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NATURAL DISASTERS AND BUSINESS DISRUPTION: HOW CAN ELECTRONICS COMPANIES EVALUATE AND MITIGATE THEIR RISK?

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ABSTRACT
As we move further into the 21st century - businesses in the electronics industry will face increasingly turbulent times. This paper focuses on one particular kind of turbulence: so-called Acts of God, i.e. natural disasters like floods, droughts, waves, fires and other extreme weather events. While all businesses have always been subject to these disasters, they are occurring to an unprecedented degree in both quantity and intensity. Consequently, it is increasingly critical for all types and sizes of businesses to understand more fully 1) what "Act of God" means; 2) the way human and business activity exacerbates the number and intensity of natural disasters; 3) the financial costs related to natural disasters; 4) leading-edge methods by which businesses are protecting against these natural disasters; and 5) the ways businesses are capitalizing on natural disasters to enter new markets and generate new revenue. Furthermore, it is important for electronics companies to be aware o f the growing business-disruption threats from issues related to the Earth's carrying capacity issues that are not directly linked to natural disasters, but are greatly exacerbated by natural disasters.

Keywords: natural disasters, business disruption, emerging risks and solutions

ACTS OF GOD

"Act of God" is a legal term that refers to "events outside of human control, such as sudden floods or other natural disasters for which no-one can be held responsible." [1] It also includes tornadoes, fires, heat waves, asteroids falling from space and volcanoes spewing lava, sulfur dioxide and other materials from deep within the Earth's mantle.

Businesses have always suffered from these Acts of God. For instance, in 2000, lightning struck a Philips semi-conductor plant in New Mexico and caused a fire that impacted the supply of vital components for Ericcson and Nokia phones. [2] Historically, however, these Acts of God have been relatively predictable, e.g. the number and severity of hurricanes on the US east coast. And, based on these predictions, insurance companies have insured businesses, and businesses have developed risk-management strategies. While there have been rogue events like a "hundred year flood," the global success of businesses and markets is evidence of business innovation and adaptation.

ACTS OF GOD ASSISTED BY HUMAN HANDS

In the last century, the "natural disasters" landscape has changed dramatically. Namely, businesses within every industry have increasingly suffered from "Acts of God" natural disasters that are exacerbated by human activity and that are described as "extreme weather events." This increase is due to many inter-related factors. Several of the most important factors are described below. Understanding them is a critical step in electronic corporations' ability to minimize their risk from natural disasters.

Population

Human population has grown from 1.6 billion people in 1900 to 3 billion in 1960 and to more than seven billion in 2011. [3] This population growth means that many more homes, businesses, fabrication plants, office buildings, airports, shipping docks and other structures are built – all of which are increasingly vulnerable to both predictable natural disasters and especially to extreme weather events.

Geography

Today, far more people than ever before live, work and recreate along coastal areas subject to hurricanes; along river banks subject to flooding; in "Tornado Alley" subject to tornadoes; and on the boundary of urban and wilderness areas subject to fires, landslides and avalanches.

In addition, human beings increasingly live and conduct business in urban areas. Approximately 50% of the world's population now lives in cities. By 2030, it will be 60%. And, increasingly, these people and businesses are in mega-cities, i.e. areas with ten million or more inhabitants that are highly vulnerable to food, water and housing issues in the wake of a natural disaster. In 1995, there were fourteen mega-cities; by 2015, there will be twenty-one, including Tokyo, Mexico City, Sao Paolo, New York, Mumbai, Dhaka and Delhi. [4]

Inter-Dependence

The world's nations and economies are more inter-dependent than ever, and the electronics industry is arguably the world's most inter-dependent industry. The upside of this inter-dependence is greater access to natural resources, manufacturing facilities, global supply chains, sources of capital and markets. The downside is fragility: local events have global impact, e.g. the crash of the US housing market in 2008, and the 2011 earthquake, tsunami and nuclear meltdown in Japan that severely impacted the worldwide

electronics industry, along with the auto, food and other industries.

Reduced Natural Resources

The growing world's population demands more food, clothes, homes, computers, cell phones, MP3 players, cars and so on – all of which require energy, water, wood, fiber, copper, silicon, lithium, rare earth metals and other natural resources to manufacture and operate. In many cases, the supply of these natural resources is limited, if not falling, while the demand continues to rise dramatically.

