NATIONAL PREPAREDNESS COMMISSION

BUILDING CONFIDENCE IN THE FUTURE

Towards a framework for measuring national resilience

MarshMcLennan

EXECUTIVE SUMMARY

Threats to UK security, prosperity, and societal well-being have surged. In recent years, four major challenges (COVID-19, Brexit implementation, Russia's invasion of Ukraine, extreme weather events) have stretched the ability of national infrastructure and capabilities to meet needs and the capacity of households and businesses to absorb shocks. In the decade ahead, a more fraught geopolitical landscape, deteriorating environmental conditions, and startling, hard-to-govern advances in artificial intelligence will place core assets, services, and flows under yet greater pressure and present new risk exposures with unanticipated consequences.

The imperative for strengthening national-level resilience is acute, as is well recognised in the recent *Integrated Review Refresh* and *UK Government Resilience Framework*. Response strategies will need to take many different forms, function in concert with each other, and evolve over time. Notwithstanding trade-offs with other priorities, required levels of intervention, investment, and mobilisation are becoming ever more elevated.

Against this backdrop, improving our ability to measure how resilient we are as a nation is vital. We need a better understanding of how well organised we are for resilience, whether our efforts are deployed in the best ways, and if we are doing enough. This will encourage more effective governance, more astute decision-making, and more targeted investment.

Measuring resilience is, however, fraught with difficulty. Efforts must appreciate the different ways in which different risks test households, organisations, and the public sector. They must acknowledge the utility of different forms of resilience for different risks and take a view as to where responsibility for resilience lies across different sectors. And they must recognise that exposures and coping capacity vary by locality, socioeconomic group, and industry. Indeed, levels of resilience will alter over time as risks grow or diminish, vulnerabilities change, and resources for response vary in availability.

The UK can learn from how other countries are grappling with these intricacies. Practitioner measurement programmes — informed by a wealth of academic literature — suggest five (frequently overlapping) areas of enquiry. These are: detecting the presence of core resilience characteristics; understanding capacities for handling impacts; analysing responsive capabilities for addressing risks; monitoring progress towards resilience goals; and evaluating the expected benefits from resilience investments.

To examine the UK's resilience, it is helpful to adopt four lenses. For each lens, the report defines the rationale, the core components, and key issues to explore, providing some illustrations of why the lens is useful.

- The *"Powers and Governance"* lens looks at the ambition of the government to address critical risks, the powers available to it and how they are exercised, and the governance arrangements that scrutinise decision-making and implementation.
- The *"Assets and Capabilities"* lens looks at the reliability of the arrangements that underpin daily national life and the resources that can be brought to bear on critical challenges to deliver pre-emptive preparedness, in-crisis responses, and (post-)crisis recovery programmes.
- The *"Coordination and Mobilisation"* lens looks at the networks, collaborations, processes, levers, platforms and expected responsibilities that galvanise individual and collective action across different sectors of society.
- The *"Outcomes and Realities"* lens looks at achievement and performance — the condition of both the communities that might be affected by the materialisation of critical risks and those charged with providing core services, solutions, and support.

Diverse evaluation methods are needed to provide data and perspectives. The most accessible indicators are often reductive; more meaningful data tends to be incomplete or retrospective; capturing interdependencies and compounding effects is hard. The report sets out seven approaches across three categories that can be used in creative combinations, outlining their value for the lenses and specific considerations for deployment.

- **Intrinsic:** *Dependency mapping* between different critical assets, flows, and systems helps uncover critical vulnerabilities and points of potential failure that may be underappreciated. *Foresight and scenarios* work helps test the likely effectiveness of current resilience arrangements and plans against possible stress situations and future risk contexts.
- **Indicative:** *Standards and benchmarks* are valuable where clear availability, compliance, and performance targets or thresholds can be set and monitored. *Surveys* are well suited for getting a pulse check on state-of-mind topics such as risk and resilience perceptions and priorities that can shift quickly. *Exercises*, whether tabletop simulations or full-scale live rehearsals, test the effectiveness of plans, procedures, capabilities, competencies, and collaborations.
- **Investigative:** *Performance reviews* that retrospectively analyse how well systems and arrangements have withstood or responded to distinct challenges inform a view on their fitness for purpose and help justify the case for improvement. *Cost-benefit analyses* enable ex-ante comparisons of resilience intervention options and support ex-post value-for-money exercises that explore effectiveness and efficiency.

Measuring national resilience should reflect the systemic nature of its subject. It should recognise the overlapping interests of national resilience, national security, and national sustainability agendas. It should seek to provide evidence to calibrate assumptions of "adequate" levels of protection. A deeper understanding of where we are strong and where we remain vulnerable — mindful of what the years and decades ahead might bring — will help us act in a timely and determined manner to position the UK for future crises, whatever form they take.

This report, prepared by Marsh McLennan for the National Preparedness Commission, is intended to advance thinking and encourage debate over how to assess the UK's ability to withstand shocks and cope with challenges to national security, prosperity, and well-being. Founded on extensive desk research and interviews with resilience experts across the world, it is aimed at central government with the expectation that core elements can be adapted for use at different levels.

CONTENTS

INTRODUCTION

The UK government has undertaken to strengthen the "frameworks, systems, and capabilities that underpin the UK's resilience to all civil contingencies risks", recognising that an enhanced focus on "protective and preparatory action" will help further national security, economic competitiveness, and other interests.[1, 2]

Against this backdrop and the action it will spur, three questions demand attention: How do we know if we are well organised for resilience? How do we know whether our efforts are deployed in the best ways? How do we *know* if we are doing enough?

Several factors make the issue of measurement — how we understand preparedness, performance, and progress — an essential and pressing matter. First, the threats to national prosperity and societal well-being from interlocking challenges are many, varied, and complex. Second, expectations of responsibility and the nature of cross-sectoral response strategies will need to evolve as critical risks become more impactful and change shape. And third, the required levels of intervention, investment, and mobilisation are becoming ever more elevated.

Currently, the UK's ability to withstand shocks and cope with change is reviewed by multiple government bodies, oversight committees, and third parties. Diverse analytical approaches are deployed, including scenario modelling, metrics on critical infrastructure reliability, and the assessment of government agency performance in specific crises. Often these lead to constructive innovations. However, looked at as whole, the wealth of intelligence generated remains partial, inconsistent, and disjointed. It contains significant blind spots and frequently impedes timely planning for plausible future predicaments; adjustments to response arrangements in the light of new evidence are often highly targeted and limited in cross-sectoral benefits.

Now is the moment to be more ambitious, wide-ranging, and nuanced regarding the approach to measurement. This report, prepared by Marsh McLennan for the National Preparedness Commission, is intended to advance thinking and encourage debate over how to assess resilience more effectively. Primarily aimed at central government, the core elements can be adapted for use at different levels. Building off extensive desk research and interviews with resilience experts across the world, it is neither an assessment of the UK's resilience levels nor a critique of the country's resilience evaluation arrangements. While it should inform thinking about the contents of the Annual Statement to Parliament on resilience promised in the new Framework, it intentionally looks beyond civil contingency risks to broader strategic resilience challenges, such as those posed in the *Integrated Review Refresh*.

The first chapter, "Gauging the Challenge", frames the key difficulties with measuring resilience and examines how different authorities and researchers tend to address them. The second chapter, "Gaining Perspective", explores a range of lenses that provide a multidimensional view of the strength of current and prospective resilience arrangements. The final chapter, "Generating Insight", proposes a set of principles to underpin resilience measurement and reflects on the core analytical approaches that can be deployed in individual evaluation projects.

GAUGING THE CHALLENGE

If measuring the resilience of individual organisations is hard, then gauging it at a national level is markedly more difficult — and problematic when comparing different countries. But existing approaches and practices illustrate opportunities that are available.

1. MEASUREMENT QUANDARIES

The internet hosts multiple indexes that purport to identify the most resilient countries in the world. In recent years, accolades have gone to Norway, Denmark, Switzerland, Vietnam, and Dubai, among others.[3, 4, 5, 6] These studies are valuable when grounded in balanced criteria and multiple indicators that can be unpacked. Nonetheless, they risk presenting resilience as a condition rather than as a journey and seldom form a view as to whether even the top-ranking countries are doing enough.[7]

Moreover, they can be exposed by the specificity of individual crises. The notional pre-eminence of the US and the UK on pandemic preparedness as indicated in one global study prior to the arrival of COVID-19 was challenged by the actual turn of events in early 2020 and response decisions.[8] Indeed, during the course of 2020-2022, it was notable that resilience indices found different countries to be in the ascendant at different times, depending on inherent national strengths, response strategies, and waves of the virus.[9]

In any case, approaches designed to compare countries struggle to be meaningful about individual country practices. Indeed, attempts to measure national resilience are beset by three well-known challenges.

