurity, exacerbated by global warming-induced drought, is increasingly pitting interest groups against one another, and creating economic drags, in water-challenged countries like India. A 2016 drought was estimated to have cost the economy \$100 billion.³⁷ In India, where about 15% of its GDP comes from agriculture and roughly 68% of its 1.3 billion people are farmers, the 2016 water shortages caused financial hardship, driving many farmers to suicide or forced migration.³⁸ Foreign companies with water-intensive products were often seen as unwanted competitors for water. Coca-Cola and PepsiCo were the subjects of a high-profile campaign to boycott their products in Tamil Nadu. Two trade associations publicized the water-intensity of sugar-cane, a crop that competes with traditional rice farming for water. Coca-Cola and PepsiCo are India's largest and third-largest sugar-cane consumers. Rice farmers and others staged angry protests, accusing the companies of straining water resources and depleting water supplies.³⁹ In response to public interest litigation arguing that water scarcity had diminished water for drinking and irrigation, an Indian High Court in November 2016 ordered that water from Tamil Nadu's Tamirabarani river not be diverted to the drinks manufacturers' bottling plants for two months.⁴⁰

Water insecurity issues continued to plague the subcontinent in 2017, as another heat wave swept over southern India. In Kerala, PepsiCo shut a plant after government-imposed water rationing required industry to cut back water use by 75%. The state's largest retailer association asked members not to sell PepsiCo or Coca-Cola products because of their perceived exorbitant water use.⁴¹ Many companies' production suffered, including Grasim Industries, a building materials company, which temporarily shut down its 73,000 ton-a-year pulp unit in Karnataka, due to severe drought conditions.⁴² Tamil Nadu Newsprint and Papers Ltd. halted one of its paper machines due to water shortages, lowering production by 35%.⁴³ In June 2017, Tamil Nadu's capital city, Chennai, one of India's fastest-growing urban areas, saw its daily water supply of 830 million liters halved as a result of one of the worst droughts in 140 years.⁴⁴

ENERGY SECURITY

Energy security is an essential condition for running a stable business, as energy supply shortages can result in the shutdown of production lines due to blackouts and transport bottlenecks and prevent employees from reaching their workplaces.⁴⁵ As defined by the International Energy Agency, energy security means a business has uninterrupted access to energy at an affordable price. In the long term, this is a function of investing in adequate infrastructure to supply energy, given the changing energy landscape, regard for the environment, and business needs. In the short term, energy security means the ability for a company to adjust to volatile prices and supply shortages without impairing business operations.⁴⁶ With ongoing growth in energy demand, geopolitical threats to energy supplies, and a continued dependence on fossil fuels, supply chains and manufacturing hubs in Asia remain susceptible to energy-related risks. Indeed, concerns over energy price shocks in Asia-Pacific have consistently been ranked by senior executives in Asia among the top five risks over the past three years.⁴⁷

An example of a recent energy supply shock is that experienced by Japan in the aftermath of the Tohoku earthquake. Prior to it, about 30% of Japan's power came from nuclear energy, and plans called for it to comprise as much as 50%. Japan's energy consumption per unit of output (GDP) was the lowest in the world. After the Great East Japan Earthquake, the country closed all of its nuclear plants for four years and most units remain idle. Imported fossil fuels made up the gap and contributed to the country's first trade deficit (2.5 trillion yen) since the aftermath of the oil crisis in 1980. Most of this was due to a 25% (4.3 trillion yen) increase in fossil fuel imports (LNG, crude oil and petroleum products), comprising nearly one-third of Japan's import spending.⁴⁸ In response to power shortages after the disaster, Prime Minister Naoto Kan imposed rolling blackouts, thus forcing companies like Sony and Toyota into temporary shutdowns.⁴⁹ Falling prices for renewable sources of electricity and battery storage will allow companies in the future to build long-term energy security.

