'Inspiring' Bill Clinton

'Timely and insightful' Kofi Annan

'Powerful and pragmatic' Arianna Huffington

'Ground-breaking' Michael Bloomberg

THE RESILIENCE DIVIDEND

JUDITH RODIN

Managing disruption, avoiding disaster, and growing stronger in an unpredictable world

PRAISE FOR *THE RESILIENCE DIVIDEND*

"Dr. Rodin's extraordinary leadership has helped introduce the world to the concept of resilience—the critical strategy for breaking the endless cycle of emergency response and relief for millions of people. From supporting our nation's recovery in the aftermath of Hurricane Sandy to helping megacities in Asia protect their most vulnerable citizens, Dr. Rodin has made resilience a global priority at home and abroad. Rigorously analytical and powerfully argued, Dr. Rodin's book challenges us to work smarter and more collaboratively to predict disasters before they strike and enable citizens to build stronger communities and thriving economies."

—Dr. Rajiv Shah, administrator of USAID

"With heartbreaking stories and practical examples, Judith Rodin makes a timely and much needed contribution for creating a better world in an increasingly volatile environment. Turning volatility into advantage is a skill that leaders at all levels of any organization can use in building resilience into business models."

—Paul Polman, CEO of Unilever

"This book makes a compelling case, drawing on stories from countries and communities across the world, that resilience is not just a defense mechanism but a positive gain or dividend, with added value in economic and social terms. The message is timely, given the increasingly disruptive force of climate change and the need to encourage communities to respond positively. It is also a highly readable account because it relies on actual human experience."

—Mary Robinson, president of the Mary Robinson Foundation-Climate Justice, and UN Special Envoy on Climate Change

"Judith Rodin is a world-class entrepreneurial philanthropist. In *The Resilience Dividend*, she brings her life's work to bear on the subject, drawing on her deep and personal experiences from around the world. She uses every tool available (including the world's most advanced technologies) to understand the urban terrain and to deploy real-world solutions. All with the goal of saving and improving human lives."

—Dr. Alex Karp, cofounder and CEO, Palantir

"In a world where disruption is a fact of life and uncertainty is guaranteed, Judith Rodin draws on years of experience to offer an inspiring look at how we can prepare for the unexpected—and by doing so make our communities stronger, more prosperous and more connected in the process."

—Bill Clinton, former President of the USA

"From climate change, to economic adjustment, to the breakdown in political governance, the scale and complexity of threats and challenges in today's interconnected world are immense. This timely and insightful book by Judith Rodin, president of The Rockefeller Foundation, reminds us that we urgently need to build greater resilience to enable individuals, businesses, and communities to prepare for both systemic disruptions and new opportunities in the world order."

—Kofi Annan, former Secretary-General of the UN and chairman of the Kofi Annan Foundation

"Judith Rodin's ground-breaking work at The Rockefeller Foundation is helping cities adapt to a changing climate—and a changing world. In her new book, *The Resilience Dividend*, she lays out a powerful case for why governments and companies should prepare for—and not just react to—disruptions to business as usual."

—Michael Bloomberg, founder of Bloomberg LP & Bloomberg Philanthropies, and 108th mayor of New York City

"Positive, pragmatic, and powerful, Judith Rodin's *The Resilience Dividend* is precisely the innovative thinking we need. By focusing on the ways individuals, businesses, and communities can build a foundation for resilience, Rodin gives us a blueprint for a future where we are stronger, more adaptable, and better equipped to

meet the world's greatest challenges."

—Arianna Huffington, president and editor-in-chief, The Huffington Post Media Group

"Embracing and driving change is key to adapting to our customers' needs and is a big part of what enables us to deliver great service. Every company must adapt and change in order to grow and succeed. *The Resilience Dividend* makes a powerful case for doing business differently in a dynamic and disruptive world."

—Tony Hsieh, *New York Times* best-selling author of *Delivering Happiness* and CEO of Zappos.com, Inc.

"Humanity has long celebrated those able to avoid, overcome or bounce back from adversity. And, in an increasingly interdependent and volatile world, resilience has never been more valuable—or seemed in shorter supply. Indeed, as we strive to make progress in our communities, organizations and families, we must seek to understand and build resilience. With her new book, *The Resilience Dividend*, Judith Rodin provides valuable insights into the growing importance and transformative potential of resilience. Highly recommended for all those seeking to create lasting positive change in the world."