First, risks of national concern are complex and interconnected, and have multiple cascading consequences. Resilience measurement approaches must therefore appreciate not only the distinction between fast-onset risks that present shock events, chronic risks that erode, and slow-burn escalation risks that may trigger strategic crises, but also the dynamics of specific risks within each of those risk types. Cyberattacks, extreme weather events, supply chain fractures, labour shortages, misinformation and disinformation campaigns, and declining water availability test households, organisations, and the public sector in different ways.

Second, resilience takes different forms, and the utility of those forms varies according to the risk. The risks mentioned above (and others like them) place different stresses on preparedness efforts, responsive agility, and recovery activities, and require different interactions across systems. Moreover, for some risks, public sector powers and resources are the foundation of resilience; for others, responsibility rests with the population and depends on latent strengths and vulnerabilities. Just as risk appetite is hard to define, so too is the question of how resilient we want to be as a nation and our willingness to expend effort in addressing eventualities that might not happen.

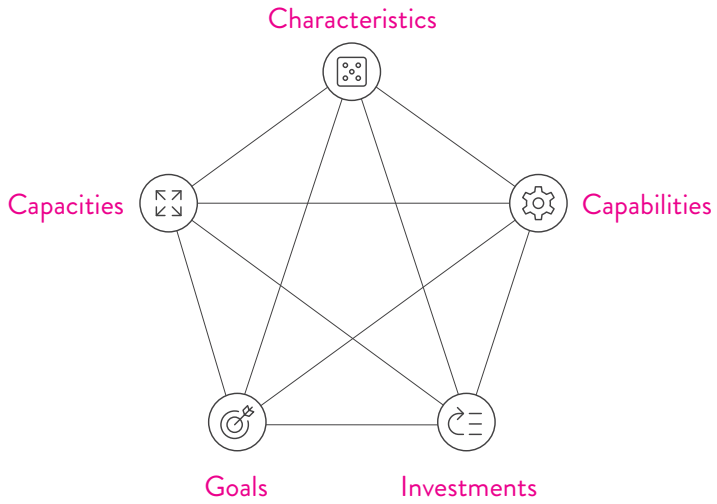
Third, context is vital. Context underpins the assessment of potential impact and the likely effectiveness of countermeasures. Exposures and coping capacity inevitably vary by locality, socioeconomic group, and industry; moreover, levels of resilience alter over time as risks grow or diminish, as vulnerabilities change, and as resources for response vary in availability.[10] Plans and capabilities that suffice now may be inadequate for the future; conversely, programmes that actively seek continuous or periodic improvement will better anticipate changing circumstances and achieve better results than those rooted in more basic expectations.[11]

As a result, measurement tools can struggle to support decision-making. The most accessible indicators are often reductive; more meaningful data tends to be incomplete or retrospective. It's hard to capture interdependencies and compounding effects, which inhibits attempts to confirm (let alone quantify) the true effect of resilience measures. Moreover, at the national and institutional level, resilience is seldom a stand-alone goal; it usually needs to be balanced or blended with other economic and societal priorities.

2. MEASUREMENT IN PRACTICE

Cross-country comparisons build on national-level measurement approaches, where current efforts suggest five underlying (and frequently overlapping) areas of enquiry. As shown in Exhibit 1, these are: detecting the presence of core resilience characteristics; understanding capacities for handling impacts; analysing responsive capabilities for addressing risks; monitoring progress towards resilience goals; and evaluating the expected benefits from resilience investments.

Exhibit 1: Focus of resilience measurement



2.1 Detecting the presence of core resilience characteristics

Some studies identify characteristics (robust, flexible, inclusive) that are indicative of, or contribute to, resilience. At the level of the individual organisation, these may be attributes such as effective and empowered leadership and the presence of information-sharing processes.[12] This approach is also used at city level, setting out features that help to "transition, transform and change to a better, stronger state".[13]

EXAMPLES:

The OECD presents four key sets of drivers of resilience that lead to resilient qualities. These drivers are economic (such as diverse industries, innovation capacity), social (citizen networks, access to key services), institutional (clear leadership, long-term vision), and environmental (infrastructure, natural resources). Supporting indicators include average response time during an emergency, average duration of unemployment during an economic crisis, and average annual property damage due to natural disasters.[14]

Mexico City's resilience strategy leverages the Rockefeller Foundation's qualities for resilient cities – inclusive, integrated, robust, resourceful, reflective, redundant, and flexible. The different pillars of its strategy are then aligned with these qualities. Progress is qualitatively assessed through the resilience value of goals and actions under each pillar. For example, the pillar of developing innovation and adaptive capacity reflects the quality of robustness. One of the actions under this pillar is promoting private sector participation. The resilience value articulated for this is leveraging a broader set of capabilities and resources to accelerate recovery.[15]

2.2 Understanding capacities for handling impacts

Vulnerability represents the degree to which a system, or part of it, may be adversely affected by stresses and shocks.[16] With respect to individuals, households, and communities, it's often evidenced in the impact on well-being. Reducing vulnerability involves enhancing three interdependent forms of capacity.[17] Action involves taking intentional steps to cope with and recover from known shocks and stresses (absorptive); making incremental adjustments with a view to creating more flexibility to address uncertainty and future changes (adaptive); and introducing interventions to stop or reduce the cause of risk/vulnerability (transformative).

EXAMPLES:

The Baseline Resilience Indicators for Communities (BRIC) initiative identifies and compares vulnerabilities across counties in the United States by operationalising features typically found in resilient communities. These include infrastructure (shelter availability, medical capacity) and institutional factors (insurance coverage, disaster training).[18]

The European Commission's resilience dashboards examine vulnerabilities and capacities in Member States through 124 indicators across four dimensions: Socioeconomic, green, digital, and geopolitical. The methodology compares the latest year against an earlier reference period with a view to helping states identify "areas for further analysis and potential policy actions in relation to ongoing societal transformations and future challenges".[19]

The lack of coping capacity forms one dimension of the European Commission's INFORM risk methodology. This is aggregated by a geometric mean of two categories: institutional (which covers the existence of disaster risk reduction programmes that address mostly mitigation, preparedness, and early warning matters) and infrastructure (which measures the capacity for emergency response and recovery).[20]

Marsh McLennan/JLT's Local Government Vulnerability programme in Australia, which takes inspiration from the United Nations International Strategy for Disaster Reduction's Local Government Self-Assessment Tool, uses a mixed-method framework to assess the critical natural hazard exposures of individual councils and to identify institutional and community vulnerabilities.

2.3 Analysing responsive capabilities for addressing risks

One aspect of national-level resilience assumes that systems critical to the functioning of society and the economy — such as healthcare, education, energy, food, communications, and banking — can perform as required in the face of different stresses and shocks. To this end, it is important to understand what individual operators and those with broader systemic responsibilities can deploy to mitigate the impact of different types of disruptions and erosion.

EXAMPLES:

The National Risk and Capability Assessment undertaken by the Federal Emergency Management Agency in the United States asks all levels of government to undertake a preparedness review that involves examining how current protective and responsive capabilities match up against key risks and their associated impacts. This is the starting point for identifying gaps and setting data-driven capability targets.[21]

In the 2023 national budget, Singapore's government underscored the need to continually build strong capabilities to build a resilient nation. Progress towards building resilience is assessed by monitoring the development of capabilities that bolster different aspects of national resilience. Past examples of such capabilities include setting up a National Public Health Laboratory for managing diseases, building multi-purpose infrastructure (train stations that double as shelters in times of crisis), and establishing a Coastal and Flood Protection Fund to build climate resilience.[22]

2.4 Monitoring progress towards resilience goals

Some countries align resilience planning with their broader long-term ambitions for the economy and society. Often, national-level resilience plans follow an outcome-oriented approach — taking their main goals and then breaking them down into sub-goals or objectives. Progress towards these objectives acts as an indicator of resilience. In some cases, traits or characteristics of resilience, as well as actions undertaken, form the basis for measurement.