With a heavy dependence on water-intensive energy resources, such as coal, Asian business operations must contend with the water-energy nexus, a reference to the large amounts of water used for energy production and the significant amounts of energy used for water treatment, purification, and pumping. Both of India's main sources of energy generation, thermal power plants and hydroelectric plants, are highly water-intensive. During 2016's severe drought, India lost approximately 14 terawatt-hours of thermal electricity generation, enough to power all of Sri Lanka for a year, due to a lack of water to cool the generating plants.⁵⁰ India's hydropower plants also suffered, most starkly illustrated when India's tallest dam, Tehri Dam, capable of storing 2.6 billion cubic meters of water, ran dry of stored usable water in May 2016.⁵¹ Out of 91 reservoirs monitored by India's Central Water Commission across India, usable water measured 31 billion cubic meters in aggregate, amounting to an alarming 19% of their capacity. As water insecurity grows in tandem with energy demand, building energy resilience will be crucial, as we increasingly face a potential trade-off between water demand for power generation, for drinking, agriculture, and other industries.

Southeast Asia is seeing a surge in fossil fuel dependence. Many key ASEAN economies have become net energy importers and energy diversification developments remain slow. In its report *Southeast Asia Energy Outlook, 2017*, the International Energy Agency (IEA) analyzed energy demand and consumption in the region. Southeast Asia, formerly a net exporter of oil and gas, in 2016 recorded a net energy deficit of \$20 billion, which the IEA projects will rise to \$300 billion by 2040, driven by importing oil and, to a lesser extent, gas. This large increase in imports raises energy security concerns for countries across the region.⁵² Increasing use of cheap and abundant coal, particularly in Indonesia, is also set to inhibit strides in energy diversification and contribute to a significant increase in ASEAN's greenhouse gas emissions. As one of the regions most vulnerable to climate change, these trends are problematic, and identify a critical need for the build-out of renewable energy infrastructure in the region.

Reliance on energy sources coming through transportation chokepoints also leaves companies vulnerable to disruption. In 2016, about 18.5 million barrels of oil per day passed through the Persian Gulf's Strait of Hormuz; 80% of that oil went to Asian markets, with China, Japan, India, South Korea, and Singapore being the largest consumers.⁵³ A three-month closure of the Strait of Hormuz would create a supply shortage equal to 26% of Asia's oil consumption.⁵⁴ If oil flows through the strait were disrupted, alternative routes are scarce. The Strait of Malacca, between Malaysia and Indonesia, is a similar potential chokepoint, one through which 16 million barrels of oil pass daily. The Energy Information Agency asserts that if oil flows stopped, almost half of the world's fleet would be forced to re-route around Indonesia. This would overwhelm global shipping capacity, increase shipping costs, and drive up energy prices. Geopolitical tensions, like Iran's threats to close the Strait of Hormuz, are not the sole triggers potentially disrupting transit through these energy transit points. A recent Chatham House report points to climate change as another. Analysts argue that greater frequency of adverse weather will result in increased closures of key chokepoints. Rising sea levels will affect both port operations and coastal storage infrastructure, heightening infrastructure vulnerability to storm surges.⁵⁵

While energy-related risks are diverse in nature—transport risk to energy supplies, natural disaster-induced energy shortages, and an increasing dependence in certain parts of Asia on fossil fuels—when it comes to energy security, they are intertwined. To build resilience in one area of risk often has the benefit of building resilience in others. Integrating renewable energy into business operations, especially with solutions that lessen dependence on centralized utility grids, and greening supply chains, represent long-term solutions.

GEOPOLITICAL TENSIONS

Geopolitics matter to supply chains because of their potential to disrupt trade and business continuity and threaten human and employee safety. Real and perceived geopolitical tensions in Asia are now high. The World Bank for the first time highlighted geopolitical threats in its October 2017 *East Asia and Pacific Economic Update*, pointing to the potential for disruption of trade flows stemming from the region's central role in global shipping and manufacturing supply chains.⁵⁶ Indeed, nine of the world's ten busiest container ports, including South Korea's Busan, are located in Asia.⁵⁷ The World Bank also warned of the potential for increased volatility in global financial markets. Financial market instability typically leads to significant capital outflows from developing countries, weakening currencies and raising the cost of borrowing.⁵⁸

The perception of heightened geopolitical risk in Asia results from issues as diverse as increasing military maneuvering in the contested South China Sea, tensions in the Korean Peninsula, the China-India border, and frosty cross-Strait relations. To take one example, war on the Korean Peninsula would lead to an incalculable loss of lives. Besides the human toll, there would be huge disruptions to businesses operating there and any conflict would have serious consequences for world trade; as of 2016, South Korea was the seventh-largest exporter in the world.⁵⁹ South Korea accounts for 40% of

global production of liquid crystal displays, and is the second largest producer of semiconductors, with a 17% share of the global market. It also is home to three of the world's largest ship builders and one of the world's biggest car makers.⁶⁰