—Muhtar Kent, chairman and CEO, The Coca-Cola Company

"*The Resilience Dividend* delivers powerful proof that building resilience helps individuals, communities, and cities better recover from disasters and disruptions. Judith Rodin details connections between human, environmental, and economic systems, and offers a strategy to proactively address the threats they face. This very important book will help tackle complex challenges today and well into the future."

—Mark R. Tercek, president and CEO, The Nature Conservancy, and author of *Nature's Fortune*

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For Paul and Alex

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INTRODUCTION
Why Resilience Matters

I was in Beijing speaking at a conference on global health when Superstorm Sandy struck New York City with incredible force on October 29, 2012. When I understood just how catastrophic the storm was, I frantically tried to reach my chief of staff, who lives in Brooklyn, but the phone lines were completely jammed. I was worried. Our headquarters are in Manhattan. Many of my colleagues and staff members live in the New York area. I had no idea whether they were OK or what the status of our work was. As I watched the flood waters surging through Wall Street on TV, I urgently kept texting my executive assistant, who lives in New Jersey. No response. As I learned later, communication channels throughout the region had either been taken down or were overwhelmed. Not even emergency personnel could get through. People and places I cared about were in danger, and there was nothing I could do.

In the end, we were lucky. None of our staff members suffered injury, although several had to abandon their flooded homes, and many could not return to them for months. I managed to get a flight back, but only days later. Our New York offices were closed for a week because the area of Manhattan where we are located was without power, but we were able to keep some operations going and to help one another by communicating via our personal e-mail addresses. We were disrupted, for sure, but we continued to function, and the foundation was back to almost normal within a week.

That was not the case for many throughout the region. Superstorm Sandy brought damage beyond what we had ever seen in this area and even greater than we had imagined, though I was well aware of the devastation that a storm of this magnitude could wreak on New York City. Indeed, The Rockefeller Foundation had helped to support the development of a report by the New York City Panel on Climate Change that explored the potential effects of intense hurricanes, extreme wind, coastal flooding, and storm surge on the city's infrastructure. We had also funded groups of architects, engineers, and planners to collaborate on innovative design solutions for the city's response to rising sea levels, which were exhibited at the Museum of Modern Art.

In other words, our region knew a great deal about the worst-case scenarios related to storms and sea rise, but until Superstorm Sandy hit, it had all been hypothetical. Now the nightmare had been realized, and we could see that New York should have been better prepared and could have responded more effectively than it did. It was a wake-up call we could not ignore.

Only weeks after the storm, Andrew Cuomo, governor of New York, convened the NYS2100 Commission, a group of skilled and knowledgeable people whose task was to study the effects of the storm and make recommendations for what we should do to

better prepare and rebound more quickly when the next shock hit. The commission had a broad and sweeping charge to make New York more resilient. Governor Cuomo asked me to act as cochair of the commission, and I jumped at the opportunity because I knew The Rockefeller Foundation had a lot to offer. For years, we had been working on issues of resilience, many of them related to climate change and weather disruptions, through our offices, partners, grantees, projects, and endeavors in countries throughout the developed and developing world. Participants in our 100 Resilient Cities initiative include places as diverse as Rome and Mandalay, Glasgow and Medellin, Melbourne and Rotterdam, Da Nang and Vejle.

I knew, therefore, that we had a lot to contribute, and I knew the work of the commission was vitally important, but when I visited some of the areas most devastated by Sandy, I realized how truly essential it was. I saw homes destroyed, neighborhoods disrupted, people's lives in disarray. In Breezy Point, where more than a hundred houses had burned to the ground, we talked with a firefighter who was digging through the rubble of what had been his home. He was trying to find his father's World War II medals.

In Bay Ridge, I walked to the end of a pier and looked across New York Harbor. From that vantage point, the vulnerabilities of the area were dramatically obvious. There were the low-lying neighborhoods of Staten Island exposed to sea rise, flooding, and storm surge, where people had died in the storm. I saw damaged dunes and other soft, natural infrastructure that had been washed away, leaving neighborhoods completely unprotected. Sited at the margin of the upper bay was Owl's Head Wastewater Treatment Plant, which had failed during the storm, allowing raw sewage to flow into the waters. In other words, I was looking at threats to the three interconnected elements that make up our world: human beings and their communities, the natural systems we share and depend upon, and the built environment that reflects our shelter, our commerce, and our aspirations.