Global Warming

The widespread risks to businesses from global warming are perhaps the least understood of these factors. In that regard, it is helpful to note that - in the last two hundred years and especially since the end of World War Two – human activity has increased the level of greenhouse gasses in the atmosphere faster than at any other time in the Earth's history. Captured within the atmosphere by gravity, these additional greenhouse gasses reflect and trap a portion of the sun's heat that would otherwise radiate out into space. Furthermore, humans have cut down much of the world's forested areas, thereby reducing Nature's ability to absorb greenhouse gasses and increasing climatic turbulence and extreme weather events.

While global warming can result in increased local snowfall because of particular weather patterns, the overall Earth warmed by 1.33° F during the 20th century and continues to warm today. [5[This warming has a variety of impacts that increase risks for all businesses. To cite a few examples:

- Heat Effects

In 2010, the combination of El Nino weather patterns in the Pacific and higher average temperatures worldwide made 2010 one of the hottest years on record in one of the hottest decades on record. In Pakistan, temperatures rose to 128.3° Fahrenheit in May 2010. Heat waves scorched Russia, resulting in massive fires that resulted in half of Russia's wheat harvest being destroyed which contributed to rising food prices that contributed to uprisings in Middle Eastern and North African countries in the Spring of 2011.

- Drought

At the time of this article being written in early August 2011, Dallas is experiencing its 33rd consecutive day with temperatures above 100 degrees; electricity usage is at record levels; and businesses and individuals are being asked to cut back on electricity usage during peak times. Furthermore, Texas is a major center for electronics research, development and manufacture, as well as sales. Today, 73% of Texas is in "exceptional drought" – the most severe category of drought. And, across the US, more than 1 million square miles is in "extreme" or "exceptional" drought – an area roughly 25% larger than the entire country of Mexico. [6]

The future is not promising for the US Southwest. As indicated by a recent US Bureau of Reclamation study, it is entering a natural 50 – 60 year drought cycle that is exacerbated by global warming. The added heat within the atmosphere is shrinking regional precipitation. It is also increasing insect populations, e.g. bark beetles that have destroyed millions of acres of trees that, in turn, have provided additional fuel for the recent fires that have destroyed millions of acres across Arizona, New Mexico and Texas, impacting large and small businesses in every industry.

- More Intense Storms

Warmer temperatures increase the rate of evaporation from both land and oceans, and warmer air holds more water vapor. As a result, natural weather events like thunderstorms and hurricanes increasingly become extreme weather events that devastate communities and businesses because there is more water vapor to fuel them.

For instance, ever since 1970 in the US, the number of rainstorms has increased 7%. However, two-inches-a-day rains have increased 14%; four-inches-a-day storms have increased 20%; and six-inches-a-day rains have increased 27%. [7] In turn, these more intense storms have contributed to numerous hundred-year floods like the 2011 Mississippi River flood that has damaged virtually every industry and business. Similarly, recent flooding in Australia damaged its mining industry; flooding in China severely damaged its agricultural industry, cost the Chinese government an estimated $41 billion and contributed to China's recent inflation spikes that affected the electronics and other industries; and flooding in Pakistan inundated 62,000 square miles – an area the size of Wisconsin - that cost the Pakistani government an estimated $43 billion. [8]

- Rising seas

Warmer atmospheric temperatures raise ocean temperatures, resulting in water expanding in volume. Combined with glacial melt from the Greenland and Antarctic ice caps, as well as glaciers around the world, sea levels are rising, coastal areas are eroding and even naval bases are threatened. These impacts directly affect the fishing, agriculture, tourism and real estate industries. Indirectly, they affect the electronics industry and every other industry by damaging roads, railroad tracks, ports and other infrastructure, all of which raise the transportation costs to businesses, as well as the risk of shipping delays. In addition, businesses are impacted financially because consumers have less discretionary spending to buy cars, computers, smart phones, clothes and other products.

QUANTIFYING DISASTERS

As one of the world's largest reinsurance companies, Munich Re has direct financial interests in tracking natural disasters. According to Peter Hoppe, head of Munich Re's Geo Risks Research Center: "Our figures indicate a trend towards an increase in extreme weather events that can only be fully explained by climate change. It's as if the weather machine had changed up a gear." Munich Re's database

indicates that, in 2010, there were 960 natural disasters globally vs. a ten-year average of 785. [9]

QUANTIFYING DAMAGE

In terms of human death, more people died in natural disasters in 2010 than have been killed in terrorism attacks in the past 40 years combined. [10]