Other issues, like political unrest within economies, can also disrupt business operations. In Thailand, large-scale anti-government protests in 2008 closed Bangkok's Suvarnabhumi International Airport, resulting in a \$8.5 billion loss to the economy as tourism declined and exports were delayed.⁶¹ The electronics and auto industries suffered, as did fruit and flower exports.⁶² Cargo and logistics companies made efforts to route exports through Phuket airport instead, but they were only able to accommodate 10% to 20% of outbound air freight.⁶³

WHAT ASIAN COMPANIES CAN DO TO BUILD MORE RESILIENCE

Strategies that enable businesses to decrease their vulnerability to external risks and build resilience in their organizations have different time horizons—immediate short-term actions to anticipate and respond to disasters, minimize economic and operational costs, and ensure business continuity; medium-term actions to identify weaknesses and build stronger supply chains; and longer-term actions to build stronger infrastructure and industry standards, including greening supply chains and financing greener operations.

SHORT-TERM MEASURES

Immediate response in the wake of disaster involves rapid and coordinated efforts of the private and public sectors. Companies also need to plan ahead by having business continuity plans and utilizing supply chain risk-management programs before disaster strikes, to better understand and prepare for risks to their business operations.

MANAGING THE AFTERMATH OF DISASTERS

Post-disaster actions can be improved by advance planning, clear understanding of disaster response responsibilities, and tight coordination with regional and local governments. The private sector response during 2013's Typhoon Haiyan in the Philippines serves as a model for public-private coordination. The Philippine Disaster Resilience Foundation, an entity backed by the country's largest corporations, was among the key players coordinating the private sector effort. The Foundation also linked government agencies, civil society groups, and local government relief efforts. A study by the Humanitarian Practice Network lauded the private sector response during Haiyan as more sophisticated than in previous disasters.⁶⁴ Companies with a local presence donated essential relief items, provided logistics assistance, services, project management expertise, and volunteers.

DEVELOPING BUSINESS CONTINUITY PLANS

Having a business continuity plan (BCP) in place also enables companies to respond to disasters more quickly and effectively. Many Asian companies are not well-prepared, even on paper. A 2011 survey by Asia-Pacific Economic Cooperation (APEC) found that the level of BCP development varies greatly by firm size: only about 16% of SME respondents have a written BCP, while 52% of large company respondents do.⁶⁵

Business continuity planning means taking appropriate measures to ensure the continuity of critical operations. Actions and outcomes include identifying the critical operational functions of the organization; insulating key assets from threats before they happen; ensuring BCP effectiveness through regular drills and ongoing employee education; and insulating the company from being seen as negligent (reputational risk) if it is unprepared.

C-suite executives are responsible for ensuring that a robust BCP is in place, one that allows operations to get back as close to normal as feasible in the shortest time possible, allowing employees to

resume work safely. This is an increasingly difficult challenge given the emergence of complex threats such as cyberattacks, IT failures, pandemics, terrorist threats, and disruption from exogenous political events. An entire industry that specializes in creating BCPs tailored to company-specific needs and best practices has developed.

Specialty commercial property insurance underwriter FM Global provides an example of an engineering-based approach to building resilience. It tailors its insurance policies, based on an analysis that helps the client company anticipate and manage risk to its properties by looking at how fire, gale-force winds, floods, and other natural catastrophes could affect a company's physical plant. It suggests changes to ensure the structural integrity of corporate assets, which helps allocate capital to strengthen the business overall. FM Global also has a supply-chain risk-management service which gives the client tools to model revenue flow and understand supply-chain inter-dependencies, based on the client's suppliers' locations—as well as those of those suppliers' suppliers. This type of analysis is designed to give both the insurer and its clients more visibility into potential losses.⁶⁶ Most important, the exercise helps build stronger businesses that should suffer fewer losses.

MEDIUM-TERM MEASURES

Medium-term strategies to build resilience to risks include increasing supply chain transparency and traceability, reducing single-supplier concentration risk, and building in flexibility and redundancy. Because a medium-term horizon affords more time to consider different aspects of the supply chain, it can also include reducing risks stemming from constrained resources like water or energy.

