

RESILIENCE INSIGHT



12 CITIES ASSESSMENT SUMMARY



FEBRUARY 2016

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1 INTRODUCTION

Cities have become the preferred living environment for the world's population. Since the beginning of civilisation the freedom, opportunity, society, stability and security provided by cities have drawn ever greater numbers of people. In 2007 this growth reached the point where over half the world's population was living in cities rather than rural communities and this is anticipated to grow by an extra 2 billion people by 2050.

The impacts of climate change, much of which can be attributed to unsustainable city living, pose a disproportionate threat to our cities because of their location, (generally near the coast (sea level rise) or on river crossings and deltas), high resource demands particularly in terms of fresh water and the concentration of people and assets. Other strategic challenges such as aging demographics; the growth of the middle class; a growth in obesity and diabetes; anti-microbial resistance and others; are all adding stress to our city systems and could cause some cities to fail with significant harm to their populations and world stability. These factors will also increase the impact and severity of factors that can significantly shock our city systems; shocks such as flooding, drought, desertification, disease migration, mass migration, armed conflict and terrorism.

If population growth is to be sustained and our cities are to continue to be the vibrant and progressive communities within which people want to live, we need to greatly improve their sustainability whilst at the same time developing strategies to meet the challenges they face. Action will only take place if the problems can be identified, measured, understood and the cost/benefit case for taking action made.

2 BUROHAPPOLD’S RESILIENCE APPROACH

BuroHappold were joint winners of last year’s Royal Charter International Research Award presented by the BRE Trust and Worshipful Company of Constructors. Our team of experts have spent the past year researching and developing our resilience framework (Resilience Insight) and applying this approach to twelve cities around the world. Through our research we wanted to meet the urgent need to make city resilience measurable; with a useful level of detail to reflect each city’s specific circumstance, whilst still providing a consistent set of metrics against which cost/benefit cases for resilience building can be made.

From interviews and experience we found there is a tendency for cities to approach resilience in a siloed way and without prioritising initiatives systematically. Often the major focus is the last disaster, for example flooding, when in fact, the city may be less prepared for a more urgent risk such as an epidemic. All parts of a city are dependent on one another and any shock to a city, even if it only directly impact one aspect, will have ripple effects throughout. It is for this reason that resilience needs to be viewed holistically, breaking down silos and understanding

interdependencies. Traditionally there has not been one entity that has an overview of all these areas and that is cited as the reason for this lack of joined up thinking. However, in the UK with more powers moving to city mayors (e.g. London, Bristol), this is changing. The Rockefeller 100 Resilient Cities Program has introduced the concept of Chief Resilience Officers (CROs) – a person responsible for delivering resilience strategies for the city - there is now an opportunity to think differently and truly understand and prioritise the many issues facing our cities and develop holistic solutions that benefit more than one issue or group.

With this in mind, we approached our research project by developing a means of assessing city resilience that was holistic, risk based, multi-hazard and built on the best understanding of resilience capacity measures.

Our framework shown in Figure 2.1 separates into three themes with four components each, it encapsulates aspects and interconnectivities of a city including social, economic, political as well as the built environment. The Framework introduces the engineering concepts of demand and capacity into the resilience

arena. This was key to providing a robust understanding of resilience as a balanced and measurable system. The themes and components break down as follows:

This framework considers long-term stresses, as well as shocks, and assesses the capabilities of the city to manage them. We start by collecting base data to understand the current state of the city from a range of perspectives; social, economic, environmental, the infrastructure and systems, and how the city is organised, governed and funded. We also examine the city’s vision, goals and plans for the future.

The aim of the framework is to act as a tool to (1) assist municipal authorities and other key private/public sector stakeholders in assessing current and future resilience demands and capacities, (2) gain a holistic understanding of each city sector’s resilience and their interrelationships and (3) for prioritizing and measuring the performance of policies and physical interventions that will improve the city’s resilience. By making resilience quantifiable, the framework makes it measurable, comparable and crucially manageable.