Although I had always believed our resilience work at The Rockefeller Foundation was critical, it was in that moment I realized it was the most important work that we could do. Since then, my conviction has only grown stronger. In a time as turbulent as ours, we have no choice: we must all work to build greater resilience.

WHAT IS RESILIENCE? Resilience is the capacity of any entity—an individual, a community, an organization, or a natural system—to prepare for disruptions, to recover from shocks and stresses, and to adapt and grow from a disruptive experience. As you build resilience, therefore, you become more able to prevent or mitigate stresses and shocks you can identify and better able to respond to those you can't predict or avoid. You also develop greater capacity to bounce back from a crisis, learn from it, and achieve revitalization. Ideally, as you become more adept at managing disruption and skilled at resilience building, you are able to create and take advantage of new opportunities in good times and bad. That is the resilience dividend. It means more than effectively returning to normal functioning after a disruption, although that is critical. It is about achieving significant transformation that yields benefits even when disruptions are not occurring.

In the twenty-first century, building resilience is one of our most urgent social and economic issues because we live in a world that is defined by disruption. Not a month

goes by that we don't see some kind of disturbance to the normal flow of life somewhere: a cyberattack, a new strain of virus, a structural failure, a violent storm, a civil disturbance, an economic blow, a natural system threatened. Yes, the world has always known disruption, but there are three disruptive phenomena that are distinctly modern: urbanization, climate change, and globalization.

The world's population is more rapidly urbanizing than at any time in human history, forming into highly concentrated urban and metropolitan areas, some of truly astonishing proportion both in terms of population and geographic size. Cities are extraordinary and wonderful places, yet their growing populations and increased density make them newly vulnerable to disruption, crisis, and disaster in many ways. They are more susceptible to weather and climate-change threats, because, as they grow, buildings and structures are often developed in areas that are more vulnerable to hazards. They are more in danger of systems dysfunction because infrastructure is inadequate, nonexistent, or poorly maintained. They are more likely to experience rapidly spreading disease outbreaks because of the close contact of shifting populations and insufficient health-care facilities. Economic systems are burdened, governance structures are strained, and social cohesion comes under stress. What's more, the expansion and further development of urban areas typically affect ecosystems, the natural systems that are fundamental to human resilience, so the impact of urbanization is almost always a social-ecological one.

The second twenty-first-century problem is climate change, which, in the last decade, has emerged as an undeniable contributor to the severity and extent of the disruptions we must deal with. We face threats from weather- and environment-related issues as never before: shifts in the carbon-nitrogen-oxygen cycle, global warming, sea-level rise, dramatic fluctuations in rainfall, increase in storm intensity, longer periods of more intense heat, land loss and subsidence (the subsiding, or sinking, of land), and the disturbance of natural ecosystems. Extreme weather events are increasing in frequency and severity. Many communities face flooding that destroys infrastructure, threatens economic activity, and tears at social cohesion. Other areas undergo constant stress due to lack of water and become so afflicted with chronic drought that people become "climate refugees," leaving their homes to join the urbanizing waves.

The third factor of the twenty-first century is globalization. We are well aware of this phenomenon and have seen its effects in all aspects of our lives—from the sprawling supply chains of global business operations to the increasingly multicultural populations of our institutions to the extraordinary mobility we have across geographic borders, time zones, and social networks. Globalization has accelerated the pace of change, introduced new and unaccustomed risks, added complexity to our systems, and increased the amount of volatility we face—particularly economic volatility. Our globalized commerce is unpredictable and puts strains on individuals, families, enterprises, economies, and governments. In a globalized world, disruption is such a regular occurrence and fundamental feature that change management has become a recognized field of study and practice.

These three factors are intertwined and affect one another in a social-ecological-economic nexus. Because everything is interconnected—a massive system of systems—a single disruption often triggers another, which exacerbates the effects of the first,

so that the original shock becomes a cascade of crises. A weather disturbance, for example, can cause infrastructural damage that leads to a public health problem that, in turn, disturbs livelihoods and creates widespread economic turmoil, which can lead to a further degrading of basic services, additional health problems, and even political conflict or civil unrest. In this way, a discrete disruption can quickly devolve into a full-on disaster. People are injured and die, often in shocking numbers. Survivors suffer trauma and hardship. Livelihoods are threatened or destroyed. Institutions are crippled, businesses fail. Infrastructure is overwhelmed. Communities are weakened and sometimes wiped out. Precious assets—from life-giving forests to cherished works of art—are ruined. Financial resources are depleted.