BUILDING SUPPLIER RESILIENCE

Reducing single-supplier concentration risk has helped companies successfully manage the impact of supply chain disruptions following natural disaster events. When Thailand's Chao Praya river flooded in 2011, numerous industrial parks were inundated. Thailand's automobile production dropped by over 60% in the fourth quarter compared to the prior year. Japanese auto makers with operations in the country suffered.⁶⁷ But not all of them suffered equally. Lessons learned from Toyota and Nissan show why they had very different experiences. Nissan fared better, due to a combination of luck and good planning. One of the key differences was that Nissan used common parts, and sourced them on a global scale, while Toyota did not.⁶⁸ In the earthquake, only one of its plants was damaged.⁶⁹ In the Thai floods, none of Nissan's own plants was damaged, but it stopped production on October 17, as 120 of its suppliers were inundated. Toyota was severely hit by the Thai floods, as Thailand was its third largest production area outside Japan.⁷⁰ It took 42 days to resume operations. Toyota lost 240,000 cars in the Thai floods, more than it had in the Great East Japan Earthquake, and lost \$1.25 billion of operating profit.

Nissan had more inventory on hand at the time of the Thai floods. And, since its production was more geographically diverse, Nissan capitalized on its global supply network relationships to get substitute parts into Thailand. It resumed operations in just 29 days. It lost only 33,000 cars in the floods and only \$78 million of operating profit, and it enjoyed uninterrupted production in North America, Europe, and China.⁷¹

One of the reasons Nissan found itself in better shape was that in 1999, on the verge of bankruptcy, it had signed a collaborative agreement with Renault. Consolidating the two companies under the leadership of then-COO Carlos Ghosn, who shook up the traditional keiretsu buying structure, increased global market reach, and allowed the combined company to cherry-pick best-practices from both companies, which included using standardized parts worldwide.⁷²

After the 2011 Tohoku earthquake disaster and the Thai floods, Toyota undertook a rigorous analysis of its largely domestic supply chain, reducing single-source dependency and developing common parts sourced from multiple factories. It found about 300 suppliers were “at-risk” single sources for almost

1,000 parts. Toyota asked those suppliers to spread production to multiple locations or hold extra stock. Perhaps most significantly, Toyota developed common parts for about half of its components.⁷³

Supply chain visibility refers to the knowledge of where a company's products are at any given point in the supply chain. A 2017 Business Continuity Institute (BCI) report on supply chain resilience found almost 70% of respondents said they do not have full visibility into their supply chains. Further, the majority of organizations surveyed by BCI in 2017 reported that they do not use risk analytics or other technologies to track and monitor their supply chains.

Blockchain technology can help companies increase visibility in their supply chains and better position them to respond to disasters and other crises affecting their suppliers. Blockchain is a distributed system, meaning no single company has control, useful for resolving problems of disclosure and accountability between individuals and institutions whose interests aren't necessarily aligned. Blockchain creates a digital ledger that is 100% accurate, one which is increasingly being used to replace processing documents and information by hand.

IBM and Maersk are partnering, using blockchain, to simplify global shipping and lower the cost of paperwork across the supply chain ecosystem, a cost which now amounts to twice the actual voyage cost for a single shipping container. Blockchain's digital distributed permission platform allows key participants in the supply chain ecosystem, like shippers and port officials, to exchange event data and handle document workflow. The technology gives participants access to real-time information on the status and location of goods along their journey. Large businesses and startups alike are exploring using blockchains to better monitor goods by transferring critical data onto blockchain's shared ledgers. A U.K.-based startup, Provenance, is using its blockchain technology to track products' environmental and societal impact, while Walmart is exploring using a blockchain to track the movement of pork in China.⁷⁴

In addition to improving supplier visibility, improving coordination with suppliers and developing better communication channels helps to manage risk. As noted above, the nature and depth of relationships companies have with suppliers varies significantly. Consulting firm EY found that more mature companies spend more on training and capacity-building than less mature businesses.⁷⁵ A 2016 BCI report on supply chain resilience found that only 6% of large enterprises interviewed said that all of their suppliers have a BCP in place.⁷⁶ Further, almost one-third of organizations did not broach the topic of business continuity plans during contractual discussions with suppliers. With over one-third of organizations attributing at least a quarter of their disruptions to their external inbound supply chain, almost double the reported number in 2015, there is a clear need for greater coordination with and preparation of suppliers. Although BCI's same report for 2017 showed progress in greater coordination regarding developing BCPs with suppliers, fewer than 10% of organizations reported that all suppliers have BCPs in place and almost 50% of respondents did not even check the BCPs of their suppliers.⁷⁷

