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100

RESILIENT

CITIES

Getting real about resilience

How cities can build
resilience thinking
into infrastructure
projects



Building a better
working world

Introduction

100RC

More than 60% of the metropolitan regions that will exist in 2050 have yet to even form.

As this happens, over three billion more people will be added to urban centers and massive investments will be made to construct the infrastructure to support them. These investments must support infrastructure designed to allow cities to keep pace with their burgeoning populations while bolstering a complex and rapidly changing ecosystem.

To accomplish this, 100RC works with cities to take a holistic and integrated look at their shocks and stresses. We also give them the space to engage and explore the social, technological, economic, environmental and political implications of their decisions.

Through our network of cities and partners, we've catalyzed a global movement of practitioners that embed this kind of resilience thinking into their planning and implementation.

Critical to building resilience is partnership with other actors in the field. We're excited to partner with EY to further integrate resilience thinking in both the private and public sectors. EY's networks and experience in the infrastructure space makes it an ideal partner for 100RC.

This paper is only one piece of a growing effort from both EY and 100RC to add precision and clarity to the practice of urban resilience. Our partnership also represents an excellent opportunity to build practitioner awareness, ensuring that resilience thinking informs the entire infrastructure project life cycle.

We look forward to fostering further collaborations that can help address the urban challenges and opportunities of the 21st century.



Elizabeth Yee
Vice President, City Solutions
100RC

EY

Cities around the world are going through a period of unprecedented growth and change. And it looks set to continue.

This means that the infrastructure that keeps cities running – from schools and hospitals through to housing and roads – will come under increasing stress. Extreme weather events and terrorism will only add to this pressure.

At EY, we know that to grow and thrive, cities need to build infrastructure that's resilient to these shocks and stresses. We also know that this kind of infrastructure has the potential to bring economic, social and physical benefits in the long term.

With global investment in infrastructure high, the conditions are right for cities to start prioritizing resilience. Yet often, the best-laid plans fail to become reality. Why?

To explore this issue, we decided to run a survey, with the help and expertise of our partners at 100RC. Through it, we wanted to ask three questions:

1. How can governments demonstrate their commitment to resilience thinking and convey both the financial and non-financial benefits of this approach?
2. What are the challenges and opportunities for the private sector around innovating and incorporating resilience thinking into project proposals, design, financing and implementation?
3. Are citizens aware of the short and long-term benefits of this type of decision-making, and can these discussions generate buy-in and support for this work?

This report sums up the findings of our survey. But it's just the start of the conversation.

We hope you'll join us for the rest.



Bill Banks
EY Global Infrastructure Leader

Getting real about resilience

Results and recommendations from a joint EY/100RC study on how cities build resilience thinking into their infrastructure projects.

If 90% of your city were below sea level, and surrounded by water on all sides¹, would you insure your house against floods? Or would you build flood controls to prevent it from getting flooded in the first place?

The city we've described is Rotterdam, a busy shipping port in the Netherlands. Its government has chosen to go down the second route, developing the Rotterdam Climate Proof strategy to become more resilient to the effects of climate change. Innovative measures include "water plazas" – playgrounds that turn into

water drainage systems during heavy rain – and a parking garage that incorporates an underground rainwater store.

But the strategy hasn't just brought great outcomes for citizens. By applying resilience thinking to every aspect of how it plans for and carries out infrastructure projects, Rotterdam has been able to future-proof its investments, too.

¹ Local Governments for Sustainability, 2017



What is resilience thinking?

Resilience is a city's ability to respond, grow and thrive in the face of shocks, such as floods and terrorist attacks, and stresses, such as unaffordable housing and pressure on public services.

Much of the burden for this is borne by infrastructure – that's everything from a city's water, energy and waste systems to its transportation, telecoms and buildings.

Cities that build resilience into their infrastructure projects do five things:

1

Incorporate systems thinking into their decision-making, taking into account shocks and stresses

2

Engage with diverse stakeholder communities in the planning process

3

Integrate projects within a broader city vision that includes vulnerable populations

4

Assess and build projects based on the long-term environmental, social and economic benefits they'll bring, as well as their ability to withstand short-term disruptions

5

Recognize that their infrastructure needs to adapt to new and unforeseen challenges in the future

The planners in Rotterdam may not have initially used the word "resilience" in their decades-long approach to living with water. But their work has demonstrated many of these key tenets of resilience thinking.

More recently, they've consolidated and built upon that thinking, publishing a [Resilience Strategy](#) for the city in 2016. Its approach to water management recognizes that the systems making up the city – including its environmental, economic and social systems – all interconnect. And they're all affected by the infrastructure we mentioned earlier.