In terms of financial loss, Swiss Re, another global reinsurance firm, indicates that natural disasters cost insurers approximately $110 billion in 2009. In 2010, the cost to insurers nearly doubled to $218 billion. [11]

Furthermore, it is widely expected that these financial losses will increase in the future. Recently, for instance, International Finance Corporation – a part of the World Bank – issued a report estimating that, in the next few decades, investors could lose trillions of dollars because of the warming climate and both its direct and downstream impacts on businesses. [12]

In 2005, Sir Nicholas Stern – the former Chief Economist and Senior VP of the World Bank – was commissioned by the UK government to estimate the potential economic damage from the impacts of climate change. "Using the results from formal economic models, the (Stern) Review estimates that if we don't act, the overall costs and risks of climate change will be equivalent to losing at least 5% of global GDP each year, now and forever. If a wider range of risks and impacts is taken into account, the estimates of damage could rise to 20% of GDP or more." [13]

In terms of direct business loss, the impacts can be devastating. Forty three percent of businesses that close during a natural disaster never reopen. An additional 29% that do re-open will close permanently within two weeks. While these businesses are small to medium sized businesses, they impact larger corporations as well, because they often supply to those corporations, transport their products or sell their products. [14]

To cite three recent examples of how natural disasters impacted business:

- Hurricane Katrina (2005)

Katrina breached levees in more than 50 locations. Eighty percent of New Orleans was flooded. Fifteen feet of water covered parts of the city. According to The National Hurricane Center, Hurricane Katrina "…caused about $81 billion dollars in property damage alone." And, according to The Journal of Economic Perspectives, the total financial cost was about $156 billion dollars. More specifically, the hurricane destroyed or damaged thirty oil platforms. Nine oil refineries were shut down. Fuel prices rose and impacted businesses worldwide. Less well reported, 1.3 million acres of timer were lost, costing the forest industry an estimated $5 billion. Sixty percent of small businesses were destroyed. More than 18,000 businesses across Louisiana never reopened. [15]

- Iceland Volcano (2010)

When Eyjafjallajökull erupted and spread ash across most of Europe's airspace, 107,000 flights were cancelled over eight days. These cancelled flights affected roughly ten million passengers and 48% of total air traffic. The International Air Transport Association estimated that the volcano cost the airline industry $1.7 billion. [16]

- Earthquake, tsunami and nuclear meltdown in Japan (2011)

In financial terms, this disaster is the world's largest. Preliminary damage estimates were set at $200 billion. The Nikkei stock index dropped 6%. And, due to reduced electrical generation capacity, rolling blackouts have persisted through the spring and summer, impacting both consumers and businesses.

Every industry in Japan was affected by the disaster. For example: traces of radiation have impacted the agricultural and fishing industries with reduced markets and national import bans. But while those impacts were primarily localized, the impacts to the electronics industry were not localized. In fact, because the electronics industry is global and because of Japan's prominent position within the industry, the disaster – following just three years after the worldwide recession - is arguably the largest single disaster of any kind to affect the industry.

Before the disaster, in 2010, Japan accounted for 13.9 percent ($216.6 billion) of all global electronic equipment factory revenue, including computers, consumer electronics devices and communications gear.

More specifically, in 2010, Japan accounted for 16.5 percent of global consumer electronics equipment factory revenue and 10.2 percent of worldwide data processing revenue. Japanese suppliers provided more than one fifth of global semiconductor production in 2010. Companies headquartered in Japan generated $63.3 billion in microchip revenue in 2010, representing 20.8 percent of the worldwide market.

Furthermore, in 2010, Japan exported $91.3 billion worth of electronic parts. Japan dominates the world market in the supply of LCD film, semi-conductor sealants and other areas. And, according to Sam Perry, senior investment manager of Pictet Japanese Equity Selection Fund, "There are a huge number of little bits of the high-tech food chain which are done nowhere but in Japan. Nobody else has the quality or the consistency and, in some cases, the technology, to do it." [17]

As a result of the disaster, virtually every Japanese OEM and supplier suffered production setbacks. For example: Sony Corporation has 54 plants worldwide. Fifteen of its twenty-five plants in Japan were affected by the disaster. Nine plants in northeastern Japan were damaged. A number of them either closed or had reduced output due to damage or parts shortages. In February, one month before the

disaster, Sony had projected a year-end profit. After the disaster in March, they projected a year-end loss of $3.2 billion.

Canon suspended all its domestic camera production temporarily. It was also hampered because staff couldn't get to their workplaces due to the scarcity of gasoline and train service.