The losses from disruption are so extensive they are impossible to accurately calculate. We can get a sense of their scope, however, from the World Bank's estimate that, between 1980 and 2012, nearly $4 trillion has gone into relief and recovery efforts worldwide for natural disasters alone. But that figure includes only quantifiable damage, and only from one kind of disruption, and says nothing about the greater toll on people, the environment, and economies exacted by the interruption of activity, loss of opportunity, and all the rest. Disruption comes in much smaller increments, too: local shocks, organizational disturbances, individual setbacks. The damage done by these may not be as costly, but can be devastating.

There is no question that building resilience must become a priority for us all. As we learned during Superstorm Sandy, and as people and organizations throughout the world have learned from disturbances of many kinds, we need a keener awareness of the threats we face, greater ability to withstand and survive the disruptions we can't avoid, and a deeper commitment and broader capacity to resume functioning so we don't suffer debilitating loss or even collapse. We can no longer accept our vulnerabilities or ignore the threats we live with. Nor can we devote such great amounts of resources to recovering from disasters that could have been prevented or responded to more effectively. Nor can we continue to delude ourselves that things will get back to normal one of these days. They won't.

The good news is that resilience building is a concept that can be learned and a practice that can developed; resilience is not an inborn individual trait or an inherent characteristic of a company or community. Any entity can build resilience. Too often, however, resilience thinking does not really take hold until a galvanizing event or a major shock—such as Superstorm Sandy—brings the need into high relief. But we should not need things to go terribly wrong for us to work to make them more right. We need to take action, and we need to do so in anticipation of disruption, in advance of shocks, in preparation for stresses—not after they have started to wear us down.

The goal of this book is to help frame and contribute to the process of building resilience by providing a template for thinking about resilience and by describing methods for putting that thinking into practice. I begin by defining the five characteristics of resilience (aware, diverse, integrated, self-regulating, adaptive) and then step back for a look at the roots of resilience thinking in ecology, engineering, and psychology and describe how systems theory and the concept of the adaptive cycle have come to be relevant in many disciplines today. I then explore the three phases of resilience building—readiness, responsiveness, and revitalization—and conclude with a discussion of the fundamental concept that gives this book its title: the resilience

dividend. Throughout, I tell stories and draw on examples of individuals, organizations, and communities around the world.

I stress that resilience building must move forward on three fronts: structural, social, and natural. In all three, we need to seek both “hard” and “soft” solutions. We need to develop technologies, systems, mechanisms, and products that will prevent or protect us from the threats we can identify or predict. Just as important, we need to strengthen and improve our approaches to governance and leadership, knowledge creation, communication, community development, and social cohesion. As we’ll see in almost every instance, resilience is increased where there is an optimal combination of hard and soft solutions. Superior infrastructure alone cannot ensure resilience, nor can resilience be maximized with only human effort.

If we build resilience as I know it can be built—because I have seen individuals, organizations, and communities around the world do it successfully—we can not only survive whatever crises come our way and emerge from them stronger; we have the chance of realizing the higher benefit: the resilience dividend. We will have the capacity to create and take advantage of *new* personal, social, and economic opportunities: endeavors we might never have imagined possible and achievements that seemed out of reach. When we do that, we can create and lead lives less shadowed by threat, develop communities and organizations that are more productive and innovative, and strengthen societies such that they are brimming with greater opportunity and prosperity.

1

THE RESILIENCE FRAMEWORK
Five Characteristics

Let me begin our exploration of resilience in what might seem like an unlikely place: Medellin, Colombia. What happened in Medellin—and is still happening there—is a vivid illustration of the dynamic and constantly changing nature of resilience building and how it almost always involves structural, social, and natural factors. It also demonstrates two simple truths: that resilience is not (and never reaches) an end state and that building resilience brings with it benefits that are sometimes beyond what you can imagine. Medellin, although still struggling with vulnerabilities, has so built its resilience that it is now beginning to realize the resilience dividend—of opportunities and possibilities it had never before considered possible.