Figure 2.1: Resilience Framework Structure

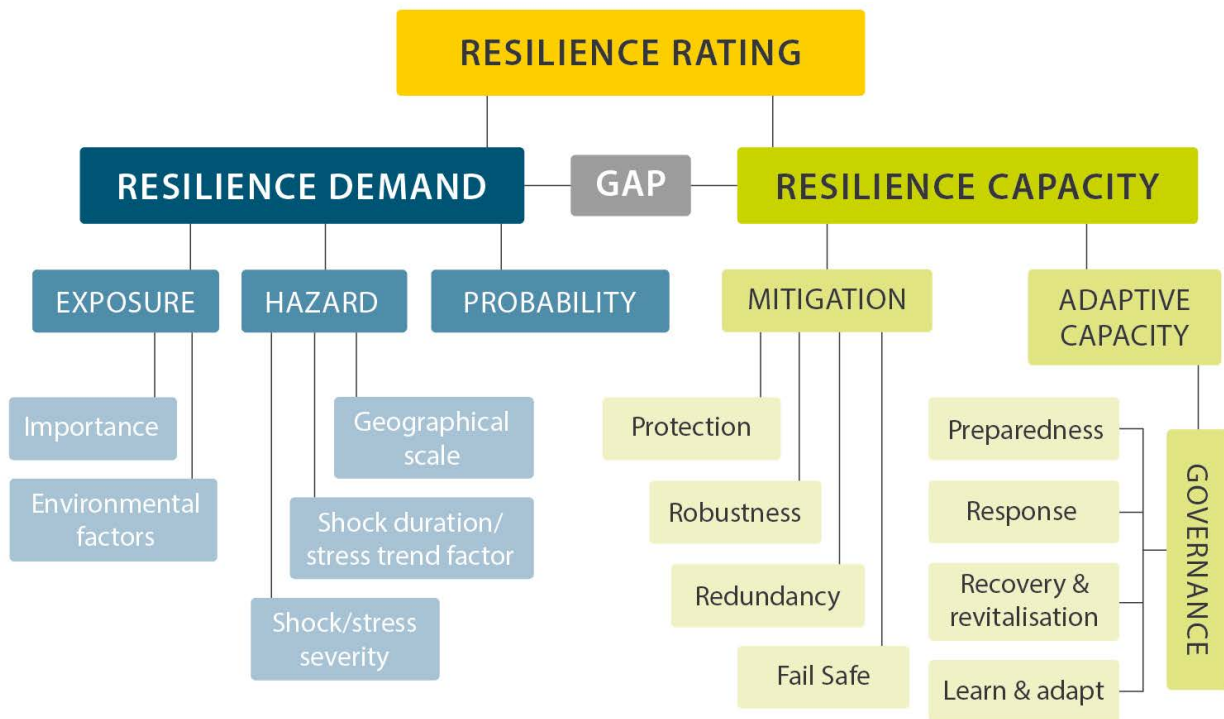


Figure 2.2: BuroHappold Resilience Approach

As shown in Figure 2.2, the diagnostic process calculates resilience demand and resilience capacity. Resilience demand is a combination of; (i) multi-hazard events and (ii) the city's exposure to these by city component (iii) the probability of their occurrence or in the case of stresses, the rate of growth of that trend and (iv) the impact of hazards.

Resilience capacity is the capacity to deal with shocks and stresses and is broken down into two aspects; mitigation and adaptive capacity. Mitigation measures are proactive measures to reduce exposure and vulnerabilities before an event occurs.

Effectiveness of existing mitigation measures is evaluated for the identified shocks and stresses on 5 point scales which are categorised into the following mitigation strategies; protection (e.g. the Thames Barrier in London), robustness (e.g. enhancing a structure for blast loading), redundancy (providing a back-up system) and fail-safes (understanding the failure mode and preventing cascading failures such as that seen at Fukushima).

Adaptive Capacity is the capacity of people, organisations, cities, regions, nations and trans-national organisations to anticipate, respond, learn and adapt to the changing environment be that through a short term shock or a long term stress. Measurable strategies for adaptive capacity include an effective response system that provides good preparation, response capability, recovery and the ability to learn, adapt and improve.

Resilience rating is the headline measure for resilience. It is calculated by dividing resilience capacity by resilience demand. It is effectively the percentage of the demand that is met either through mitigation measures or adaptive capacity measures.

3 TWELVE CITIES COMPARISON ASSESSMENT

As part of the validation process BuroHappold has considered twelve global cities as case studies (Bristol, Detroit, Dhaka, Glasgow, Hong Kong, London, Manchester, Miami, Mumbai, New York, Riyadh and Sao Paulo). The framework was then used to assess three of these cities (Bristol, London and Sao Paulo) in further depth at a sectoral level which were validated in stakeholder workshops with each city. Results of the twelve city comparison are shown in Figure 3.1.