Yet despite the shocks and stresses increasingly affecting cities, and ongoing significant investment in infrastructure, many other governments aren't embedding resilience thinking into their infrastructure strategy and process.

1 study, 2 organizations, 3 main findings

We decided to explore this issue through a joint EY/100RC study.

It revealed three main findings:

1

When asked how well they understand and apply resilience thinking, policy makers and private sector players rate themselves (and each other) very differently.

2

Applying resilience thinking throughout the life cycle of a project is a challenge for both city governments and the private sector.

3

Neither the private nor the public sector is confident that there are sufficient incentives to consistently incorporate resilience thinking into infrastructure projects.

This combination of factors can prevent stakeholders from realizing the benefits of these kinds of projects. And it appears to hinder the private sector from recognizing the importance of – or prioritizing investments in – resilience.

In this report, we've used data and insights from the study, as well as from our own work, to suggest some ways in which the various players can overcome these issues. But this is just the beginning of the conversation – and we don't pretend to have all the answers.

If you have any feedback on this report, or aspects you'd like us to look at in more depth, please do get in touch. You'll find our contact details at the end of the report.



3 reasons to prioritize resilience

1

Cities are subject to growing uncertainty.

- ▶ Over the last 10 years, disasters have brought estimated direct losses of US\$1.4t.²
- ▶ Over the next decades, 301 of the world's leading cities risk losing US\$4.6t of their projected GDP to 18 threats (manmade and natural).³
- ▶ The consequences of climate change remain highly variable and poorly understood.

2

Rapid urbanization and globalization is putting cities under stress.

- ▶ Over half of the world's population currently lives in cities. Ongoing urbanization could see that number rise to 70% by 2050.⁴
- ▶ By 2030, experts predict that there'll be 41 cities with more than 20 million residents. (There were two in 1950.)⁵

- ▶ A "just-in-time" globalized supply chain makes it more likely that disruptions far away will wreak havoc at home.

3

The private sector has the funds and the will to invest.

- ▶ Global investment in unlisted infrastructure assets hit a record US\$413b in 2016, up 14% on the year before.⁶
- ▶ Institutional investors and banks have US\$120t in assets that could partially support infrastructure projects.⁷

² The UN Office for Disaster Risk Reduction, 2014

³ Lloyd's City Risk Index, 2015

⁴ The Organisation for Economic Co-operation and Development (OECD), 2017

⁵ The Organisation for Economic Co-operation and Development (OECD), 2017

⁶ Preqin, January 2017

⁷ Bridging Global Infrastructure Gaps – McKinsey Global Institute, June 2016

A shared vision: the why, what, when and who of the joint **EY/100RC study**



Why we partnered with 100RC

100 Resilient Cities (100RC) helps cities around the world become more resilient to the physical, social and economic challenges of the 21st century. It does this by supporting them to develop and implement a Resilience Strategy that takes a holistic and integrated look at their resilience-building opportunities in the short-, medium-, and long-term.

At EY, we believe that our experience in infrastructure, as well as our commitment to building a better working world, makes us an ideal partner to help achieve this goal. So in 2016, we committed to becoming one of 100RC's platform partners for five years. (Find out more.)

What we wanted to achieve with this study

Our aim was to explore how government and the private sector currently build urban resilience thinking into their infrastructure programs. We also wanted to ask how those groups could engage with each other better to plan, procure, deliver, finance and measure the costs and benefits of these types of investments. This would allow us to identify what good looks like, and recommend how city governments and the private sector could get there.

Overview of our methodology

We conducted an online survey of our combined networks in the public and private sectors over a one-month period in April-May 2017. In June-July 2017, we also carried out interviews with a select group of Chief Resilience Officers and other people from our networks. In both the survey and the interviews, we asked our respondents about the role, issues and opportunities for resilience thinking throughout the infrastructure project life cycle.

Who took part



400*
people from EY/100RC's networks in 10 regions



48%
public sector respondents from city, state or national governments



38%
private sector respondents, including entrepreneurs and private enterprises



9% people from non-government organizations (NGOs)



5% people from academia

**Percentage split for N=292, where respondents disclosed their sector*

What our study said

Here, we've captured what we think are the three most interesting and relevant findings from the study. And we've shared what we believe is behind them.

In the next section, we've used responses from the study, along with the experience of the EY and 100RC teams, to come up with some recommendations for how to overcome the issues our study raised.

We'll delve into the findings in more detail in future reports.