Depending on your age, where you live, and your global experience, you probably think of the city of Medellin, Colombia, in one of two ways. You may have a lingering impression of the place as it was in the 1980s—the drug and murder capital of South America, home to the infamous Pablo Escobar and his Medellin cartel. Or you may think of it in a very different way, as it has emerged in the last decade or so—a dynamic and exciting place, an emerging travel destination, a city chosen from among two hundred contenders around the world as Innovative City of the Year 2013[1] and host, in 2014, to the seventh annual World Urban Forum, a global conference organized by UN-HABITAT. If, in 1985, you had said the city might be a good place to host a major international conference or that you were planning to vacation in Medellin, the response would have been disbelief.

In Medellin's worst days—the early 1990s—it was a city trapped in a downward spiral of violence, poverty, citizen flight, and drug crime. It was not unusual for there to be upward of 5,500 murders per year and more than 15 murders in the city per day. At its peak in 1991, there were 381 murders per 100,000 people.[2] In New York City that rate would translate to 32,000 homicides each year.[3]

When a bad thing happened—another murder, a gang fight over turf, a community dispute over sanitation or water, the failure of a business, the destruction of homes by a landslide on one of the steep slopes surrounding the downtown—the city took the punch and fell back on the ropes. Every disruption seemed to link to another disruption. People did not bounce back so much as hang on, cope as best they could, and absorb the blows that kept coming.

For people like Adriana Restrepo, who has lived for years in a hillside barrio called San Javier, Medellin was a scary place to be. When she was a teenager, there was often

nothing to do but stay inside her family's small house for days on end until the shooting subsided. Neither she nor the city had the capacity to overcome the constant shocks, relieve the grinding stress, or find a path to something new. Restrepo says she was "ashamed" to live there.

With all its troubles, Medellin has always had plenty of assets, however, starting with its beautiful environment. It lies in the verdant Aburra Valley, with the pleasant Medellin River flowing through the heart of the city, and enjoys a spring-like climate with an average annual temperature of seventy-two degrees Fahrenheit, or about twenty-two degrees Celsius. It is surrounded by beautiful hills rising toward the snow-strewn Andes mountain range. Not everyone is ashamed to live there, and even those who rue its faults still want the city to succeed.

But for decades these assets were overshadowed by Medellin's vulnerabilities. Economically, the city was plagued by the suffocating presence of two illegal "industries"—drug trafficking and human trade. Socially, there was a big divide between rich and poor and physical isolation of one neighborhood from another. Extremely poor neighborhoods perched on the steepest hillsides, where residents could gaze over the buildings of the downtown and across the valley to where the wealthy (many of them drug lords) lived in gated communities and minipalaces on the hills across the city. The educational system was lacking. The public transportation system was poor. Prisons were overcrowded, but incarceration did little to restrict the drug trade—illegal business could easily be conducted from behind bars. International companies steered clear of Medellin. Tourists did not come.

The city population was growing, however, not just because people came in seeking some kind of opportunity but because many were escaping the violence, illegal activity, and guerilla warfare in the countryside. Many people had few choices but to live in shacks and tiny structures erected in the least desirable areas of the city. As crime grew worse and the city swelled with newcomers, there was an exodus of educated and capable residents who saw no alternative but to escape what seemed like a dying place. They took up residence in other parts of the country, in other countries in South America, in the United States, or elsewhere abroad.

Finally, in the 1990s, the city hit bottom. Then at last it began to face its threats, overcome its vulnerabilities, and build resilience. It set off on a multifaceted effort that involved numerous initiatives and groups, including the national government, departments of city government, businesses, community groups, nongovernmental organizations (NGOs), and individuals, including the mayor, business and community leaders, as well as—and this is very important—ordinary citizens. There were mothers' groups, volunteer street monitors, neighborhood watch associations. The city found many ways to chip away at its issues and reduce the threats and incidences of violence, while taking action to become more resilient as well, although the way was hardly smooth or the going easy.

By 2014, Medellin was on a new path. It had built its resilience through concerted efforts to increase accessibility and mobility. An innovative and integrated transportation system connects many of the most isolated neighborhoods of the city to economic opportunities never before available. The most stark and dramatic evidence of Medellin's successful approach to building resilience thus far is the reduction in violence. The city reported that its homicide rate had fallen from a high of 381

homicides per 100,000 inhabitants in 1991 to an average of 38 per 100,000 residents in 2013.[4] That's a dramatic change from the time when people were being murdered nearly every hour of the day.