REDUCING VULNERABILITY TO RESOURCE CONSTRAINTS

Taking active steps to reduce a business's dependence on scarce natural resources, including water and energy, can help improve supply chain resilience in the event of resource depletion or disruption, even as it cuts costs. In the case of water, higher levels of transparency and disclosure paired with investments into advanced water treatment and recycling technologies help companies prepare for growing costs associated with water risk. Addressing water scarcity can mean the difference between success or failure for water-intensive businesses. More than 2,000 companies reported water data via CDP in 2017. In its *Global Water Report 2017*, CDP suggests a range of strategies, including measuring water use both directly and throughout the supply chain, investing in water supply infrastructure, diversifying water supplies, and setting targets for site-specific actions. In 2017, CDP reporting companies undertook over 1,000 projects across 91 countries, investing over \$23.4 billion on projects to tackle water risk.⁷⁸

Hong Kong-based Esquel Group long has been committed to implementing water and energy sustainability practices. This commitment stems from an acknowledgement that carbon and water are underpriced, and a recognition of the imperative to prepare for future increases in the price of electricity and water.⁷⁹ Esquel has reduced water and energy consumption by 64% and 45%, respectively, per unit of production since 2005, even as profits have hit record levels, the fruits of more than 15 years of efficiency efforts.⁸⁰

Taiwan Semiconductor Manufacturing Company Ltd. (TSMC) has implemented a robust water resource management strategy, including a company-wide taskforce dedicated to managing the risk of a water shortage that might arise due to climate change. TSMC measures its internal and supply-chain-related water use, and shares the company's water management lessons learned with other companies in its industry. TSMC has developed a highly water-efficient semiconductor wafer fab facility, capable of reclaiming 85% of process water.⁸¹

Companies are also enhancing energy efficiency to save costs and decrease greenhouse gas emissions. Siam Cement Group (SCG) is an example of an energy-intensive business that is improving energy efficiency within its production processes, using waste-heat generation techniques to convert waste heat from its cement-making process to electricity, and utilizing alternative energy sources like refuse-derived fuel, biomass, industrial waste, and solar, to generate electricity. Including biomass and industrial waste, in 2016 alternative energy supplied 10% of SCG's total energy consumption needs. Through 2016, SCG reduced GHG emissions by 1.81 million tons of CO₂ equivalent, or 7%, from 2007 levels. SCG's 2020 target is to reduce GHG emissions per production unit 10% from the base year of 2007.⁸²

DEVELOPING STRATEGIC FORESIGHT

Finally, developing strategic foresight in light of the inherent unpredictability of event risks can build senior management's capacity to analyze the expected impact of natural and man-made disasters and plan ahead for them.

A range of approaches has been used by companies to develop strategic foresight, including scenario planning, horizon scanning, and simulation and war-gaming. Scenario planning involves imagining the "possible futures" based on key uncertainties to determine what companies can do to prepare for possible future events. Horizon scanning uses input from a broad variety of sources, including think tanks, social media, business intelligence, professional experts, and news outlets, increasingly supplemented by big data analytics, to spot emerging trends in the global operating environment. The trends are used to create hypotheses about the possible impact of the change. By forming strategies to tackle risks, or capitalize on potential positive outcomes detected, organizations can better understand the impacts of trending issues as varied as technological change, epidemic outbreaks, or changing customer buying habits.