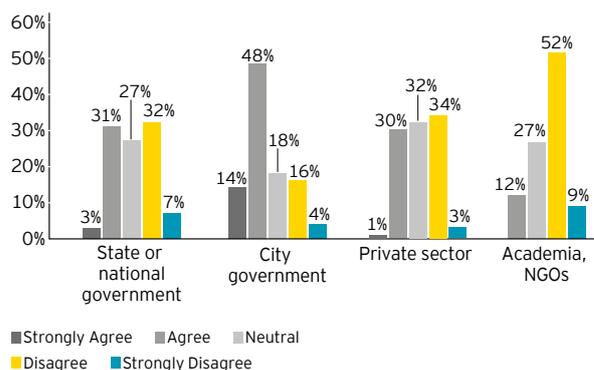
1. When asked how well they understand and apply resilience thinking, policy makers and private sector players rate themselves (and each other) very differently.

City governments are relatively confident of their ability to understand and capture resilience thinking in the infrastructure planning and financing process. But the private sector doesn't share that confidence – either in policy makers or in itself. These findings are largely consistent across geographies.

City governments think they understand the challenges of urban resilience relatively better than others think they do.

Figure 1

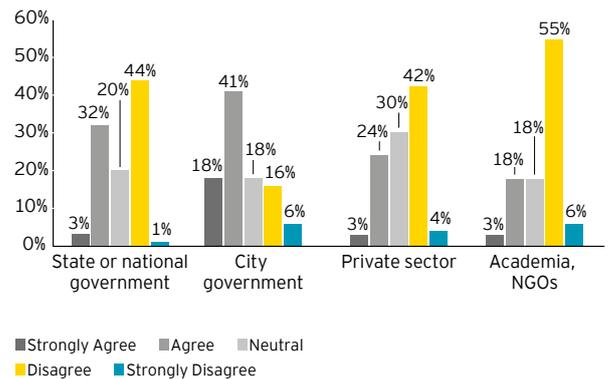
In your opinion, do Municipalities understand the urban resilience challenges they face?



This perception gap extends to how well city governments think they build resilience thinking into their decision-making – and what everyone else thinks.

Figure 2

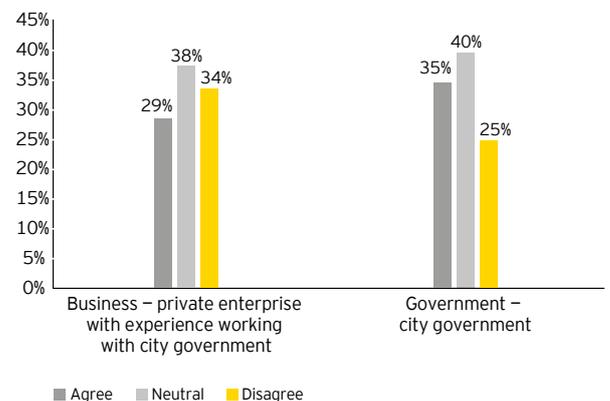
In your experience, do city governments typically incorporate resilience thinking into their decision-making around infrastructure projects?



City governments rate the private sector's ability to incorporate resilience thinking into infrastructure projects more highly than the private sector itself does.

Figure 3

Are urban resilience challenges facing cities well understood by the private sector?



The EY/100RC view

In many respects, these results aren't a surprise. We've seen plenty of policy makers include resilience thinking in their master plans for infrastructure. But that thinking often doesn't make it into tender documents, in the form of key performance indicators (KPIs). Or, when it comes to the final decision, city governments may still opt for the cheapest and quickest solution – which isn't always the most resilient one.

The study nonetheless generated some less predictable results. In figure 2, for example, the gap between city governments and everyone else is clear. Look also at the number of "agrees" and you'll see that the state and national governments rate city governments lower than city governments rate themselves (35% compared to 59%).

To close this gap, policy makers need to stop talking about resilience and start making it an integral part of how they "do" infrastructure. In other words, they need to "walk the talk" – and that includes aligning and coordinating better with state and national governments.

Meanwhile, the fact that city governments rate the private sector higher than it rates itself suggests there's also scope for more collaboration between the two groups.

"In general, it's difficult articulating the business case for spending more upfront to achieve greater infrastructure resilience. Resilience is either not valued by decision-makers, or the incremental value of resilience is difficult to quantify."

Study respondent

2. Applying resilience thinking throughout the life cycle of a project is a challenge for both city governments and the private sector.