There is now a palpable sense of excitement in Medellin. People are energized. Most neighborhoods are no longer dominated by gangs. Adriana Restrepo and her daughter, Stefania, thirteen, walk to school, work, and community meetings. Many who left the city in its worst days are returning. The population has grown to 2.5 million, making Medellin second only in size to Colombia's capital, Bogota. Twentysomething Martin Zapata, for example, is working along with his girlfriend to build an online home décor business. He returned to Medellin after spending several years living in California with his parents. "California was nice," he said. "But here it is exciting. We have a lot of work to do."[5]

That is true. I will not assert that Medellin is a perfect place, that drugs and corruption are now unknown there, or that the city does not have significant vulnerabilities and threats to its well-being. I will say that the people and organizations of Medellin are intensely aware of the fragile nature of their success and of the great deal of work that must be done to further build the city's capacity to reduce its vulnerabilities, deal with shocks, and find ways to adapt and improve more quickly than in the past—and they are confident of their ability to further improve their city. Adriana Restrepo now says she is proud to live in San Javier.

In 2013, Medellin was selected for the 100 Resilient Cities, an initiative pioneered and funded by The Rockefeller Foundation (and joined by several partners, including the Clinton Global Initiative), the goal of which is to enable one hundred cities around the world to build resilience in order to better address the increasing shocks and stresses of the twenty-first century. In their application for consideration in the program, the city's leaders wrote that Medellin "is a good candidate because in spite of its numerous and continued efforts it is still rated as the most inequitable city in Colombia, and Colombia, in turn, is one of the most inequitable countries in Latin America."[6] That is a bold and difficult admission for a city to make about itself.

This awareness of and commitment to place, a sense that obstacles can be overcome, and the availability of sufficient assets—infrastructure, institutions, and leadership—to fix things that go wrong and improve things when possible—these are telling signs of greater resilience.

THERE ARE FIVE MAIN characteristics of resilience and they can be developed, to a greater or lesser degree, by any individual, community, or organization. To be resilient is to be aware, adaptive, diverse, integrated, and self-regulating. These characteristics are all present, to different degrees and in different manifestations, in all resilient entities.

AWARE

Being aware is an essential aspect of resilience building because you must know what your strengths and assets are, what liabilities and vulnerabilities you have, and what threats and risks you face, to be able to effectively prepare for disruptions, respond to them, and bounce back from them. What's more, you need to be aware, as much as

possible, of all aspects of a situation—the infrastructural elements, human dynamics, and natural systems—and how they interconnect.

Of course, the nature of disruption in the twenty-first century (and, indeed, for all human history) is such that it's impossible to predict, plan, or completely prepare for every possible stress and shock. Totally unexpected things happen. Circumstances change rapidly. Secondary effects proliferate. So being aware is not a static condition. There are fundamental unchanging factors to be aware of (such as a river running through your city) and there is also the need for "situational awareness"—an ability and willingness to constantly assess, take in new information, reassess and adjust our understanding of the most critical and relevant strengths and weaknesses and other factors as they change and develop.

TABLE 1.1. THE FIVE CHARACTERISTICS OF RESILIENCE

AWARE	The entity has knowledge of its strengths and assets, liabilities and vulnerabilities, and the threats and risks it faces. Being aware includes situational awareness: the ability and willingness to constantly assess, take in new information, and adjust understanding in real time.
DIVERSE	The entity has different sources of capacity so it can successfully operate even when elements of that capacity are challenged: there are redundant elements or assets. The entity possesses or can draw upon a range of capabilities, ideas, information sources, technical elements, people, or groups.
INTEGRATED	The entity has coordination of functions and actions across systems, including the ability to bring together disparate ideas and elements, work collaboratively across elements, develop cohesive solutions, and coordinate actions. Information is shared and communication is transparent.
SELF-REGULATING	The entity can regulate itself in ways that enable it to deal with anomalous situations and disruptions without extreme malfunction or catastrophic collapse. Cascading disruptions do not result when the entity suffers a severe dysfunction; it can fail safely.
ADAPTIVE	The entity has the capacity to adjust to changing circumstances by developing new plans, taking new actions, or modifying behaviors. The entity is flexible: it has the ability to apply existing resources to new purposes or for one element to take on multiple roles.