EXAMPLES:

The European Commission's Recovery and Resilience Facility aspires to help the EU achieve its goal of climate neutrality by 2050 and set Europe on a path of digital transition, creating jobs and spurring growth in the process. Funds for countries are unlocked on fulfilling agreed milestones and targets identified in reform plans, which de facto become measures of progress. By way of example, Estonia's ability to access finance for energy storage is contingent on grid enhancements that support greater renewable energy production capacity, stronger resistance to natural disasters, and enhanced overall reliability.[23]

The UK Climate Change Committee has sought, despite data challenges, to explore "tangible changes in the economy and across society and the environment" by identifying outcomes needed to deliver climate resilience in areas such as nature, working land, water and energy supply, towns and cities, community preparedness, health, business, and finance. It also provides a more granular model of the enabling conditions necessary to achieve these outcomes.[24]

Nigeria's Resilience Strategy 2021-2023 integrates several pathways for resilience through four main outcome areas. These areas combine and interlink interventions aimed at strengthening institutions. Each outcome area lists key sub-goals (outputs) and objectives which need to be met for greater resilience. For example, security for agriculture-based livelihoods (an outcome) is grounded in two key outputs — enhancing emergency livestock health services and improving access to agricultural inputs and technologies.[25]

China Standards 2035, the follow-up to the Made in China 2025 plan, focuses on building resilience primarily in the form of economic and technological resilience through the achievement of targets for the development of advanced technologies (such as AI and 5G) and the accompanying norms and standards.[26] These targets include reducing the time needed for the formulation of national standards to less than 18 months by 2025 and setting up more than 50 national technological standards coordinating bodies to integrate activities such as R&D and accreditation by 2035.

2.5 Evaluating the expected benefits of resilience investments

With limited resources at their disposal, governments need to prioritise between resilience-building initiatives and infrastructure investment programmes. Measurement frameworks that guide the disbursement of public funds often estimate future benefits or opportunities that will result from resilience investments versus inaction. The economic case can also be made by calculating the negative ramifications of a less resilient system.

The concept of 'net resilience gain' has gained traction in infrastructure and climate resilience studies. Like 'net zero', 'net resilience gain' seeks to ensure that all new investments offset any additional risk they cause. More broadly, it aims to increase the overall resilience of a system by minimising actions (such as non-compliance) that reduce systemic resilience and by prioritising initiatives aimed at building systems that are resilient to future disruptions and crises.[27]

EXAMPLES:

A study in New Zealand calculated that NZD6 million spent on the seismic strengthening of electricity transmission and distribution infrastructure would reduce direct asset replacement costs by NZD30-50 million.[28]

The Nature Conservancy made a case for protecting coral reefs off the coast of Cancún (Mexico) by estimating that a one-meter loss of reef height could translate into 1,300 square kilometres of inland flooding and USD20 billion in lost infrastructure.[29]

In Bangladesh, although accounting for climate change in the design of infrastructures increased capital requirements by USD560 million for additional flood protection, it could save up to USD1.6 billion in damages.[30]

In a value-for-money assessment reviewing responses to the COVID-19 pandemic, the UK National Audit Office found that in 2020 the government spent GBP13 billion on personal protective equipment. To balance this, they recommended estimating the cost of investing in arrangements that would enable domestic production capabilities that could quickly switch to producing what was needed at reasonable prices.[31]

GAINING PERSPECTIVE

Examining national resilience through different lenses helps secure a systemic understanding of capacity and progress. It can also reveal where further action might be taken to build preparedness for future crises.

1. SETTING THE FRAME

Recent years have seen four signature developments that — individually, collectively, and concurrently — have rocked business-as-usual expectations, stretching the ability of national infrastructure to meet needs and the capacity of households and businesses to absorb shocks. These are the COVID-19 pandemic, the implementation of Brexit, Russia's invasion of Ukraine, and a succession of extreme weather and climate-related events (see Exhibit 2 on the next page).

Each one has had multiple direct impacts on daily life and the national economy, with the prospect of lasting reverberations that sap resilience. Deaths and privations caused by the pandemic, the prolonged disruption of international supply chains, and price spikes in energy and food markets due to the war in Ukraine stand out. But storm damage to property and infrastructure, recurring public sector industrial action, and the problems caused by the intense heatwaves and drought of 2022 are also significant.

As the *Integrated Review Refresh* notes, core services and flows are destined to come under yet greater pressure in the years to come. Demand for electricity (due to electric vehicles) and healthcare (due to aging populations) will continue to rise. The supply of water (due to climate change) and specialist goods and commodities (due to geopolitical and geoeconomic factors) will become more constrained. Meanwhile, biodiversity decline in the UK continues apace while the risk exposures generated or amplified by rapid advances in artificial intelligence and related technologies continue to outstrip attempts to contain them.

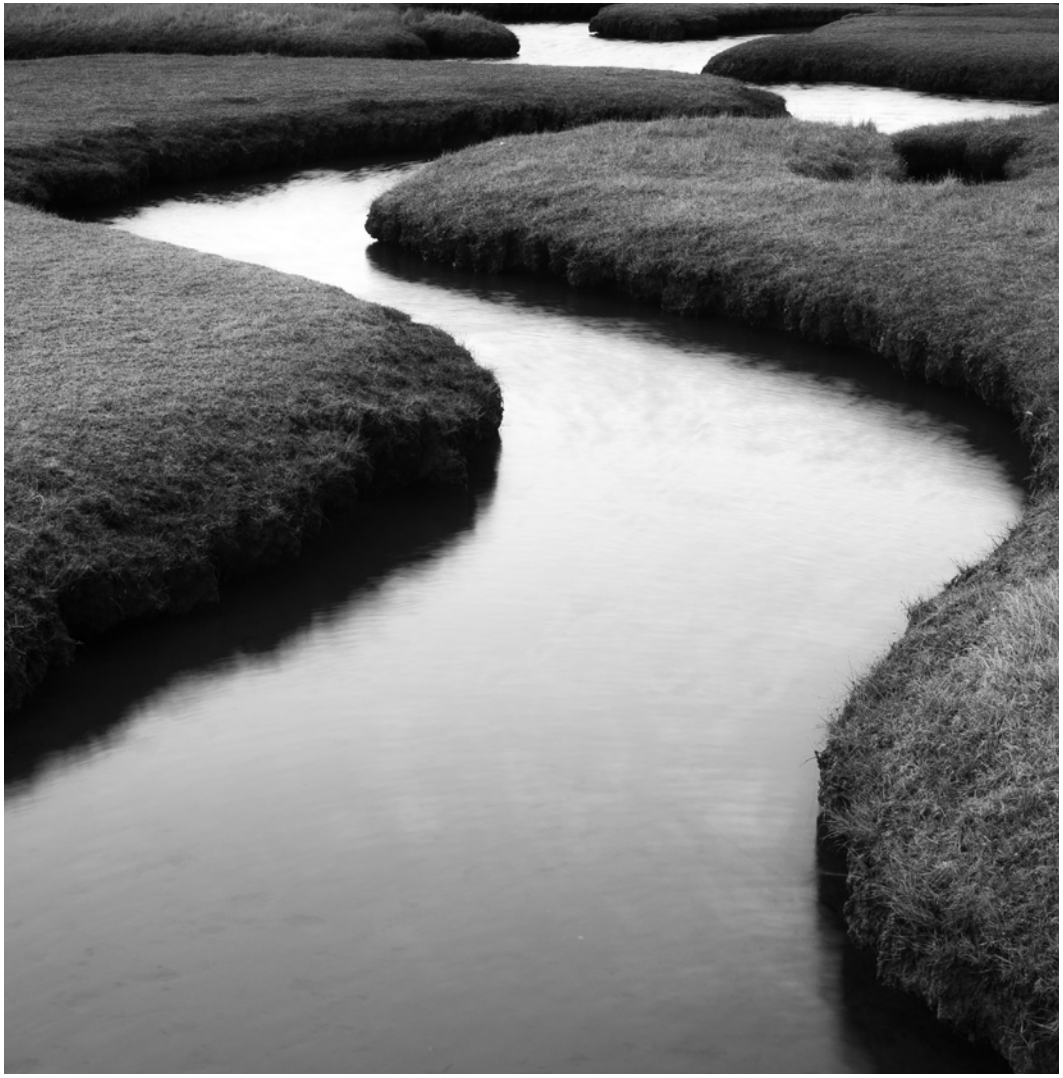
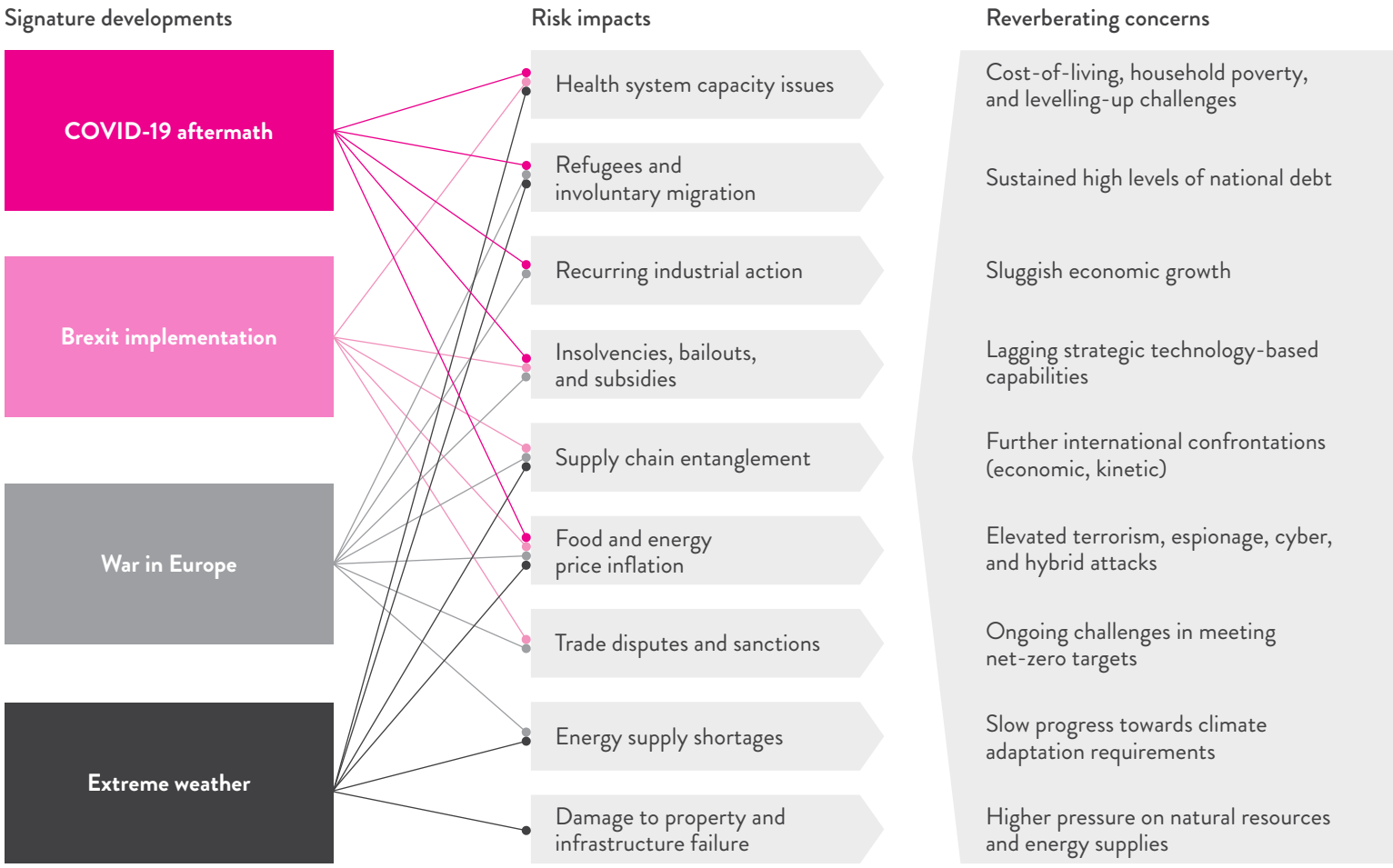