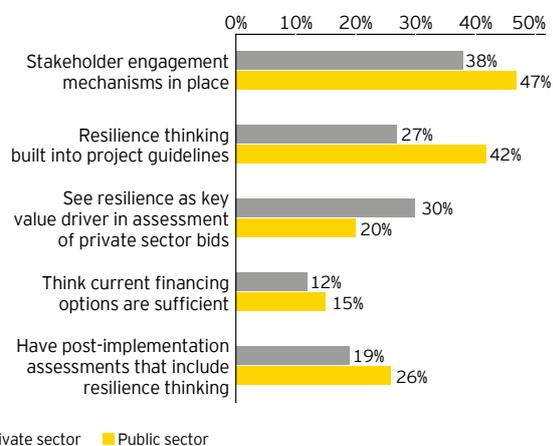
We wanted to explore why rhetoric doesn't always become reality. So we asked respondents to rate how well city governments and the private sector build in resilience thinking across the various stages of the life cycle: stakeholder management, planning, procurement, financing and measurement.

Clearly, these stages interlink, and what happens in one stage has a knock-on effect on the others. But using them to frame our study questions has revealed that city governments and the private sector are stronger and weaker at different stages of the cycle. It's also shown that for both parties, thinking about resilience is one thing; applying those principles to a 'live' project is another.

Overall, resilience thinking is strongest at the earliest stages of the project life cycle. After that, it drops off – with financing the weakest point.

Figure 4

Percentage of survey respondents who agree that:



What our study said

How the public sector views the project life cycle

Figure 4 shows that governments believe municipalities are best at incorporating resilience thinking when they're putting stakeholder mechanisms in place. But that confidence starts to weaken along the path from planning to implementation (figures 5 and 6).

The survey results for planning and financing show this particularly clearly. For planning, approximately 40% of government respondents think "resilience is captured in planning guidelines", while less than 20% think resilience benefits are captured in the project development process. This shows that incorporating resilience thinking at a project level is challenging.

Figure 5
Is resilience thinking typically built into the planning guidelines that you work with?

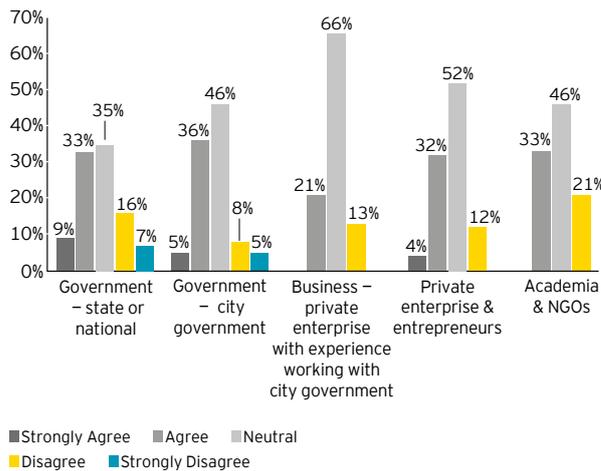
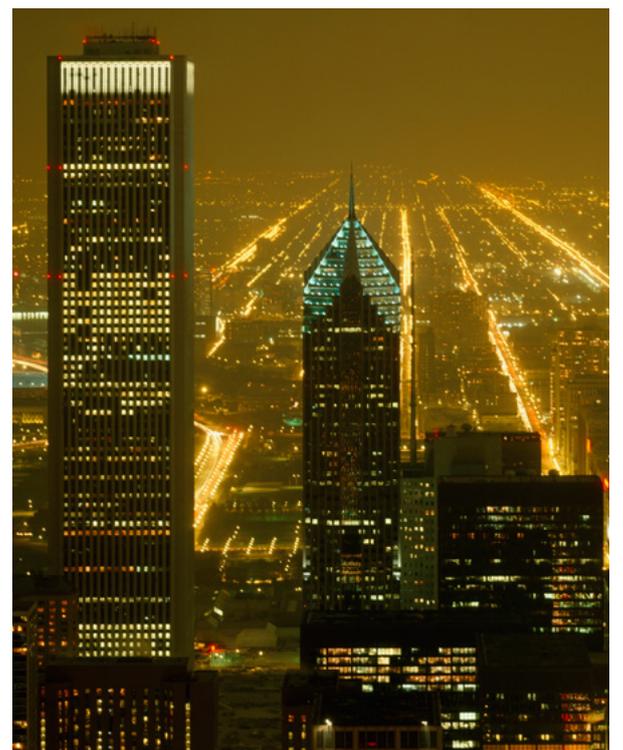
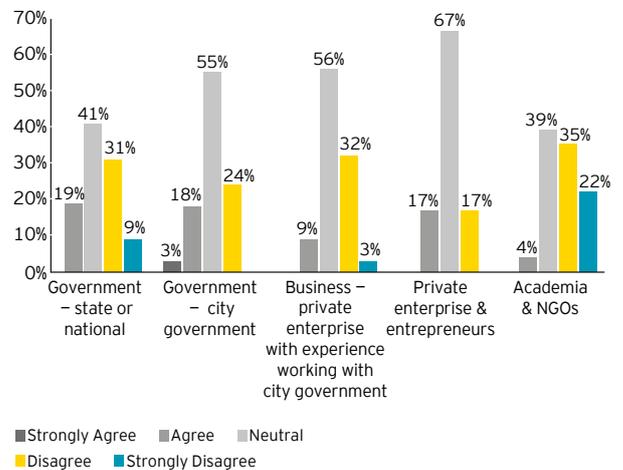