Simulation and war-gaming entails replicating a real-world situation in order to gauge an organization's ability and preparedness to respond to unexpected shocks to its business. For example, Intel Corporation utilized war-gaming to enhance its resilience against cyber-attacks, hiring experts to play attackers, highlighting its vulnerabilities in order to strengthen its defenses against a real attack. While these methodologies are not new, increased access to big data and advanced data analytics present new opportunities for businesses to integrate technology into their strategic planning processes.⁸³

One of the unpredictable and high-impact risks in Asia that would benefit from this type of strategic exercise is potential military conflict on the Korean Peninsula. Some organizations are already taking steps to better prepare for a possible attack. A number of South Korean banks reportedly are preparing for a possible electromagnetic pulse attack from the North by considering setting up data centers abroad. War or no war, this sort of redundancy is an insurance policy against a failure at home. In addition, a broader strategic exercise to understand the possible scenarios can help businesses better prepare for different possibilities in which events could play out.⁸⁴

LONG-TERM MEASURES

Strengthening supply chain resilience in the longer term involves setting and attaining corporate sustainability goals, building new and improving existing infrastructure, and can include joining international agreements to collectively improve resilience and sustainability. A long-term time frame allows companies to firmly embed such practices in their corporate culture, and improve industry-wide standards.

SETTING AND ATTAINING CORPORATE SUSTAINABILITY GOALS

Change starts at the top. Large companies' CEOs are exemplars for their industry. It is key for the long-term success and health of a company to set long-term emissions and climate-resilience goals, and for these to be part of the strategic dialogue. Three hundred and thirty-seven businesses, including HSBC, Lotte Chemical Corporation, Fubon Financial Holdings, Hitachi, Ltd., Hitachi Construction Machinery Co. Ltd., Suntory Holdings Ltd., and TSMC have committed to setting their greenhouse gas emission reduction targets in line with climate science.⁸⁵ To date, 119 companies, including Bloomberg and HSBC, have joined the RE100 global initiative, which pledges them to 100% renewable energy by a target date. In HSBC's case, this is 100% of its electricity from renewable sources by 2030, with an interim target of 90% by 2025.⁸⁶ This embrace of renewable and low-carbon energy sources is increasingly being broadened to require the same standards of suppliers as well.

HSBC plays a powerful role as a capital allocator, broadcasting its message via its willingness or unwillingness to lend, and through its corporate materials and its submission of responses to CDP's annual survey on both Supply Chain and Climate Change. HSBC, in its 2017 CDP submission, makes the business case clearly: "Sustainability risk can lead to commercial risk for customers, credit risk for HSBC, and significant reputational risk." HSBC ties compensation to meeting sustainability goals and focuses on supporting internal businesses which benefit from the transition to a low-carbon economy. HSBC recognizes the importance of the financial system in the energy transition by screening lending and banking clients for sustainability risk and severing relationships that do not meet its standards.⁸⁷ The bank has promised to provide \$100 billion in sustainable financing and investment by 2025.⁸⁸

BUILDING BETTER INFRASTRUCTURE

Weak infrastructure, as noted above, is a major supply chain vulnerability over which companies have limited control. However, companies can take efforts to ensure improvements are made and better prepare themselves for infrastructure-related disruptions. Globally, the Netherlands has been a pioneer in building resilience in a country that would be largely underwater were it not for sophisticated engineering. This effort has been government-led but has provided numerous opportunities for private businesses.⁸⁹

A notable example highlighting the importance of investing in better infrastructure occurred in August 2017 when Typhoon Hato struck Macau and Hong Kong, cities on opposite sides of the PRD that are both vulnerable to flooding. This example is of particular importance because of the stark difference in losses suffered by Macau, where nine people died. Hong Kong has 10 times Macau's population and more than 30 times its land size, yet no one died in Hong Kong and the territory's storm damage of about \$513 million was little more than one-third Macau's \$1.42 billion.⁹⁰ After the typhoon, former head of the Hong Kong Observatory Lam Chiu Ying commented that while Hong Kong has pursued initiatives to prevent property losses resulting from rising tides during typhoons, Macau had done little to implement such practices.

Hong Kong was not always a leader. In 1962, Typhoon Wanda killed 130 people, catalyzing a long-term resilience strategy designed to minimize flooding and landslides and ensure that buildings were built to higher standards.⁹¹ Massive drainage tunnels were built to divert storm water away from hill-sides and into the sea, storage tanks and storm sewers installed, and river widening and village flood protection systems added.