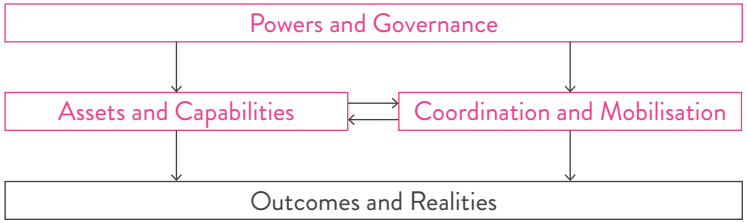
Exhibit 2: Selected UK challenges



2. FOUR LENSES

The UK should consider an approach to measuring the nation's resilience that connects the challenges highlighted above and the concepts outlined in the previous chapter ("Gauging the Challenge"). This can be done by adopting four lenses (see Exhibit 3).

Exhibit 3: Four lenses for measuring national resilience



The first lens enables a view on the mandate for government action and the associated oversight that supports decision-making and implementation. The next two lenses provide separate perspectives on the "whole-of-society" resources that might be drawn on for preparedness and in crises, and the ease with which those resources can be roused to action. A final lens looks at the overall results of the effort in the context of evolving circumstances.

Each lens is unpacked below. Its value is noted, its component parts described, and the key issues for periodic exploration articulated. Deployed in combination, they support a view on the questions raised at the outset of this report — whether as a nation we are sufficiently well-organised for resilience, targeting efforts appropriately, and doing enough.

2.1 Powers and Governance

A starting point for the furtherance of national resilience is the ambition of the government to address critical risks, the powers available and how they are exercised, and the governance arrangements that scrutinise decision-making and implementation. Recent crises have presented strong arguments for a more assertive government, albeit one where trade-offs between different policy objectives are transparent and where there are both appropriate checks on executive action and strong assessments of both the costs of inaction and the value presented by different expenditure options.

The core components of this lens are:

- *Civil contingencies and national security legislation* — in other words, the ability of the government to make appropriate fiat-based responses to different challenges and crises, curtailing via legal measures (for a limited time) normal societal and economic behaviours
- *Strategic future-proofing legislation and policy initiatives* designed to protect critical assets against the challenges of the future and identify resources and capabilities to mitigate the associated risks
- *Regulations and standards* that provide direction and oblige participants in key ecosystems to address important systemic vulnerabilities, and that also permit actions and interactions by participants that help advance resilience
- *Budgeting and resourcing* that balances the resilience needs of the present and opportunities for near-term growth with due attention to the needs of the future and protection against adverse scenarios, eventualities, and trajectories

On this basis, intelligence relating to strategy, mandates, and accountability would generate insights into levels of preparedness and potential performance. Details are set out in Exhibit 4 (see the next page).

Some examples of the importance of this lens may be helpful. The pandemic demanded the significant, periodic curtailment of societal and economic freedoms to slow the spread of the virus while vaccines were being developed. Rising geostrategic competition and the growing readiness of countries to deploy geoeconomic levers has heightened the imperative for strategies that secure the future availability of critical minerals and components such as high-end semiconductors and constrain market access to suppliers that present a national security risk.

Exhibit 4: Key issues to explore — Powers and Governance

STRATEGY

- Level of ambition and imagination of national security and risk assessment exercises, especially for big risks and plausible crises
- Net-zero and climate adaptation strategies that have near-to-mid-term targets permitting a view on the likely achievement of long-term goals
- Clarity of science and technology ambitions for the UK that will deliver a "smart" future for households and businesses with associated cybersecurity protections and without undue dependency on foreign-owned providers, investors, and partners
- Long-term strategies for the secure and reliable supply of food, water, energy, and critical minerals that anticipate changes in supply and demand
- Strategies that appreciate the evolving nature of malicious actions, including terrorism, cyber risks, and hybrid threats
- Protections given to natural ecosystems that ensure their viability across generations and help reverse biodiversity decline

MANDATES

- Clear resilience-focused duties for all regulators of critical national infrastructure, with expectations of a system-wide view and a fulsome future orientation
- Powers, capabilities, and bandwidth in government and regulators that enable them to enforce resilience standards in regulated sectors, intervene where necessary, and apply appropriate sanctions
- Periodic reassessment of oversight arrangements for currently unregulated sub-sectors, capabilities, (e.g. AI) and assets (e.g. data centres) that may become more systemically important in the future
- Ability of government to secure appropriate risk and resilience data from critical infrastructure assets and systems at risk of failure
- Ability of government to decree the development and maintenance of stockpiles of strategic goods, and ban exports if necessary
- Probity and effectiveness of accelerated research and development and emergency procurement procedures that lower normal due diligence requirements at times of high urgency
- Assignation of responsibilities for exploring critical emerging risks — in addition to known priority risks — and the establishment of authorities that enable those risks to be managed

ACCOUNTABILITY

- Quality of departmental/agency, devolved administration, and local authority preparedness plans for crises that may affect them as well as for crises for which they have lead responsibility
- Effectiveness of arrangements that analyse and resolve challenges associated with risk interdependency and cascading effects
- Effectiveness of arrangements to analyse trade-offs and resolve conflicts between competing policy objectives and budgetary priorities
- Appropriate deployment of security classification policies that balance national security needs with the benefits of wider intelligence sharing
- Timely, wide-ranging reviews of crises, with effective data access provisions so lessons can be learned for future contingencies
- The ability of a cross-government resilience lead to represent the resilience agenda effectively to the Prime Minister and Cabinet
- Reporting to Parliament generally — and relevant committees specifically — on progress towards a more resilient UK, including a view on the performance of Lead Government Departments, Local Resilience Forums, and other bodies

2.2 Assets and Capabilities

The bedrock of resilience is the reliability of the arrangements that underpin daily national life and the resources can be brought to bear on critical challenges to deliver pre-emptive preparedness, in-crisis responses, and (post-)crisis recovery programmes. Without the right "things", enough of them, the right quality, and in the right places, risk exposures are magnified and vulnerabilities expand. To avoid definitional complications, this lens consciously excludes as an asset the broader population of the UK, which is covered in Lens 3.

