Climate resilience: Asset owners need to get involved now

Climate-related risks are on the rise, and our critical infrastructure is underprepared. Both public and private infrastructure owners should pursue three actions immediately to shore up our assets.

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Infrastructure represents an enormous collective investment by our society and a tremendous resource for our economy and communities. However, these essential assets are increasingly vulnerable to climate-related forces: rising sea levels, drought, earthquakes, and violent storms are having far-reaching humanitarian and economic impact. The Global Facility for Disaster Risk Reduction estimated in 2016 that extreme weather events due to climate change in the preceding two decades affected more than four billion people and caused more than $1.9 trillion in economic losses across sectors.[1]

In addition, we are starting to see economic impact beyond the direct costs. In the United States, for example, average home prices in areas prone to flooding, hurricanes, and wildfires have stalled in comparison with those in lower-risk areas—in fact, homes in exposed areas are worth less today, on average, than they were a decade ago.[2]

Despite this threat, governments and infrastructure owners around the globe continue to underinvest in infrastructure adaptations that would mitigate the predictable effects of climate change.[3] One reason for this shortfall is the unpredictability of disasters in both timing and extent. Another is that many cities, regions, and nations are struggling to keep up with basic infrastructure needs; building for resilience is costly, making it a frequent target for cuts in infrastructure budgets.

But as with most modifications, in the long run it is nearly always easier and cheaper to build resilience considerations into asset development from the start rather than as a response to a major event.

Owners of major infrastructure projects, notably those developed in coastal and heavily urbanized areas, can make real strides toward building resilience by taking the following three actions:

- Incorporate risk assessments and adaptation strategies into capital budgets at the start of a project
- Take a layered approach in applying adaptation strategies (single solutions seldom address all threats)
- Adopt a resilience scorecard and rating system

Making a concerted effort in each of these areas will help infrastructure asset owners develop more climate-resilient infrastructure to strengthen the communities they invest in.

Make resilience part of asset development and design

Building adaptation strategies into design typically costs much less than incorporating them after construction or in response to a major event. The Institute for Building Sciences estimates that every dollar invested in building resilient infrastructure saves $6 in future costs including economic disruptions, property damage, public health crises, and deaths caused by extreme weather disasters.[4]

Asset owners must start by answering fundamental questions about the particular risks of their unique geography, calculate costs of asset loss or damage as well as business disruption, decide how to protect critical components, and prioritize strategies with the greatest return on investment.

Pay attention to local risks and hazards. Local hazards are often a function of climate, topography, and the extent of the local built environment. A host of government agencies and nonprofits have attempted to predict sea-level rise and flooding, but owners should recognize that current policies and guidelines are typically based on broad assessments and should be taken as just that—guidelines.

Because many risks are localized, asset owners may need to modify the published code requirements to meet their specific needs. For example, the US National Flood Insurance Program uses the 100-year floodplain (that is, areas with a 1 percent chance of flooding in a given year) to define zones likely to experience a flood in each century—but the frequency of these floods has increased in recent years, particularly in low-elevation coastal locations such as New Orleans, Louisiana. Owners may be better served by more cautious standards that recommend a greater elevation for critical infrastructure assets, such as the 500-year floodplain, or they may consider adding freeboard—essentially a buffer that assumes higher flood levels—to their standards and planning.

To help determine these needs and predict hazards more accurately, owners should consider consulting with experts who are familiar with local conditions. Specialized firms, often associated with environmental or engineering firms, are meeting this need at a local level.

Calculate potential costs. Typically, owners only consider damages to the asset itself. However, the true costs and externalities of damage go much deeper, including both direct and indirect costs such as loss of use, business disruption, lower property values, and continued unreliability. Owners also need to consider potential damage to services that they depend on but do not control, such as the power grid and other utilities.

Identify and protect critical elements. Finally, asset owners must quantify and assess the risks to critical components of their infrastructure assets and make these a priority for mitigation strategies. For example, the owners of a wastewater-treatment facility at sea level may decide to protect the entire asset with a perimeter wall. Or they may find it more economical and practical to protect critical components by elevating the switch gear and controls, and accept risk in other parts of the facility.

As technology becomes more accessible, advanced analytics can help guide decisions on whether to maintain or replace an asset. A data-driven approach can yield more accurate insights on asset longevity and the trade-offs between maintaining an asset or investing in a new one.[5]

Use a layered approach

Infrastructure asset owners need to use a range of adaptation strategies to mitigate climate-related asset risks. In general, owners and government agencies can either accept these risks (and their resulting costs to society) as inevitable and opt not to act, or mitigate them through adaptation strategies.[6]

Clearly, adaptation is the preferred response. To begin with, asset owners should not exclusively consider local regulations and guidelines in siting a project; in addition to that baseline, they should develop their resilience strategies using forward-looking analyses based on recent impacts and trends.

Early consideration of resilience will also lead to greater flexibility in selecting adaptation strategies. Owners should consider a layered approach including a range of solutions, starting with no-regrets and robust designs that have minimal cost (which is almost always easier to implement if done early). For example, backup generators can be elevated, or storm-resistant windows can be added to existing structures to provide a first line of fundamental protection or basic power redundancy. Asset owners should also explore strategies that allow them to be isolated from the disruption caused by the loss of service of critical utilities. This includes backup power supply and alternative water sources, for example, as well as the road networks that support them.