Figure 6
Are the resilience benefits of an infrastructure project evaluated/quantified project development?

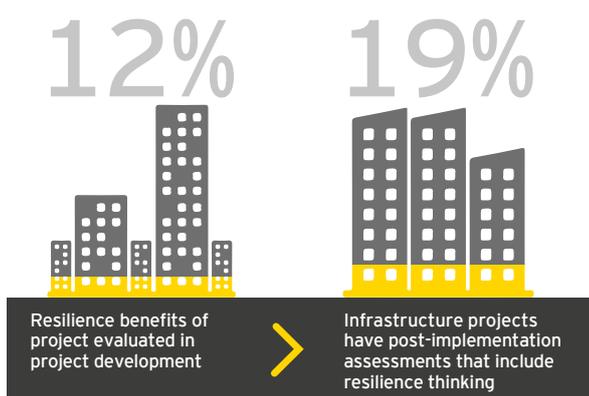


How the private sector views the project life cycle

For private sector respondents, execution is also the point at which confidence in municipalities starts to wane (figure 4) – including quantifying resilience costs and benefits for project planning and financing. For example, 40% of private sector respondents think “stakeholder engagement mechanisms are in place”, compared to 30% who see “resilience as key value driver in assessment private sector bids”.

This highlights the key difference between seeing resilience as important and actually incorporating its benefits into project development. As figure 7 shows, there’s plenty of scope to quantify and evaluate resilience impacts at the start of the project planning and execution process. This will allow projects to maintain resilience value throughout the life cycle.

Figure 7
The % of private sector respondents who agree that:



The EY/100RC view

Again, these findings aren’t a big surprise; when it comes to project delivery, resilience can often be the first thing to go.

We think there are three main reasons for this:

- 1

The long-term social and economic benefits of building resilience into individual projects often aren't quantified. This makes it difficult for policy makers to make an informed decision about which bid to select. And it makes it difficult for the private sector to find innovative financial justifications for incorporating resilience thinking into their projects.

- 2

Without specific KPIs around resilience built into the request for proposal (RFP), and set points in the cycle to check progress against those KPIs, resilience can become less of a priority.

- 3

Infrastructure projects of this kind tend to be large and complex, with different partners responsible for the project at different stages. This means there are lots of handover points at which the resilience goals can get lost.

So while it’s encouraging that a healthy percentage of respondents think policy makers do good work early on, there’s a lot to do to prioritize and protect resilience outcomes throughout a project's life cycle. More collaboration between the private and public sectors would be a great start.

What our study said

3. Neither the private nor the public sector is confident that there are sufficient incentives to consistently incorporate resilience thinking into infrastructure projects.

We see in figure 8 that the private sector has some appetite to fund or build resilience thinking into its projects. Less than 35% of respondents flag prohibitive whole-of-life project costs as a barrier to investment.

But more than 50% of public and private sector respondents say that insufficient regulatory incentives, and activating new revenue streams, are a challenge. At the same time, private sector players are concerned that they don't fully understand, or have visibility of, the risks and benefits of resilience-building projects. This affects whether or not those projects are "bankable".

The EY/100RC view

This data shows that high upfront costs aren't necessarily what deter private sector actors from getting involved with resilience-building infrastructure projects; it's how to substantiate a business case for investment.