The core components of this lens are:

- *Economic and societal infrastructure* — including the provision of energy, food, water, and communications; transportation networks; critical manufacturing, storage, and research and development facilities; financial system arrangements; and health and education facilities
- *Natural resources* — encompassing minerals; the availability of water, sun, and wind; and natural ecosystems including productive agricultural land, fisheries, and biodiversity more generally
- *Moveable assets* — including logistics and supply chain assets, vital manufactured products and components, and data
- *Financial capital* — covering the availability of loans on reasonable terms, investment capital for infrastructure renewal and innovation more generally, and insurance to mitigate losses from catastrophic risks
- *Governmental capabilities* — comprising administrative, diplomatic, and security-focused resources, in addition to those focused on emergency services, healthcare more generally, and other key services
- *Strategic national capabilities* — including especially the scientific, engineering, technological capabilities that support innovation and commercialisation, but also the broader skills base that can support key industrial transformational agendas

On this basis, intelligence relating to investment, backups, protections, and resources would generate insights into levels of preparedness and potential performance. Details are set out in Exhibit 5 (see the next page).

Some examples of the importance of this lens may be helpful. Extreme weather in the form of storms, floods, and heatwaves has exposed material vulnerabilities in the nation's economic infrastructure (power lines, train tracks, runways, sewerage) and insulation shortfalls in the nation's building stock. The power grid is struggling to connect new renewable capacity in a timely way. Crises of different kinds have highlighted gaps in the UK's complement of healthcare professionals, cybersecurity experts, and individuals with deep experience of countries that may represent geopolitical flashpoints.

Exhibit 5: Key issues to explore — Assets and capabilities

 **INVESTMENT**	• Achievement of appropriate annual maintenance targets by (critical) infrastructure operators • Financial strength of (critical) infrastructure operators — in addition to banks — in the face of extreme market events • Levels of annual investment in infrastructure renewal and new infrastructure to meet new demand, counter growing risks, address sustainability agendas, and deliver against national transformation ambitions • Investment programmes that support the phased renewal/timely replacement of critical infrastructure assets and networks in line with their expected longevity
 **BACK-UPS**	• Existence and levels of stockpiles/storage of strategic assets such as gas, water, health care items (e.g. vaccines, PPE) • Availability of redundant or buffer capacity for energy generation in the event of asset or market failures • Availability of workaround resources and routings in the event of damage to chokepoints (e.g. rail networks, ports, and interconnectors) for critical flows • Extent of concentration in the technology sector (cloud computing, data centres) and the availability of substitute communication systems in the event of damage to phone masts, undersea cables, Global Positioning System technology, and other networks • Viability of alternative sources of supply for critical imported goods should core source countries and supply chains become unreliable
 **PROTECTIONS**	• Robustness of infrastructure and defences against extreme weather events and climate change, mindful of the need for relocation in some areas • Equity of digital infrastructure rollout and growth in the digital capabilities of communities to support societal wellbeing and economic advancement • Adequate insurance market capacity and coverage for critical risks — especially for natural catastrophes and (state-sponsored) cyber risk
 **RESOURCES**	• Strength of the science, technology, engineering, and maths (STEM) base in the form of expertise, investment, high-end research, and follow-through to innovation • Suitable levels of trained workforce to support the implementation of national transformation programmes (e.g. heat pumps) • Adequacy of health system resources (e.g. bed spaces, clinicians of all types, medical equipment and supplies, and volunteers for drug experimentation) to meet patient needs • Depth and bandwidth of intelligence and diplomatic capabilities to assist progress with critical ally and unfriendly countries • Presence and range of local emergency service, voluntary, and private sector capabilities that can be accessed in a crisis

2.3 Coordination and Mobilisation

Powers, assets, and capabilities are not enough by themselves to galvanise and continually enhance resilience. To achieve lasting preparedness and agility, networks must be deepened and renewed, processes sharpened and tested, levers refreshed and expanded, platforms developed and leveraged, responsibilities clarified, and trust nurtured.

The core components of this lens are:

- *Collaboration within government* — joint working across departments and agencies, communication with devolved administrations, the armed forces and local authorities, and interactions with foreign governments
- *Harnessing of private sector strengths* — both the self-organising preparedness and agility of businesses for their own resilience and, additionally, strategic partnering between public and private sectors
- *Leveraging of the science and technology research base* — both directly in support of resilience planning and indirectly to generate the sustainable innovations on which future prosperity depends
- *Encouragement and support for communities and the voluntary sector* — both formally and informally to build a culture of locally driven risk anticipation and crisis response

On this basis, intelligence relating to engagement, deployment, and levers would generate insights into levels of preparedness and potential performance. Details are set out in Exhibit 6 (see the next page).

Some examples of the importance of this lens may be helpful. The rapid mobilisation of vaccine development and production was vital during the COVID-19 pandemic; expectations are high for the defence industry to accelerate the manufacture of ordnance to supply Ukraine for some time to come; the nation will need to greatly enhance its skills base to deliver on the different pathways to net zero. Communities across the country showed strong dedication and ingenuity in supporting the vulnerable during the pandemic. Efforts by all parts of society and businesses to reduce energy consumption — according to their capacity — will continue to mitigate the risk of geopolitically driven supply shortages.

Exhibit 6: Key issues to explore — Coordination and mobilization

ENGAGEMENT	• Extensive mobilisation of leaders and experts from different sectors to provide perspectives on critical risks and opportunities for resilience • Effectiveness of intelligence-sharing and response coordination mechanisms at supranational level on security, economic, and other matters • Preparedness to engage with, and act on, advice from scientific and other experts in a crisis • Quality of multi-directional communication flows between central government, devolved governments, and regional/local authorities in a crisis • Quality of strategic and operational resilience planning and execution in companies and other organisations as appropriate to their scale • Extent and quality of broader education and training opportunities for individuals with resilience responsibilities and society at large, including younger generations, volunteer groups, and the community at large to help them thrive in a complex and volatile world
DEPLOYMENT	• Alignment between emergency assets and the ability to deploy them at the point of need in sufficient volume at sufficient speed • Agile mustering and (re)deployment of public sector capabilities and capacities in response to sudden-onset or escalating crises, flexing capacity as facts on the ground change • Presence of contingent contracts and other provisions that enable critical assets and capabilities to be called upon in a crisis • Targeted deployment of funding towards vulnerable communities most in need of risk mitigation • Facilitation of appropriate community self-mobilisation in a crisis in the form of structured local resilience partnerships, other mutual support networks, and more ad hoc volunteer activity • Regular interactions and periodic tests to provide confidence in the efficient collaboration of resources from different organisations (possibly in different sectors) in a crisis • Structured approach to building capabilities for addressing emerging risks, starting well in advance of their likely materialisation
LEVERS	• Balanced and effective deployment of the available levers (from legislation and regulation through incentives to simple encouragement for investment in resilience) to accelerate timely and successful ecosystem change • Well-structured incentive programmes to underpin investment in the development and manufacture of scalable technology-based solutions • Removal of unnecessary barriers to collaboration (including information and data sharing) both between businesses and between sectors in pursuit of strategic resilience ends and to improve crisis response • Appropriate and sustainable risk-sharing arrangements between government and private sector stakeholders to deliver major infrastructure investment, risk transfer for uncertain, complex, and catastrophic risks, and continual investment in innovation • Publication of data on skills supply and demand that helps workers on their skills journeys and gives confidence to companies planning investment

2.4 Outcomes and Realities

Broad-based resilience provides confidence in the face of escalating risks and impending crises, and in pursuit of specific national ends. With a view to understanding what has been achieved and the general state of the country, evaluations should focus on the condition of both the communities that might be affected by the materialisation of critical risks and those charged with providing core services, solutions, and support.