Fujitsu lost 50% of its total wafer capacity due to direct damage and to water, gas and electricity shortages.

Mitsubishi Gas Chemical Company Inc. and Hitachi Kasei Polymer Co. Ltd., which supply 70% of the main raw material used to make printed circuit boards, stopped production for several weeks. [18]

Additionally, in the auto industry that is closely tied to the electronics industry, Toyota closed eighteen Japanese assembly plants and seven facilities that make parts and engines, resulting in an estimated loss of 140,000 automobiles from March 14–26. It postponed the introduction in Japan of a new Prius wagon. And it told its North America affiliates that it expected to halt production at one or more plants because of shortages of Japanese-made parts. Overall, the company revised its fiscal results and predicted a 31% decline in net profit. Subsequently, GM replaced Toyota as the world's #1 auto manufacturer. [19]

DOWNSTREAM IMPACTS

As indicated above, the direct financial impacts to businesses from natural disasters can be very high. Unfortunately, those financial impacts do not end when the flood recedes or the volcanic ash dissipates.

One category of longer-term downstream impacts are predictable and well-known, e.g. shortages of electricity, gasoline and water; employee loss or distraction due to family tragedies or the need to rebuild homes; and the loss of revenue as a community struggles to recover.

Other, less well-recognized impacts are related to the kind of extreme weather events that electronics companies are facing. Below are several examples.

Persistent Rolling Blackouts

Full or rolling electricity blackouts that last a day or several days are common. Persistent rolling blackouts are not, e.g. the one still occurring in Japan - five months after the disaster at the time of writing this article.

Higher Transportation Costs

When oil refineries, coastal docks or inland airports and roads are severely damaged by floods, tornadoes and other natural disasters, transportation costs to businesses rise.

Higher Commodity Prices

Natural disasters that reduce the supply of silicon, coal, copper, oil and other commodities will translate into higher business costs. The 2010 Pakistani flood decimated the cotton crop, which resulted in higher prices for US and other manufacturers of cotton clothing. Currently, the exceptional drought in the US is forcing cattle ranchers to sell their herds prematurely; while this will depress beef prices in the short-term, it will drive up the prices over the longer-term, as demand outpaces supply.

Disease

It is not uncommon for outbreaks of malaria, cholera and/or dengue fever to occur following very large floods. There have also been reports of heightened disease related to E. coli and to Cryptosporidium that are associated with over-two-inch-a-day rainstorms.

CAPACITY TO MINIMIZE DAMAGE AND TO RECOVER

The capacity to minimize – and to recover from - damage caused by natural disasters can be divided into two broad categories: activities 1) that are commonplace and 2) those that are emerging as the "normalcy" of extreme weather events becomes accepted.

Common Activities

Briefly, these activities include physical alterations to factories or stores in order to protect workers and customers from storm, flood and other dangers; human resource back-up plans, e.g. identifying which employees can cover for other employees when their families or homes have been harmed; developing a business continuity plan; locating alternate manufacturing sites, suppliers and distributors; providing for information back-up and access; and developing both PR and client communication teams. Other commonplace activities include the purchase of flood insurance, where appropriate, and access to FEMA, SBA and other disaster-recovery loans.

Emerging Activities

Shortly after the Japanese disaster this past March, the author of this paper interviewed the General Manager of a local US Toyota dealership about the impact on his business. Initially, he laughed and, in effect, said: "You know: we've always planned for risks and disruptions. But this is a whole new ball-game. We've got to plan for things we never conceived of."

As the world faces more extreme weather events, it becomes increasingly important to plan ahead – whether opening a new business, a new division of a business or simply maintaining the status quo. In that regard, below are a few of the many areas that electronic companies may want to consider, even though they may be outside their normal business activities and require additional thought, knowledge and even cost.

- Geography

Increasingly, it is important for businesses to think seriously about where they locate their headquarters, manufacturing facilities, distribution centers, retail stores and other

structures. To cite several examples: 1) Given the intensity of recent floods and the likelihood that they will continue, locating a fabrication plant along the Mississippi, the Thames or the Yangtze rivers would constitute an unnecessary business risk. 2) Constructing hotels or office buildings along the Miami coastline would similarly add unnecessary risks and insurance costs, given the likelihood of more Category 5 hurricanes and coastal flooding. 3) Any soft-drink, natural gas exploration or computer chip manufacturing business that requires a great deal of water would not want to operate in the US Southwest, based on the scientific predictions of drought and the economic predictions of heavy competition for water. 4) Bangladesh is widely considered to be one of the three most climate-vulnerable countries in the world, because of its low-lying lands and increasingly strong monsoons. Contracting with a firm in this country to assemble smart phones or sneakers could be construed as a questionable business practice by shareholders. 5) Developing sustainably-harvested forests in Canada makes more sense these days than in Georgia, where drought-driven fires and insect populations would be more likely to decimate those forests. 6) Although the cost of building factories and assembling printed circuit boards in Northern China is favorable, companies would be wise to consider the impact of droughts and depleting aquifers on the potential for social unrest in this part of the world.