China's One Belt, One Road (OBOR) initiative—an investment that is expected to grow to an estimated \$1 trillion, a sum seven times larger than that spent on the Marshall Plan, the U.S. initiative that helped rebuild Europe after WWII—is focused on the development of roads, bridges, railways, ports, airports, telecom networks, and energy pipelines in more than 60 countries, all of which will help reduce infrastructure challenges across Asia and globally.⁹² OBOR's creation of alternate supply routes for oil and gas to reach Asia through its pipeline projects should significantly decrease the risk of disruptions at the energy chokepoints outlined above. As key transit hubs are improved and connections between them are modernized, facilitating the shipment of increased numbers of goods, the breadth and massive scope of the planned investment should greatly enhance ASEAN's physical infrastructure and give it stronger links to global value chains.⁹³

JOINING INTERNATIONAL AGREEMENTS TO TAKE COLLECTIVE ACTION ON BUSINESS RESILIENCE AND SUSTAINABILITY

Public and private sector coordination in the longer term is fundamental to building better resilience, as government policy often drives corporate behavior. The Sendai Framework, a non-binding agreement convened by the United Nations in the aftermath of the Great East Japan Earthquake, recognizes the private sector as a key stakeholder, responsible for building businesses that make risk-informed decisions and develop resilient supply chains.⁹⁴ Methods by which stakeholders can ensure better preparedness and resilience include increasing training and awareness of risks among employees, integrating disaster risk management into business models, particularly in small and medium enterprises, and sharing and disclosing relevant knowledge. To reinforce the need for greater public and private partnerships in this area, ARISE, a United Nations Office for Disaster Risk Reduction-private sector alliance for disaster-resilient societies, calls for stronger private sector participation, emphasizing that the public sector alone cannot solve increasingly complex global challenges.⁹⁵ Committing to such international agreements is a significant marker of company willingness to collectively act on business resilience and sustainability and sets a powerful example, especially for SMEs.

CONCLUSION

This briefing highlights the difficulty of doing business in an increasingly interconnected and complex world. Eliminating risk is impossible. Understanding risk and, as much as possible, quantifying it, is achievable. Small and medium-sized enterprises can start by balancing growth with risk management. For larger companies, many of whom are global leaders, successful adaptation in a changing world requires long-term thinking and perspective on enterprise-specific risks and opportunities in a wide variety of countries and physical operating environments. For the supply chain, increasing visibility and forging lines of communications with partner companies is key. Business continuity plans are a safety feature that is all too often ignored. Guidance, and pressure, from large companies can help smaller companies understand the need to develop such a plan.

Beyond the enterprise level, attaining buy-in from governments and developing the political will to invest in climate-adaptive infrastructure will tip the scales in favor of some nations and away from others. Countries and companies that embrace adoption of increasingly more affordable renewable energy, and that use scarce natural resources more efficiently, will be higher-margin, long-term survivors. Short-term planning horizons fail to capture the full extent of long-term risks. Energy companies are now grappling with the challenge of potentially stranded assets as a result of the transition to low-carbon energy sources.

Strengthening supply chain resilience in the longer term involves working in collaboration with government policies on climate change. It requires setting and attaining corporate sustainability goals, building and improving new and existing infrastructure, and joining international agreements to collectively improve resilience and sustainability.

Climate change is not only an environmental problem, but a business one as well. The Task Force on Climate-related Financial Disclosures, headed by Mark Carney and former New York City Mayor Michael Bloomberg, and the Sustainability Accounting Standards Board (SASB), are developing voluntary climate-related risk disclosures for gauging a company's preparedness for the longer-term effects of climate risk.

As businesses increasingly measure and disclose their greenhouse gas emissions, and their waste and water use, and benchmark themselves against best-in-class peers, they begin not only to understand more about their own operations and supply chains, but often find opportunities to improve efficiency and lower costs. Such disclosures also provide lenders, insurers, and other stakeholders information to assess and price climate-related risks and support capital allocation decisions. The expected transition to a lower-carbon world will require as much as \$1 trillion of new investments annually for the foreseeable future. It is a large figure, but one that should be put up against the value of assets at risk that could be as high as \$43 trillion.⁹⁶ This investment in resilience is in part an insurance policy against the worst effects of climate change. But it is also an investment in healthier, cleaner, safer, and more pleasant places to work and live.

There are no guarantees for enduring success in an era where new technologies are disrupting traditional business models. Still, better understanding reduces risk and prepares firms for a future beyond the term of existing leaders, making the companies themselves enduring and resilient. Consciously building resilience may be the best recipe for long-term corporate survival.

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