The core components for this lens are:[32]

- **Broadly defined societal capacities** — the ability of communities and businesses to mitigate and withstand contingencies of different kinds, and the ability of government programmes to spur fast, equitable recovery
- **Reliable critical ecosystems** — the infrastructure, functions, flows, and services that support economic activity and societal well-being on a daily basis
- **Progress towards long-term strategic imperatives** — the platforms and arrangements (especially in emerging or fast-evolving fields) that help the UK and those who live there enjoy freedom, security, and prosperity in the decades ahead, and enable businesses to be competitive

On this basis, intelligence relating to communities, systems, and collaborations would generate insights into preparedness and potential performance. Details are set out in Exhibit 7 (see the next page).

Some examples of the importance of this lens may be helpful. The pandemic and energy price crisis resulted in high levels of government support to industries and businesses in trouble, with significant implications for national debt levels; moreover, both contingencies along with food price inflation had deeper impacts on poorer communities, contributing to a broad-based cost-of living crisis. High-value trade deals have proven hard to achieve in recent years and, for separate reasons, the reliable supply of vital goods has been periodically compromised. Tensions between supply objectives and sustainability objectives have become more acute in both food and energy sectors.

Exhibit 7: Key issues to explore — Goals and outcomes

COMMUNITIES	• Literacy of households and businesses on matters such as cyber security, extreme weather anticipation, and health risk mitigation • Levels of poverty across the country linked to employment levels, cost-of-living crises, and welfare support • Physical and financial ability of households and businesses to cope with supply outages and price rises related to basic services • Availability of economic opportunities for different demographic, geographic, and ability groups in the context of industrial and economic change • Economic and health impacts (including excess mortality) of extreme weather events, pandemics, and other crises on different demographic, geographic, and ability groups • Business insolvency rates and the amount of state subsidy applied to nationally-important companies or industries in trouble • Level of trust in government and corporate messaging driving societal responses to acute and slow-burn emergencies
SYSTEMS	• Resilience of critical infrastructure and systems to distinct extreme events such as extreme weather/climate or cyber attacks • Strength of the national fiscal position affecting the potential application of funds to risks and crises • Appropriateness of dependency levels on foreign partners — and the reliability of those partners — for critical supplies • Extent of supply outages of critical goods and services, infrastructure system failures, major industrial accidents, and the closure of important manufacturing plants • Extent of chronic capacity shortages in systems such as the health (including mental health) sector and emergency services • Extent and impact of lasting disputes with major trading partner countries or blocs • Scale and longevity of price spikes in essential goods and commodities that have a material impact on community wellbeing and economic activity • Successful and safe integration of legacy and new infrastructure and technologies • Avoidance — or rapid mitigation — of unexpected and undesirable consequences of new systemic applications of technological advancements • Integrity of the UK and the level of cohesiveness in the home nations' responses to critical risks, respecting devolved powers • Ability to forestall potential terrorist incidents arising from lone wolves, independent terrorist groups, and foreign states • Quality of strategic natural resources and the population health of at-risk species
COLLABORATIONS	• Responsiveness of individuals and organisations, individually and collectively, to take action that respects the greater good both in advance of and during crises • Demonstrable collaboration between government, businesses, and other organisations to accelerate strategic development programmes, ramp up the production of vital goods, adjust supply chains, and reactivate mothballed capacity • Compliance with resilience-oriented regulations and demonstrable ability to learn from adverse experiences and recover with renewed strength

3. LENSES IN ACTION

CHALLENGE	RISK OVERVIEW	KEY RISK DRIVERS	POWERS AND GOVERNANCE	ASSETS AND CAPABILITIES	COORDINATION & MOBILISATION	GOALS AND OUTCOMES
Flood events	Impact on communities, critical systems, and local economies from extreme precipitation and coastal storm surges	Growing frequency and intensity of incidents Increasing concentration of people and assets in flood-prone areas Degradation of natural landscape defences Inadequate investment in risk reduction and preparedness Protection gap regarding flood insurance	Clear view on the flood-readiness of current and planned infrastructure based on risk modelling and stress tests Robust regulations that address development locations, planning requirements, and building codes Adaptive investment strategy for protective and adaptive measures governed by a clear economic rationale and equity considerations	Robust infrastructure maintenance regimes and system improvements to mitigate impacts Alternatives and/or back-ups for critical infrastructure that is at risk of flooding A pipeline of projects and levels of annual investment in protections commensurate with future needs	Availability of relevant flood-risk information to communities and other at-risk parties to promote timely mitigation actions Integration of resilience and insurance solutions Instruments to support adaptation finance, including the recognition of resilience co-benefits Convergence of early-warning systems and early action in crisis response	Decline in the number of properties at high risk and permissions for development in at-risk areas Balanced deployment of grey and green protection measures Increased property-owner action in self-protection Continued reduction in the insurance protection gap Timely managed retreat from locations that will be progressively and repeatedly impacted by floods
Food security	Local or national shortages, price spikes, safety issues, and nutrition shortfalls that impact population health and well-being	Extreme weather and climate change impacts on UK crop yields Import dependency and supply chain weaknesses Sanitation and storage shortcomings Implementation challenges for sustainable agriculture Excess wastage through the value chain	Long-term strategy that balances food production and biodiversity protection Farm and food production inspection regimes that enable enforcement Clear ownership within government of different types of food crises	Availability of stockpiles and storage, especially cold storage Fallback strategies for failures relating to sourcing countries and supply chains R&D that delivers crop variants that will resist future weather, disease, and predator challenges	Ability to secure more timely data from the food industry to pre-empt impending crises Inter-generational sustainability of farming communities Targeted application of subsidies and incentives Cultural reduction in wasted food through the value chain Support in a crisis (food banks) for those most in need	More balanced and sustainable diets in the population, with a lower consumption of meat Sustainable balance between sourcing from UK and foreign markets for key foodstuffs Improvement in long-term soil and ecosystem health in the UK Equitable payment systems across the food production and distribution value chain Minimal price spikes and notable supply shortages
Smart city development	Failure to deliver programmes that successfully and safely integrate multiple advanced technologies to benefit inhabitants, businesses, and the environment	Planning failures and funding gaps, weak business cases, lack of contingency preparedness Technology integration and interoperability issues, cybersecurity lapses, governance challenges Community mistrust, stakeholder misalignment, shortage of skilled workforce	Clear ambition, tangible objectives, strong business case, and clear innovation approach Robust specification of the development ecosystem, including providers, suppliers, and sources of investment Well-specified and monitored data ownership, processing, and data protection arrangements	Viable skills strategy for the execution of extended projects Maintenance and upgrade commitments by key providers Rigorous cybersecurity arrangements to accommodate expanded and interconnected attack surfaces Backup and workarounds in systems to address contingencies	Appropriate investment incentives and mandates for cross-business collaboration Compatibility standards to support the integration of legacy and new systems Demonstrable alertness to emerging and evolving risks and testing of crisis arrangements Widespread and repeated stakeholder consultation to build trust	Equity of rollout and enhancement of community adoption Improvement in key metrics relating to economic productivity, sustainability of infrastructure and lifestyles, and population well-being

GENERATING INSIGHT

Different evaluation methods support a lens-based approach to resilience measurement. Deployed in creative combinations, they can examine arrangements for dealing with current challenges, stress situations, and expected future needs.

1. EVALUATION METHODS

The lenses help specify what should be explored in order to understand the quality of our resilience arrangements, the effectiveness of our strategies, and whether enough is being done. But that still leaves the question of how evidence will be collected and analysed in a way that supports decision-making.

To that end, this chapter explores different ways of assessing resilience, clustering them in three categories (see Exhibit 8):

- **Intrinsic**: Securing an understanding of existing systemic interconnections and a view of different future contexts
- **Indicative**: Using different types of anchor to get a baseline view of the appropriateness and quality of existing resilience arrangements
- **Investigative**: Examining efficacy, performance, and value in a more rigorous way, especially when leveraging analyses from the other categories

Further details on these approaches, their value for the lenses detailed in the previous chapter, and specific considerations for deployment are set out in the sections below.