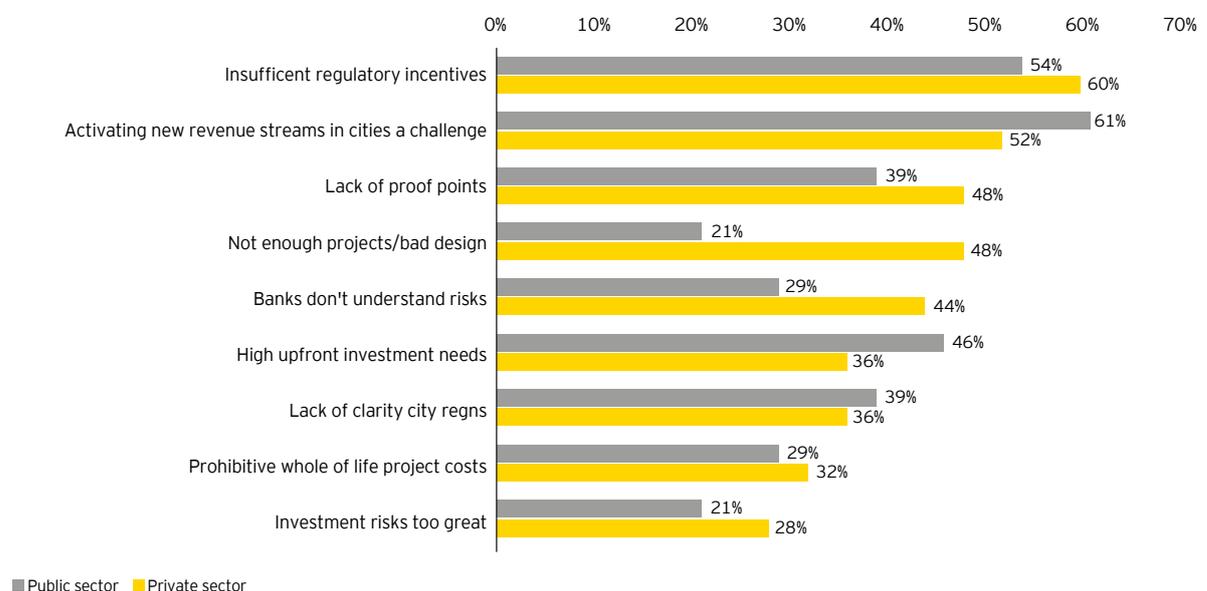
This includes how they can evaluate long-term resilience solutions positively compared to conventional, or cheaper, alternatives. That means embracing resilience-building projects as revenue generators with the potential to bring financial benefits. These benefits can be direct, by generating revenue for the city and specific private sector groups. Or they can be indirect, such as the economic activity that arises from infrastructure that provides environmental, quality of life and employment benefits. It's also how the private sector can price projects properly, and be rewarded for doing so, when regulation doesn't always support resilience.

Not understanding the benefits and risks properly is another common block. If the private sector doesn't understand or believe in the benefits of a particular project, it can't quantify and price for the risks that project involves. And from a funding perspective, investors can't decide whether to put money into a project if they don't understand both the return on investment (ROI) and the risks they're expected to shoulder.

These gaps mean there's a huge opportunity to develop incentives that will allow the private sector to innovate and collaborate with the public sector on infrastructure projects. We'll look at some of these in the next section.

Figure 8

What are the constraints for financing solutions?



How to get real about resilience

At EY and 100RC, we work with cities to help them build resilience into their infrastructure projects. So we're always interested to hear from other people working to embed this kind of thinking.

That's why we've included suggestions from our survey respondents, along with things we've learned from our work with clients.

The first section is recommendations for how to close the current perception gaps between city governments and the private sector.

The second hones in on the stages of the life cycle where those groups seem to get most stuck.

Closing the perception gap

► **City governments need to put words into action.**

It isn't enough to engage stakeholders and build resilience into planning guidelines. For the private sector to integrate resilience into its work, policy makers need to make sure resilience strategy translates into action.

That means that the multiple risks and benefits of infrastructure projects need to be clearly assessed. And project prioritization and design should reflect this analysis. As discussed earlier, this type of exploration of complex systems requires input from a variety of sectors. These discussions can be difficult, but they're critical.

This complexity also reinforces the need for clear ways to measure performance. So when city governments decide on the resilience outcomes they expect to achieve, they should also decide how that message will get through to all the relevant parties. Who will be the resilience 'protector' at each stage of the life cycle?

- **The private sector needs an incentive to incorporate resilience thinking into its work.** That means it needs to understand the benefits that the city is seeking to achieve and how that affects its ROI. By clearly articulating the systemic impacts of the projects it's pursuing, the private sector can improve the prospects of future projects. It can also convince city governments that money spent on resilience-building infrastructure projects today will bring savings in the long-term, along with other, non-financial benefits worth investing in. Driving these messages home can create a virtuous circle of innovation and investment that helps to add precision to, and raise awareness and acceptance of, resilience thinking.