The results are largely as one would expect with well-resourced cities with mature systems achieving higher rating and poorer cities with burgeoning populations and less mature systems achieving a lower rating. The key insight that this analysis presents is that Dhaka, Mumbai and Sao Paulo are all very vulnerable to a range of shock factors and will suffer disproportionately when those shocks impact. These cities also have greater problems developing and implementing strategies for dealing with long term stresses mainly due to a range of agendas competing for finite resources, but also, in some cases, because of problems with governance structures.

In the case of London, shown in Figure 3.2, the need for capacity building on a community level is highlighted as a major issue, largely due to inequality and high cost of housing.

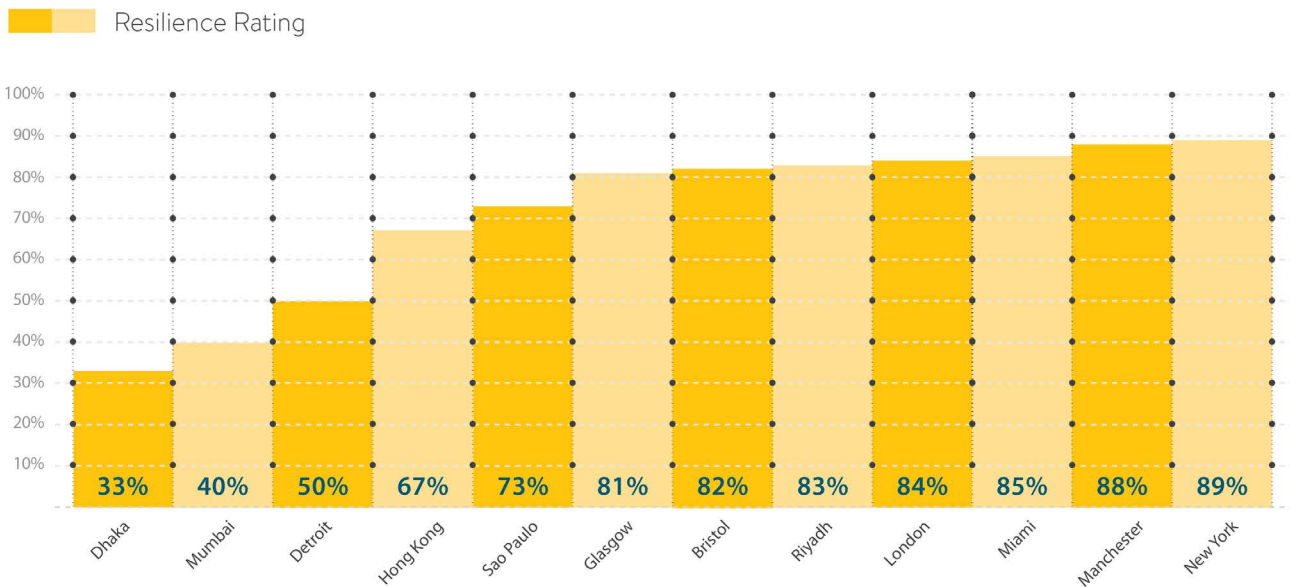


Figure 3.1: Comparison of the resilience rating for the twelve assessed cities

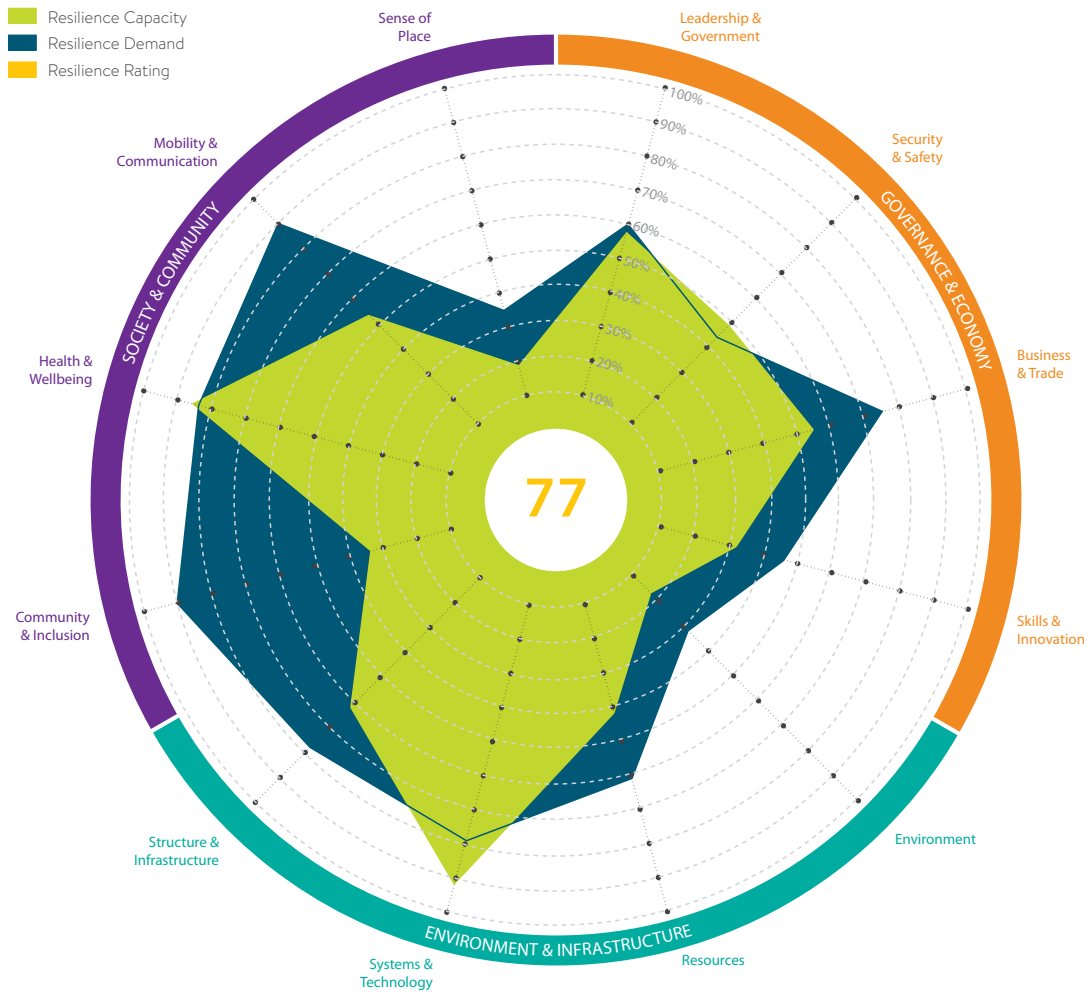


Figure 3.2: BuroHappold's Resilience Wheel for London per sector. This diagram is part of an information dashboard detailing London's challenges and opportunities. Note that Resilience Capacity (Green), Resilience Demand (Blue) and Overall Resilience Rating (% in Yellow)

When designing resilient systems, it is not sufficient to gauge the resilience demand for the here and now. The information gathered by the framework can be used to project into the future to understand how shock and stresses inter-relate and are likely to grow or shrink over time.

For example, our assessments can be used to measure the changing resilience demand of climate change for a particular city over a set time period; How far is the risk of fluvial (river) flooding, pluvial (rainfall) flooding, coastal flooding, drought, heatwave, invasive species, new diseases, and other risks likely to increase. This projection has an associated confidence level which generally reduces the further out the prediction.

Figure 3.3 below shows the current and future resilience gap for London, highlighting a growing demand in the “community & inclusion” category due to increasing income inequality, limited growth in affordable housing, increasing health inequality and limited provision to increase community resilience programs to match the increasing demand.