Exhibit 8: Measurement approaches

INTRINSIC	INDICATIVE	INVESTIGATIVE
Dependency Mapping Identification of interconnections and cascading impacts	**Standards and Benchmarks** Guidance based on points of reference and thresholds	**Performance Reviews** Synthesized evaluation of resilience efforts in practice
Foresight and Scenarios Anticipation of possibilities and drivers of resilience	**Surveys** Stakeholder perception of risk, impact, and response	**Cost-Benefit Analyses** Assessment of value for money
	Exercises Test of existing capabilities during simulated shocks	

2. INTRINSIC

2.1 Dependency mapping

Value: Mapping the linkages and connections between different assets, flows, and systems helps uncover vulnerabilities and potential critical points of failure, enabling a more systemwide view of resilience needs. These exercises help set a foundation for measuring resilience more accurately and holistically, which is critical for ensuring the robustness and reliability of assets and capabilities both now and in the future. The work can inform the prioritisation of investment, guide the establishment of protections and backups, and provide a systematic basis for building complementary competencies.

The process of identifying dependencies within and across networks also helps improve coordination and mobilisation — for both asset-based and people-based solutions. Outputs provide tangible examples and use cases for cross-departmental and cross-sector engagement, enabling more intentional and effective communication and discussions about risk-sharing arrangements.

Considerations: Dependency mapping should look beyond the physical linkages between critical infrastructure assets and systems. It's important to account for cyber-based interconnections, where industrial control systems and other vital operations can be infiltrated, manipulated, and disrupted by malicious actors or technology failures. Other key dependencies include supply chain commonalities (including providers abroad) and the people-based connective tissue between different organisations, which may affect service standards in a crisis. Indeed, it's important to appreciate how cross-organisational and cross-sectoral dependencies change between times of calm and during emergencies.

Adopting a broader view, events such as natural disasters or war can compromise supplies from affected regions, on which key infrastructure or industries might rely. In a different way, localities that are dominated by a single business depend on the strategic and financial health of that company for employment and the viability of ancillary enterprises, and the collapse of that business will have cascading impacts on the community and the local economy.

2.2 Foresight and scenarios

Value: By examining how key trends might develop and interact and result in alternative futures, foresight and scenarios work is helpful for exploring the dimensions and potential gravity of the future risk landscape (including the evolution of emerging risks) and the associated vulnerabilities.

It's therefore useful for testing the ambition and validity of resilience strategies and for spurring better and earlier decisions about building preparedness and responsive capabilities. These might include the establishment of stockpiles and supply alternatives, the enhancement of emergency service provision and insurance capacity, and the development of new partnerships. The work also helps major investments to be planned, structured, and financed in a phased manner.

Considerations: Developing scenarios relevant for multiple time horizons is crucial. While shorter-term scenarios help planning for fast-onset events such as cyber outages, energy crises tend to play out as short-to-medium term emergencies, while slow-burn challenges such as declining water availability and food insecurity need to be planned for against longer time horizons.

Detailed risk scenario definition enables the anticipation of cascading impacts, an assessment of the adequacy of existing mitigations, and the timely identification of resilience solutions — albeit acknowledging that future realities will inevitably diverge from what has been envisaged. For risks that may be emerging, foresight exercises can spur further investigations, prompt the establishment of clearer responsibilities and authorities, and initiate business case development for enhanced or new capabilities.

The work should also help identify opportunities for improved information sharing between different parts of government and across critical sectors. The Data & Analytics Facility for National Infrastructure CReDo project uses information shared between different operators to create digital twins that help assess climate resilience across different scenarios.[33] Other projects may signal the need to develop information campaigns and strategic conversations with communities about actions they may need to take or that government will take.

3. INDICATIVE

3.1 Standards and benchmarks

Value: Standards and benchmarks are most useful where clear targets or thresholds can be set, monitored, and reported on — especially those that are underpinned by hard data. For example, they are useful for monitoring the reliability of critical infrastructure and services, the achievement and preservation of designated storage or stockpile levels of critical goods, levels of compliance with key procedures, and the availability of human resources or capabilities in different critical services.

Well-articulated standards make expectations tangible, and well-chosen benchmarks become accessible proxies for critical issues that need to be explored. Standards can provide a yardstick for assessment and act as a basis for assurance; used in this way, they can support views of organisational maturity and the condition of arrangements for coordinating and mobilising different groups of contributors to national resilience. When used for examining impacts, benchmarks provide baselines for reviewing changes in community, business, and national economic resilience in both benign and challenging times, the differentiated impact of contingencies across the country, and the equitability of support provided.

Considerations: The more multidimensional and complex the topic, the harder it is to articulate a standard and the more necessary interpretive flexibility becomes. Under these circumstances, expectations (in the form of "must" versus "should" versus "could") are generally weaker, making it harder to measure performance.

Similarly, standards may fall short where risk situations and/or industrial change are evolving rapidly. Reliance on them jeopardises over-focusing on the present and the past at the expense of the future, and a failure to update standards fast enough can engender a false sense of security. Conversely, continual changes to standards can trigger frustration and pushback.

Additionally, although some standards (such as manufacturing) focus on interoperability across systems, resilience standards are often aimed at organisations and assets — where there is a clearly defined responsible owner. As a result, they often struggle to factor in systemic interdependencies — where responsibilities may be shared or blurred.

3.2 Surveys

Value: Surveys are well suited for getting a pulse check on state-of-mind topics that can shift quickly and are difficult to capture through other approaches. They can indicate how well people understand critical risks and levels of resilience, the factors that drive them, and their views on whether government or others are doing enough to address them. They can also help identify local risk concerns and preparedness priorities, and surface interest in volunteering opportunities that might enhance local resilience.

Additionally, response data can yield intelligence on the well-being and coping capacity of communities in crises; more broadly, they can indicate levels of social cohesion and trust in government.

Considerations: Longitudinal surveys and those that permit demographic or sectoral breakdowns (such as the UK Longitudinal Household Survey) are particularly useful for comparing different views over time and between locations. Sometimes this can help anticipate crisis impacts and contribute to an understanding of response strategy effectiveness.

Although surveys are useful for obtaining simple data quickly, they are less suitable for complex topics where there may be varying levels of comprehension of the topic or different understandings of the questions. Surveys are of course susceptible to cognitive biases and heuristics that may generate skewed answers, however well-crafted the questions.

When assessing resilience gaps, survey data are often most valid when triangulated with intelligence from interviews, focus group discussions, and hard data.

3.3 Exercises

Value: Whether discussion-based walkthroughs, tabletop simulations, or full-scale live rehearsals, exercises help validate plans, develop competencies through practice, and test procedures. With an operations focus, they can examine the strength of business continuity provisions; more strategically, they can explore the likely effectiveness of workaround and backup resources for supply-based interruptions. They can also examine how speedily capabilities might be brought together and ramped up in a crisis.

Exercises can also examine the process, quality, and speed of decision-making and execution at all levels. When involving participants from different organisations, they can test quality of intelligence sharing, communication, and interactions, and the speed of mobilisation. Exercises can validate other training and education efforts.

Considerations: Exercises can be used to establish benchmarks (for example, response times), which can serve as a baseline for similar exercises in other places, acknowledging different circumstances. However, post-exercise reflections should focus not just on physical impacts and the performance of participants but also on the impacts and consequences for affected parties through the simulated crisis and into the recovery phase.

Local Resilience Forums already bring together sectors to run exercises on controlling major accident hazards and managing localised flooding events. However, private-sector engagement is rarer in larger exercising efforts at the national level. Further inclusion of the private sector in periodic scenario-based tabletop exercises would help check the appropriateness of critical preparedness and incident response arrangements.

Somewhat separately, data on the take-up of online tools such as the "Exercise in a Box" from the National Cyber Security Centre might indicate levels of awareness of different forms of cyber risk and the willingness of organisations to be more prepared.[34]

EVALUATION AND THE LENSES

The seven evaluation methods provide varying support for each of the lenses. An illustration of their differentiated value is shown in Exhibit 9.

Exhibit 9: How the evaluation methods support the four lenses

		Powers and Governance	Assets and Capabilities	Coordination and Mobilisation	Goals and Outcomes
Intrinsic	Dependency mapping	Medium	High	High	Medium
	Foresight and scenarios	High	High	Low	Low
Indicative	Standards and benchmarks	Medium	High	Low	Medium
	Surveys	Low	Low	Medium	Medium
	Exercises	Low	Medium	High	Low
Investigative	Performance reviews	High	Low	Medium	High
	Cost-benefit analyses	Low	High	Medium	High

High Medium Low

4. INVESTIGATIVE

4.1 Performance reviews

Value: Analysing how well systems and arrangements have withstood or responded to distinct challenges informs a view on their fitness for purpose and helps justify the case for improvement.