- Facilities

Firms that are located in areas with increasing heat waves, e.g. Texas, Russia and southeast Asia, would be wise to implement alternatives to traditional electricity-based air-conditioning so that employees remain productive and production lines are less vulnerable to electrical blackouts.

- Supply Chains

As much as any industry, the electronics industry has developed a global supply chain. Given the added risks to many countries from extreme weather events, shortening supply chains would be prudent.

- Sourcing

As indicated earlier, a large number of businesses never re-open after they are hit with a natural disaster. As a result, companies that source raw materials, components or finished products from one source or just a few sources would be wise to broaden their sourcing suppliers.

- Inventory

While just-in-time manufacturing has revolutionized the electronics industry and other industries over the last few decades, companies are now starting to stock minimum inventory as a hedge against supply disruptions that result from earthquakes, volcanoes and tornadoes.

- Operational Costs

Increasingly, companies that operate fleets of cars or trucks are switching to natural gas, hybrid and electric vehicles to minimize cost. Similarly, businesses that depend upon high electricity usage are deploying solar panels and wind turbines as a way of controlling their costs and protecting themselves from electrical blackouts that are caused by heat waves, heavy storms and other natural disasters. To cite one example, Cargill is investing $37.8 million in a waste-to-energy system at its High River, Alberta beef processing plant. Combined with other energy innovations, the system will allow Cargill to generate 80% of the energy it needs for production. [20]

- Leadership Qualities

Managing a business in an era of increasing turbulence from natural disasters and other factors increases the need for executives and managers to develop an enhanced set of personal leadership skills. These skills include the abilities to step back and evaluate more deeply a particular situation before acting; to identify the source of strong emotional reactions to employees, customers or suppliers; and to build collaborative efforts based on mutual respect, on the ability to admit mistakes and on the ability to accept correction from others. [21]

- Bottom-Line Focus

Traditionally, businesses have focused almost exclusively on their economic bottom line. In the face of growing turbulence from natural disasters, inter-dependent financial markets, government regulators and other sources, a growing number of companies have broadened their focus to include both environmental factors and social factors. In so doing, they often reduce their costs while reducing their wastes; they generate incremental revenue by selling manufacturing by-products; and they increase brand loyalty by attending to community and other stakeholders along with their shareholders.

CAPITALIZING ON NATURAL DISORDERS

For entrepreneurs starting new companies and/or existing companies wanting to expand their products and services, an understanding that extreme weather events will occur more frequently and more intensely offers a wide range of business opportunities. For example:

- Design firms that incorporate biomimicry principles to reduce costs and the risk of business disruption, e.g. office buildings that feature natural air conditioning based on the structure of African termite mounds reduce the risk of slow-downs from storm-driven electrical blackouts

- Construction companies that specialize in rebuilding infrastructure and buildings that have been damaged by earthquakes and other natural disasters

- Electronic manufacturers who build sensors capable of automatically adjusting electrical loads that can peak for extended periods of time when a heat wave hits

- Integrated farms with multiple crops and revenue streams that provide built-in hedges not only against

market volatility, but also against the impacts of increased heat, storms and insect populations

- Restoration companies that specialize in helping individuals and businesses to recover from water, fire and other damage

- Washing machine, toilet and other equipment manufacturers who produce low-water or no-water equipment for cities, businesses and consumers who anticipate water issues related to the growing population and the impact of natural disasters on water supplies

CONCLUSIONS

The 21st century will be a period of increased turbulence electronics corporations and other businesses. One major source of this turbulence is natural disasters: floods, fires, droughts, hurricanes and so on that are growing in number, intensity and resultant damage. Increasingly, businesses are taking into account the many risks related to natural disasters. They are implementing measures to minimize the damage. And they are building new businesses or new divisions to capitalize on the many business opportunities that are related to natural disasters.

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