If the private sector can achieve this mindset shift, it'll be able to take advantage of the growing market for innovations in platforms, products and processes that reap resilience rewards. And by being a "first mover," it'll also stand to gain as the market grows.





Breaking down blocks in the life cycle

1. Financing

City governments need to commit to making resilience part of the mainstream of infrastructure financing. To do that, they should:

- ▶ Support bankable projects and look for ways to monetize resilient assets through cost savings and avoided costs, such as insurance premiums
- ▶ Reinforce and look to expand the use of PPPs. These contracts allow city governments to share the risk with other stakeholders like the private sector. They also lock both parties into building resilience over the long term
- ▶ Make sure the project scope is broad enough to maximise the resilience co-benefits the city aims to achieve. These could create additional opportunities for the public and private sector to generate revenue
- ▶ Develop and provide standardized resilience metrics on how to assess project risks, so policy makers can quantify them and the private sector can price them
- ▶ Work with interested philanthropic and development bank actors to innovate around process, including efforts to simplify the transaction structuring process and “democratize” the underwriting process
- ▶ Explore alternative financing mechanisms, including green bonds, value capture and tax increment financing (TIF). For example, revenues from TIF districts can be used to support projects with multiple environmental, social and economic benefits

The private sector should:

- ▶ “Mainstream” resilience in the infrastructure investment process by rethinking traditional financial mechanisms
- ▶ Take a portfolio approach to resilience risks: consider them together and within the context of the benefits the project will bring
- ▶ Play a more proactive role in creating innovative financing mechanisms that can be mutually beneficial. For example, Washington DC recently completed a green infrastructure project that paid out to investors based on how much the storm water run-off reduced. Mechanisms that spread the risk of these types of investments are critical to the future uptake of resilience-building projects

2. Planning

City governments should:

- ▶ Help to make the business case more viable by introducing clear legislation and regulation that reflect the goals in the city's resilience strategy
- ▶ Make sure all of the different partners involved in planning and evaluating infrastructure projects know what resilience means for the city, why it matters and how to measure success. This will keep the resilience goals on track through the different stages of the project
- ▶ Incorporate resilience into the criteria for evaluating infrastructure projects by considering the “triple bottom line” – the social, environmental and economic impacts, as well as the cost. Ultimately, this will mean the private sector has to integrate resilience into its decisions and proposals
- ▶ Be innovative: use broad criteria to assess the impact of resilience within your current frameworks for evaluating projects. And look at the impact resilience thinking could have on the city-wide system (which itself is made up of many smaller systems). Otherwise it may be too difficult to analyze the costs versus the benefits – and resilience-building projects may not see the light of day

The private sector needs to change its mindset and incorporate resilience thinking into the investment process. To do that, it should:

- ▶ Demonstrate that it can deliver resilience-building projects, and finance them in a way that gives cities value for money
- ▶ Help its public sector clients to measure the success of previous projects and embed actual outcomes from previous projects into the planning and implementation process
- ▶ Take a proactive approach in bringing innovative solutions to government that have multiple benefits, are flexible enough to respond to shocks/stresses, and incorporate the needs of multiple stakeholders
- ▶ Share global best practices with government and others working within urban resilience

3. Measurement

City governments should:

- ▶ Review each project at pre-agreed points in its life cycle to check it's still in line with its resilience objectives. (See what we say about 100RC's Resilience Value Assurance Review on page 16)
- ▶ Establish clear and measureable metrics that quantify the resilience benefits, so that policy makers, the private sector and investors can measure and value them more accurately
- ▶ Publicize the benefits of resilience-building infrastructure project investment, including the positive “What ifs?” for specific investments, and recognizing successes

The private sector should:

- ▶ Up-skill its people in how best to quantify resilience risks. This could include developing metrics and incorporating them into standard risk reviews. It could also include asking a third party to audit those metrics, along with performance and risk
- ▶ Invest in developing standard resilience analytics for each stage of the infrastructure project cycle, and develop a framework for long-term monitoring
- ▶ Work with city governments to create community-based tools for measuring the impact of a project on a community – such as jobs, social outcomes and the environment

Defining and maintaining resilience value in Norfolk, Virginia

100RC is using a new process, Resilience Value Realization (RVR), which brings together all the stakeholders at the very beginning of a project to discuss what resilience “value” it will create. The result is a milestone map that lists the actions people need to take to make sure those goals are reached. A subsequent process, the Resilience Value Assurance Review (RVAR), revisits the project at a later stage to see if it is on track to meet those goals. This can take place at various points depending on the project, but it should be tied to influencing upcoming decisions (for example, selecting a concept or awarding a contract).