You can develop situational awareness through many methods of sensing and information gathering, especially robust feedback loops. These can be as simple as a regular meeting of multiple stakeholders in a community or company or as complex as a monitoring system for a global telecommunications network. For us as individuals, there are many techniques for developing and increasing what psychologists call mindfulness. Ellen Langer, professor of psychology at Harvard and a former collaborator of mine, describes mindfulness as "a flexible cognitive state that results from drawing novel distinctions about the situation and the environment."[7] To be mindful, according to Langer, is to be able to develop new mental categories, be open-minded, receptive to different and new perspectives and new information, and to focus on processes rather than on outcomes.[8] In other words, when you are mindful you are more able to understand situations as they actually are, not as you assume they should be or always have been ("This can't really be happening, can it? …") and thus to respond more quickly and appropriately.

IN THIS AGE OF COMPLEX SYSTEMS and sprawling cities—and in which human, natural, and infrastructural systems always affect one another—an effective method of developing situational awareness (and, for individuals, to help increase mindfulness) is often overlooked or undervalued: going out into the field and taking a look. Tom Peters and Robert H. Waterman, in their classic management book, *In Search of Excellence,* popularized the principle known as "management by walking around," which was purportedly first practiced at Hewlett-Packard—and the method applies to information gathering in a disruption as well. Walk from house to house. Make an inspection. Go into the field. Too often today, we rely only on information displayed on one or more screens.

Daniel Homsey, director of neighborhood resilience for the city of San Francisco, has plenty of screen-based information at his fingertips, but he also knows the value of walking around. He learned it emphatically one day in January 2004, when the city experienced a particularly heavy rainfall—of the "hundred year" variety.

On that day, rain pelted down on San Francisco's seventy-three hills, and within minutes San Francisco's gravity-fed, "combined" sewer system—it carries both rain water and sewage—was filled with millions of gallons of drainage. Although the system is designed to handle huge quantities of water, certain variables—such as isolated storm cells concentrated over a watershed, the accumulation of debris in the system during the dry season, or storms of increased intensity and unusually heavy rainfall—can exacerbate the strain on the system. As a result, pressure at the bottom of the system built until water was forced up and out of manholes in the Mission and Excelsior neighborhoods. Residents found their streets and homes flooded with up to four feet of blackwater—"rain and poop," as Homsey describes it.[9]

Later it was determined that although the flooding was severe, it was of short duration. Once the blockage in the pipes cleared, water flowed back into the system as quickly as it had appeared. This kind of flooding tends to be confined to small areas, and it can go undetected unless a city staffer or official happens to be at the scene in the moment of the event—thus the importance of walking around. When Homsey visited homes along Shotwell Street in the Mission District and Cayuga Street in the Excelsior, he was in disbelief—one resident showed him the brown high-water mark, halfway up her wall.

This was a cascading disruption—the intense rainfall led to an infrastructural dysfunction and also revealed some "interesting economic and social justice problems," as Homsey puts it. San Francisco is one of the most expensive cities to live in and is short on affordable housing. In one of the flooded neighborhoods, many residents were undocumented people who lived, uncounted, with relatives. They were apprehensive about seeking help from traditional response professionals because they feared deportation, so they undertook recovery efforts on their own. Many dragged household items—mattresses, rugs, couches—into the streets so they could dry. But these possessions were soaked with blackwater and posed a potential health threat.

At the direction of the mayor, Homsey rapidly organized a multiagency working group representing the city and nonprofits to deal with the immediate situation. Given the reluctance of some residents to engage with the government, it was decided that the San Francisco Department of Health would dispatch restaurant inspectors into the area to lead the outreach process. Why? They had competence in engaging these

communities in a culturally sensitive way and spoke the necessary languages.

Longer-term, the city took steps to ensure such a scenario would not be repeated. When storms were in the offing, they mobilized maintenance workers to clear sewers of debris. The San Francisco Public Utilities Commission also continued to build the capacity of the system, a multibillion dollar investment. They also pursued some innovative solutions. With the help of a grant, the Mission neighborhood—which took the brunt of the flooding—tore up its old sidewalks and replaced them with permeable pavement and landscaping. Now, when water enters the neighborhood it will not flood homes but sink into the ground and, eventually, back into the system.

The storm, and Homsey's onsite visits, increased the city's awareness of specific infrastructural and social vulnerabilities—linked to urbanization and climate change. Today, Homsey manages a program called the Neighborhood Empowerment Network. It works with communities to build awareness of potential threats and then offers the necessary technical support to create and implement resilience action plans, customized by the community, allowing for consideration of their unique threats, needs, and culture.