In addition to physical adaptations, owners should think critically about how they include hazards in their insurance coverage. Insurance growth may

What governments can do

Governments at all levels can support owners in three major areas: establishing building codes and guidelines that promote climate-resilient infrastructure, supporting owners with funding and resources, and establishing resilient, focused land-use policies.

Building codes and policies. The long-term survival of infrastructure demands a more prescribed approach to characterizing threats and ensuring compliance. Governments, particularly at the local level, can promote greater infrastructure resilience across all assets through mandatory building codes and policies. This sort of effort is not without precedent. As early as the 1920s, the Uniform Building Codes in California mandated consideration of seismic forces to protect infrastructure from earthquake damage.

Funding and resources. Governments could provide incentives to help encourage compliance with building codes and guidelines for resilient structures, much as they have done with energy-friendly solutions. For example, they might offer funding and grant programs via special-purpose zones or tax credits for improvements.

Land-use policies. Thoughtful planning can restrict building in exposed areas. For example, building is becoming significantly more restricted in many coastal areas to prevent structures from being built in high-risk areas.

Governments can also adopt land-use policies to account for stormwater drainage and catchment systems that naturally canalize floodwaters and runoff. Often, poorly placed infrastructure blocks these flows or redirects them into inappropriate spaces. The city of Jeddah, Saudi Arabia, for example, failed to properly account for surface runoff in its urban planning. The city experienced an increasing number of climate change–related storms off the Red Sea, contributing to significant municipal flooding with substantial damage and fatal results. The problem was eventually resolved through a drainage program that cost more than $10 billion—costs that could have been avoided with better planning.[10]

be an important driving force for more resilient infrastructure, and the role of insurance in encouraging best resiliency practices is a topic that warrants exploration.

Adopt a resilience scorecard and rating system

As owners and investors become more cognizant of the need to consider climate change, and as the need for resilient infrastructure becomes more pronounced, they would benefit from a formal resilience-risk assessment and an acceptable resilience rating system. These measures will help owners and investors determine the true risk exposure that a particular asset faces and indicate whether an asset owner has incorporated the necessary adaptation strategies to mitigate the effects of climate change. The scorecard can provide an objective rating system by building on the efforts of organizations working toward greater transparency. For example, the Task Force for Climate-related Financial Disclosures (TFCD) aims to "develop voluntary, consistent climate-related financial risk disclosures for use by companies in providing information to investors, lenders, insurers, and other stakeholders."[7]

In the best-case scenario, the scorecard would include industry-accepted standards akin to the Envision sustainability scorecard adopted by the American Society of Civil Engineers (ASCE). It would also include a program like ASCE's Sustainable Infrastructure Certificate Program to ensure a shared understanding and sustained communication on resilience.[8]

Currently, there is no generally accepted assessment tool focused on evaluating the resilience of an infrastructure asset in the face of climate-based risks. Still, existing work in this area can serve as a foundation. For example, the United Nations International Strategy for Disaster Reduction has developed a well-known disaster resilience scorecard that helps cities assess their disaster readiness; it includes infrastructure considerations but is not specifically focused on asset-level infrastructure assessments.[9]

As the need for resilient infrastructure grows, industry, academia, and professional organizations should work as a community to develop a scorecard and certification program. Governments, meanwhile, can support infrastructure owners in several ways (see sidebar, "What governments can do").

Conclusion

The economic impact of climatic events on infrastructure around the globe has continued to grow each year, in part because of insufficient consideration of resilience when such assets were planned and built. Asset owners should approach the problem with a bias for action and invest in understanding the problem and the associated risks.

Though government policies and guidelines can help, infrastructure asset owners need to take positive action to make their infrastructure more resilient. ■

[1] *Introducing infrastructure resilience*, United Kingdom Department for International Development, July 2016, gov.uk.

[2] Christopher Flavelle and Allison McCartney, "Climate change may already be hitting the housing market," *Bloomberg*, June 18, 2018, bloomberg.com.

[3] Laura Lightbody, "Washington must modernize policy to make America flood-ready," Pew Charitable Trusts, June 8, 2018, pewtrusts.org.

[4] "National Institute of Building Sciences issues new report on the value of mitigation," National Institute of Building Sciences, January 11, 2018, nibs.org.

[5] For more on this topic, see John Levene, Sacha Litman, Ian Schillinger, and Chris Toomey, "How advanced analytics can benefit infrastructure capital planning," April 2018, on McKinsey.com.

[6] The other two classic responses to risk—avoid and transfer—generally do not apply; as demonstrated by this and other work on the subject of climate-related disaster, infrastructure owners cannot reduce the probability and thus *avoid* climate-related disasters. Similarly, they are generally unable to reduce the impact of such disasters by *transferring* the risk to a third party, as the owner will remain the ultimate steward of the asset.

[7] For more information, visit the website of the Task Force on Climate-related Financial Disclosures at fsb-tcfd.org/about.

[8] For more information about the Sustainable Infrastructure Certificate Program, visit ASCE's website at asce.org/sustainable-infrastructure-certificate-program/.

[9] For more information, see *Disaster resilience scorecard for cities*, United Nations Office for Disaster Risk Reduction, May 2017, unisdr.org.

[10] MD Al-Sulami, "'Long-term Jeddah flood projects will be ready by September 2013,'" July 19, 2012, *Arab News*, arabnews.com.