Some reviews help by assessing progress against key resilience strategies — the achievement of declared milestones and the recording of broader contextual change that might require an adjustment of priorities or pace of delivery. Others report on the degree to which critical infrastructure operators and emergency service providers have met core service and regulatory standards over a defined period. A third group examines how particular crises arose and played out, and the extent to which those with responsibilities for preparedness and crisis management could have discharged their duties more effectively, both individually and in collaboration with others.

Considerations: Confidence in the scope, integrity, and quality of the review is paramount. Narrow terms of reference may stunt inquiries; those that are very broad may yield thin results, especially if time and resources are constrained. Diverse inputs, with appropriate freedom of expression, transparency, and challenge are vital, as is the independence of the review team and board.

Swift reviews of a crisis provide opportunities for immediate action; these can be complemented by more detailed reviews at a later date when there is often a greater perspective on events. Opportunities to learn from reviews in different sectors or the experience of different countries should be taken.

4.2 Cost-benefit analyses

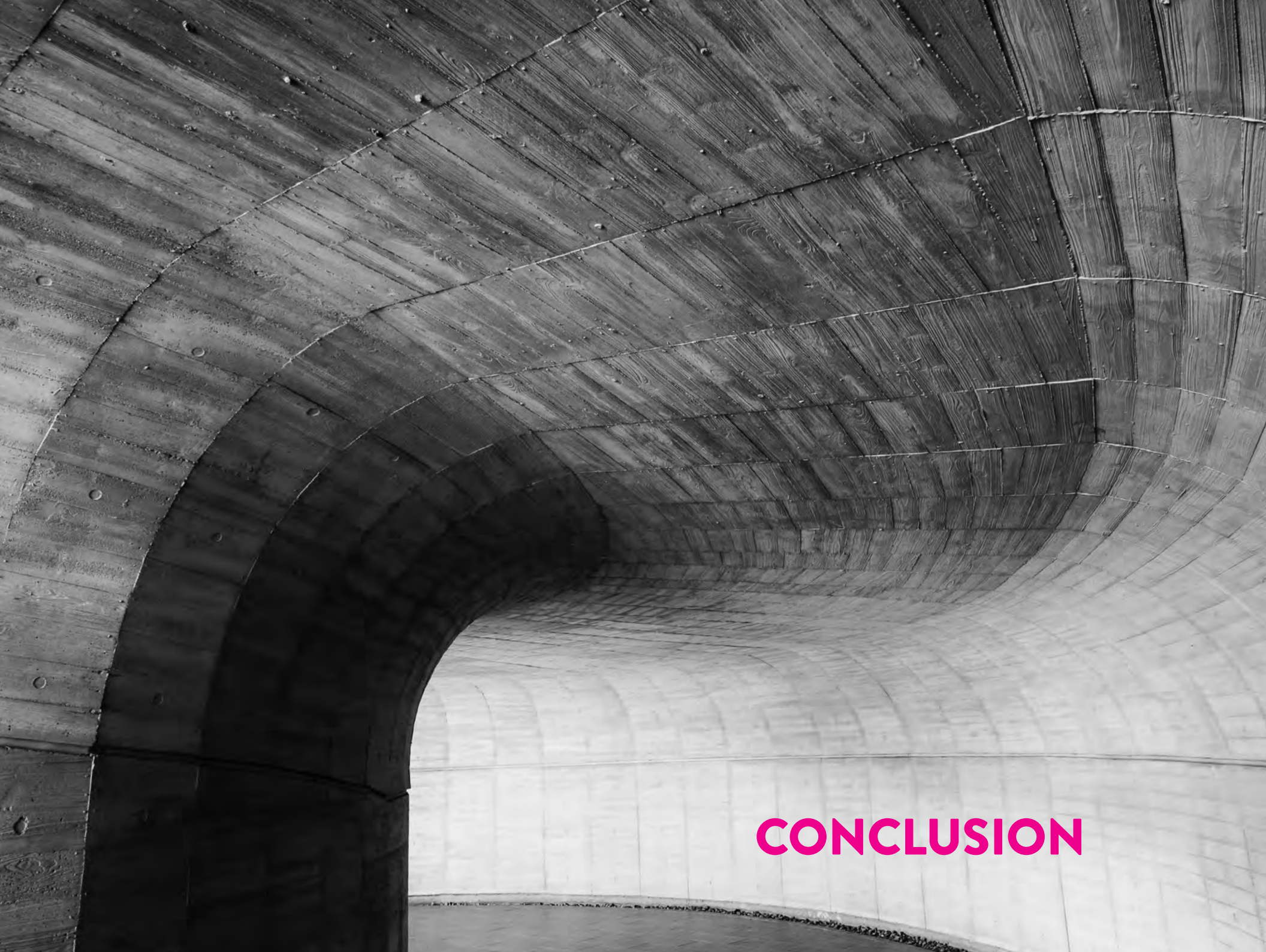
Value: Cost-benefit analyses are the foundation of strategic expenditure prioritisation exercises, the formulation of specific funding bids, and the evaluation of policy or project design trade-offs.

Ex ante, they enable some comparison of intervention options (or no action) both within the context of a single imperative and across different policy agendas. Ex post, they support value-for-money exercises by examining the efficiency of resource deployment and the effectiveness of the outcome.

Considerations: While assessments can support needs-based planning, they need to appreciate how risks may grow over time and what is required to cumulatively build local and systemic resilience through adaptive planning. Analyses that suggest a "just-enough", "just-in-time", or "just here" approach to investing may not yield lasting, timely, or pervasive results.

It's vital to factor in the broader societal and economic benefits from investments — and the cost of inaction. Using the example of flooding, assessments that focus on property damage and ignore economic activity, societal health, and impacts on nature may underestimate productivity erosion and lead to decisions that exacerbate social and regional inequalities. Given the frequent underestimation of major project costs, Green Book provisions for uplifting forecasts could be broadened from infrastructure investments to other sectors and types of intervention. Determining an appropriate discount rate is also critical in ensuring that benefits aren't under or overplayed.

Moreover, analyses that are clear about the fundamental risk or challenge faced, the costs and benefits of the planned intervention, and the associated project risk can better form a view on systemic impacts and externalities. This is a good starting point for negotiations on cost and risk-sharing arrangements for key initiatives and thus the specification of incentives where appropriate.



CONCLUSION

Resilience is notoriously hard to measure — even just capturing in one framework the different components of national resilience is not easy and open to contest. But the fact that the effort is conceptually intricate is no reason to shy away from it. Indeed, the gravity of the challenges and risks we face demand that we keep asking whether we are sufficiently well organised in our resilience arrangements, whether our efforts are deployed in the right ways, and whether, in aggregate, we are doing enough.

This report suggests that those tasked with developing national resilience frameworks and measuring progress against them should embrace seven principles:

1. Take advantage of the overlapping interests of national resilience, national security, and national sustainability agendas, but acknowledge where those agendas compete and conflict

2. Appreciate that context is critical as the presence of concurrent challenges, local situational differences, and the evolution of risks over time will greatly inform levels of resilience

3. Take a systemic view of resilience — one that recognises different stakeholder capacities and capabilities, the criticality of certain service providers, and the nature of key influences and interdependencies

4. Adopt both risk-specific and risk-agnostic methodologies since either approach alone may result in blind spots or missed opportunities

5. Recognise that resilience takes many different forms and that imperatives differ through the life cycle of a risk, with different initiatives and behaviours required for preparedness, in-crisis response, and recovery

6. Supplement understandings of resilience that is sufficient for present-day normality with assessments of likely performance under plausible near-term stress events and the distinct needs relating to longer-term future scenarios

7. Note that conclusions about "acceptable" levels of risk and "adequate" levels of protection are inherently subjective and governed by personal experience and political perspective, among other factors

In accommodating these principles, the framework presented in chapters two and three is consciously broad in scope and high-level in nature. The lenses and evaluation methods are intended less as a comprehensive solution and more as touchpoints and resources to be used for assessing whether proposed measurement projects are sufficiently strategic and whether the right issues are being covered and examined in insightful ways. They are a starting point for adaptation.

In the final reckoning, improvements in the measurement and monitoring of resilience should encourage more effective governance, more astute decision-making, and more targeted investment. A deeper understanding of where we are strong and where we remain vulnerable — mindful of what the years and decades ahead might bring — will help us act in a timely and determined manner to position the UK for future crises, whatever form they take.

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