IT ISN'T ALWAYS EASY TO DEVELOP situational awareness, especially when a disruption is very severe, long-lasting, or widespread and when conditions change rapidly, reliable information is not readily available, and feedback loops are cut off or do not exist. This was the case in Kenya in 2007, when the country was thrown into a six-week period of political and social upheaval and violence after the results of the presidential election were announced. While events were unfolding, people had little awareness of what was going on and did not trust the sources they could tap into, and there was a blackout of established media that lasted several days. The dangers were great and the violence widespread—all told, some 1,200 people died and 600,000 were displaced—and it was difficult to make basic decisions that might turn out to be matters of life or death.[10] *Is it safe to go to the market? Where are the attacks taking place?*

The need for situational awareness was so acute that, just a few days after the election results were made public, four Kenyans—Ory Okolloh, Erik Hersman, David Kobia, and Juliana Rotich—formed a nonprofit technology company called Ushahidi ("testimony" in Swahili). They developed an online crisis mapping platform and had it up and running within a few days. Citizens texted or e-mailed information about incidents of attacks, murders, protests, property destruction, and confrontations. The system synthesized and displayed the information on a map in near real time so people could make better decisions about their actions.

Given its success, the Ushahidi team adapted the platform for use in a wide variety of crisis situations. Since 2008, it has been deployed in the earthquake disasters that struck Haiti, Chile, and Christchurch, New Zealand, and used to monitor unrest in the Democratic Republic of Congo. It was even relied upon in Washington, DC, to track road conditions during the major snowstorm in 2010 that buried the mid-Atlantic coast under two to three feet of snow and became known as the Snowpocalypse.[11] The system was further refined for use in election situations (and called Uchaguzi, "election" in Swahili).[12] When the next Kenyan presidential election took place, in 2013, Uchaguzi served as an awareness builder and an early warning system that

helped prevent incidents from escalating into full-blown crises.[13]

AWARENESS IS JUST AS IMPORTANT in times of relative normalcy as it is in times of disruption. Large office buildings and residence towers, for example, are complex systems with many elements, all of which affect the capacity of the building to function normally and operate without critical failure if something goes wrong. Typically, these buildings have separate sensing, management, and control mechanisms—power, central heating and cooling, lighting, fire systems, security, elevators—and generally the subsystems function independently of one another. It's difficult for building operators, management company executives, and tenants to get the information they need to manage their operations as efficiently as they would like to—or to act as quickly and effectively as possible during a disruption.

Rudin Management, a developer and manager of commercial and residential properties in New York City, worked with partners to develop a building management system that brings all this information together. It's called Di-BOSS, the Digital Building Operating System Solution, and it enables what John Gilbert, Rudin's chief operating officer, calls "real-time commissioning." By pulling together and analyzing the data streams produced by subsystems, Di-BOSS provides operators with a full understanding of a building's state so they can make precise adjustments to systems. It also uses machine learning technology to predict future conditions. That means minor failings can be caught and corrected before they become major problems.

The development of the system began at Columbia University's Center for Computational Learning Systems where Roger Anderson was conducting research into the smart electric grid in collaboration with Consolidated Edison of New York (ConEd). Anderson wanted to get a commercial perspective on the issue and got in touch with Rudin. Anderson started off by asking John Gilbert about the East Coast blackout of 2003 that eventually affected 50 million people in eight states.[14] Anderson explained that his research showed there had been about a forty-second gap between the time ConEd knew there was a problem and the moment the lights actually went out. Anderson asked Gilbert whether a forty-second warning would have made a difference to Rudin's actions. Gilbert answered yes: "It would have prevented hundreds of people from getting stuck in elevators in our 10 million square feet of office space."[15]

They decided to collaborate and developed a technology to feed information directly from ConEd to a building's elevator system. Today's elevators are highly sensitive to electricity fluctuations and are designed to shut down when power falls below a certain level. When that happens, of course, it may cause an "entrapment"—people stuck in the elevator. With the new system, when elevators receive a warning, they are programmed to stop at the nearest floor, let people out, and then shut down until the problem is resolved.

That system led to the development of Di-BOSS. The awareness it provides also fuels larger and longer-term improvements. "From a resiliency standpoint," Gilbert says, "it's not only about how you get the building back up, but once it's tuned, how you keep it tuned. And then, if it starts to get out of tune, how do you figure out that it's out of tune and take the steps necessary to fix it?" After installing Di-BOSS, Rudin Management saved $500,000 in a single building over the winter of 2012–2013.[16]