Norfolk, in the US state of Virginia, was the first city to benefit from the RVR/RVAR process. To help tackle rising sea levels and land subsidence, it had already joined the 100RC, hired a Chief Resilience Officer and developed a resilience strategy to reduce flood risks and revitalize neighborhoods and the economy.

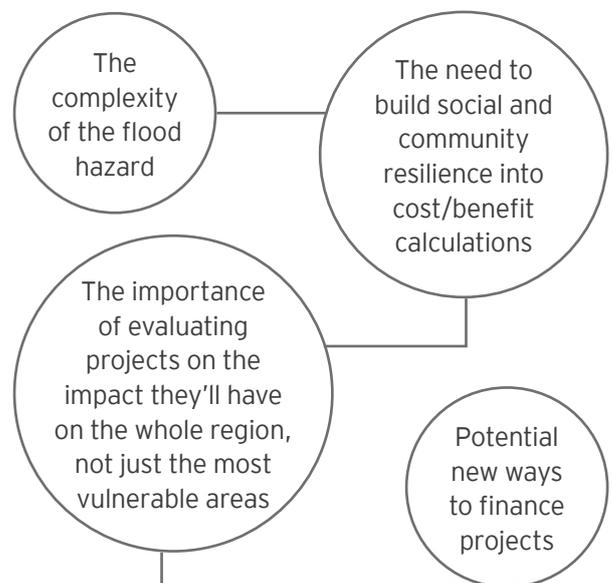
But the city isn't the only one thinking about resilience. The US Navy, which has four big installations in the area, is working on its own Joint Land Use Study. And the US Army Corps of Engineers is undertaking a feasibility study with a view to recommending a flood risk management plan.

In March 2016, 100RC brought these three groups together, along with experts, for a Resilience Value Realization workshop. At the end of that process, the group had created an opportunity statement, which included a shared vision “for reducing flood damage... while increasing Norfolk’s social, economic, and environmental resilience”.

A Resilience Value Assurance Review (RVAR) followed some months later. “The idea was to take [the Army Corps’] proposed flood risk management alternatives

and put them up against the resilience value opportunity statement, and ask if we are getting resilience value,” says Christine Morris, Norfolk’s Chief Resilience Officer.

By the end of the workshop, the groups had come to a mutual understanding of:



Described as ‘stimulating, successful and very productive’, the RVR and RVAR workshops galvanized the right people behind a set of shared goals. As Nancy Kete of Kete Consulting – who co-led the workshop with Marcela Ruibal of ValueLab – puts it, “Processes like Resilience Value Assurance Reviews are key to making sure project sponsors, investors and taxpayers know how to create and sustain resilience value creation.”

Find out more about RVR and RVAR at 100resilientcities.org.

Content extracted from a blog written by John Carey and posted by Marcela Ruibal for 100RC on LinkedIn.



Final word

Through this study, we wanted to pose three questions:

1

How can governments demonstrate their commitment to resilience thinking and convey both the financial and non-financial benefits of this approach?

2

What are the challenges and opportunities for the private sector around innovating and incorporating resilience thinking into project proposals, design, financing and implementation?

3

Are citizens aware of the short- and long-term benefits of this type of decision-making, and can these discussions generate buy-in and support for this work?

We hope the results have given you some answers to the first two. But we'd like to leave you to think about the third.

We see in our work how important it is for cities to bring citizens with them as they try to become more resilient. After all, citizens are usually the ones who'll reap the rewards – whether that's through less flooding, more reliable transport, better air quality or a host of other benefits.

Because of this, city governments and private sector players need to think about how they express the short- and long-term impact of applying resilience thinking. That means engaging in honest, open dialogue about the costs and benefits of this approach.

Ultimately, it comes back down to explaining and understanding resilience, why it matters and what people stand to gain from it over time.

How will you achieve that in your city?

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Read more about resilience

EY uses a life cycle-based approach to help private and public sector clients develop and fund successful resilience-building infrastructure projects. To find out more, go to ey.com/infrastructure.

100RC helps the cities in its network to establish a Chief Resilience Officer post and develop and implement a resilience strategy (with help from partners in the private, public and NGO sectors). To find out more, go to 100resilientcities.org.

To receive other reports in this series – and tell us what you'd like those reports to cover – send an email to government.publicsector@ey.com.

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