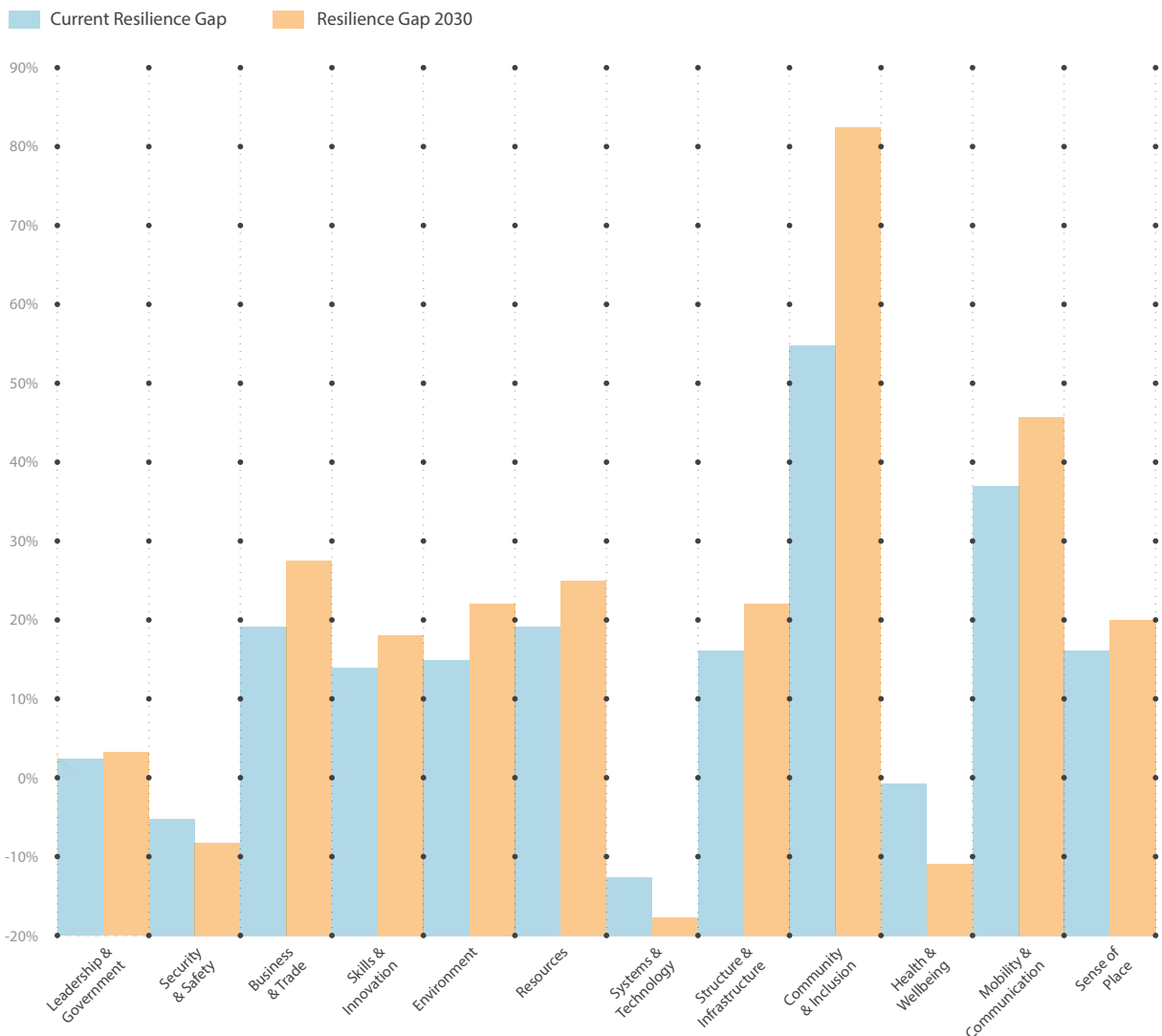


Figure 3.3: Current and future (2030) resilience gap for London

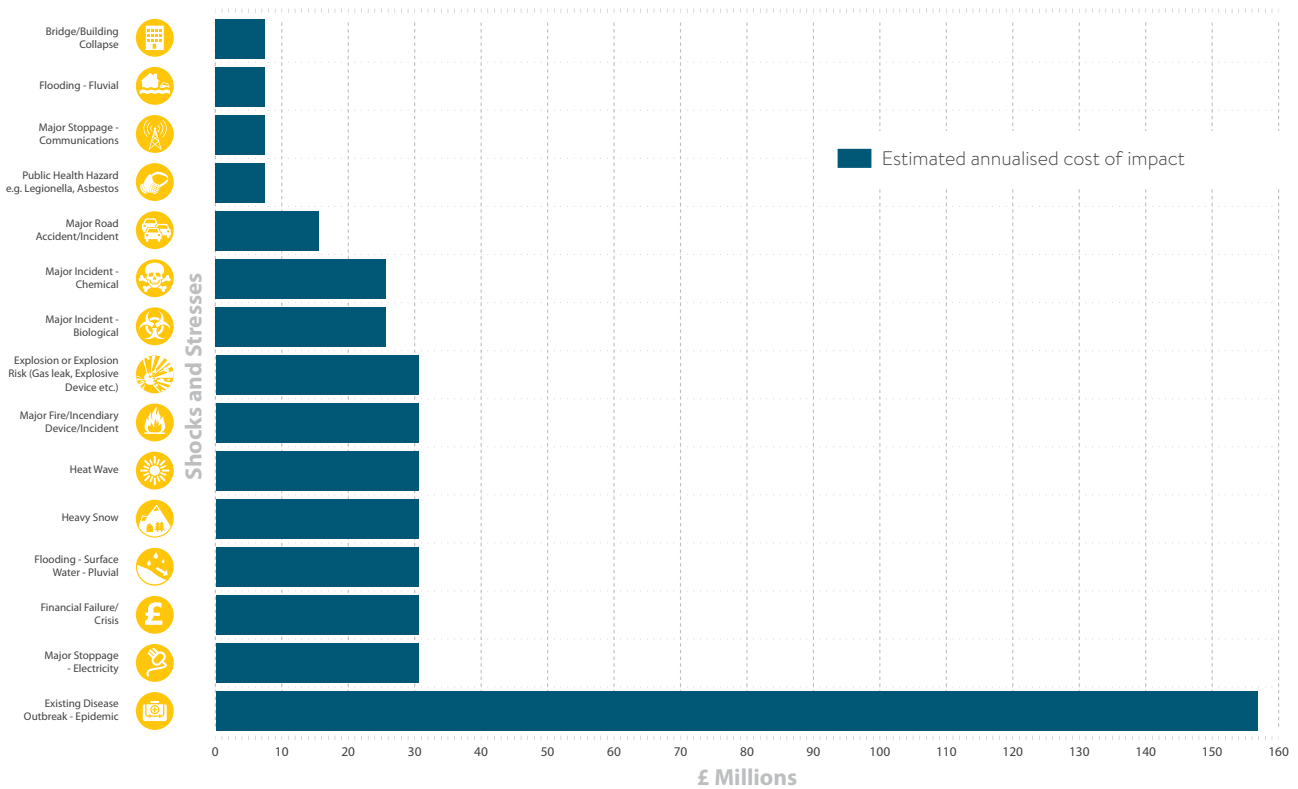


Figure 3.4: Top Estimated Financial Impacts for London

Figure 3.4 above shows the 15 hazards with the greatest annualised cost of impact for London. These figures are calculated by dividing annual probability of occurrence by the impact cost of that occurrence based on a 95% worst case scenario. Although an estimation, they can prove a valuable input into a business case for resilience investment and a means for evaluating the cost-benefit of resilience strategies.

4 CONCLUSION

The ambition behind developing the BuroHappold Resilience Diagnostic was to enable cities to create holistic resilience strategies that are capable of taking into account the volatility, uncertainty, complexity, and ambiguity of city systems. Its aim was always to enable city leaders to see the interdependencies that exist within their city and allow greater understanding by measuring resilience. The tool provides a baseline from which progress can be measured and actions and their impact can be assessed. From this initial baseline assessment, key risks and issues can be identified and prioritised. The diagnostic tool is only one part of a larger approach although it has a crucial role to play.

One of the key benefits noted when implementing this approach with city leaders is that stakeholders are unified around a common vision. A comprehensive resilience strategy will touch all aspects of a city. It is therefore a great way to integrate a city and break down silos; providing an overview of resilience means that the city is integrated around this common vision. We have found that successful resilience strategies address multiple vulnerabilities and deliver benefits across a wide range of areas. They also require interventions that cross departmental barriers; strategy workshops being invaluable in successfully aligning interests. This provides the co-benefits of better collaboration and better understanding between departments which results in resilient solutions that maximise benefits across multiple agencies.

For example; In responding to the problems of flood risk around the neglected and contaminated Wadi Hanifah water way that runs through the capital of Saudi Arabia, we created a solution that improved water quality, addressed the flood risk and also created a beautiful linear park, that has increased citizens' access to high quality green space. This has proved highly popular, helping to also address issues with obesity and to create greater social cohesion.

Exploiting the capability of the Resilience Diagnostic to model future trends, we are able to test possible scenarios against the current baseline, to assess the comparative impact and benefits of different strategic options. Our baseline assessment also enables us to take insight into the cost and benefit of different options and compare them with the cost of inaction – of doing nothing. This informs the creation of business cases around possible programmes of activity.

Clients investing millions if not billions into a development, need to know their investment is protected and the business case supporting that investment will remain pertinent for the necessary period of repayment or for the development's lifetime. The risk management model that sets the scene for our resilience approach is focused on creating and protecting value; looking at the underlying assumptions upon which business models are based and understanding how strategic risk factors can both challenge these assumptions but also reveal previously unidentified opportunities.

For further information on city resilience and our resilience tool please visit:

<http://www.burohappold.com/think-again/specialims/risk-resilience/>

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