

About Future Resilient Systems

The Future Resilient Systems (FRS) programme was set up in 2014 to address the challenges of increasingly interconnected and complex infrastructure systems. FRS brings together an interdisciplinary team of researchers to develop a framework, concepts, and tools to make interconnected infrastructure systems more robust and resilient.

FRS is the second programme of the Singapore-ETH Centre, established by ETH Zurich – Swiss Federal Institute of Technology and the National Research Foundation (NRF) of Singapore, under the NRF's CREATE programme.

www.frs.ethz.ch
info@frs.ethz.ch

CREATE **ETH** zürich
Centre for Research Excellence and Technological Enterprise

A Guide to Assess and Build Resilience

How to Use the 10 Questions?

- Develop a joint view and a joint meaning of resilience issues across experts, stakeholders, and citizens by walking through the 10 questions
- Characterise and understand the relevant resilience issues for a system under consideration by using the 10 questions as a guide
- Identify and describe gaps across the 10 resilience functions that call for action in a public setting by integrating scientific evidence, public perceptions, and perceived knowledge gaps
- Transform resilience issues into objectives, constraints, and designs solutions, followed by the selection of a preferred action and a proposal for implementation
- Communicate within workgroups and organisational units and to the public to reduce information asymmetries, to build trust, and to foster joint understanding and purpose

The Future Resilient Systems' approach is based on an integrative socio-technical point of view, considering that infrastructure systems are made up of:

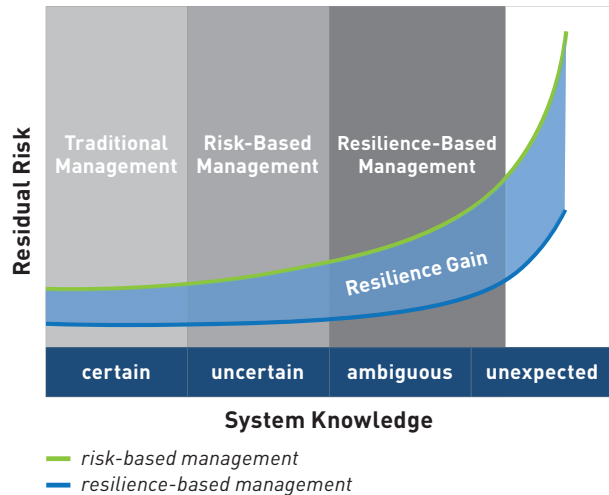
- Engineered systems
- Operating organisations
- Users of the services

Why Build Resilience?

The functioning and well-being of modern societies highly depend on the services provided by networks of critical infrastructure systems, such as power, transport, water, communication, and emergency systems.

Rapid urbanisation has been the driver for the increasing spatial density of assets and the growth of interconnectedness within and between systems. At the same time, uncertainties in environmental and geopolitical systems have been increasing, pushing the world we live in towards increased ambiguity and unexpectedness.

The increasing value at risk, the fundamental change of behaviour of interconnected systems, and the increased ambiguity and unexpectedness of our social and natural systems will result in disruptions of higher magnitude. These call for a novel approach. Resilience-based management provides a framework to cope with this challenge and is expected to reduce residual risk considerably.



Resilience originates from the Latin word 'resilire' – to spring and rebound

"We cannot solve our problems with the same thinking we used when we created them"
- Albert Einstein

10 Questions to Assess and Build Resilience

- 01** What is a system's ability to resist strain within acceptable limits of degradation?
- 02** What is a system's ability to restabilise its key functions?
- 03** What is a system's ability to rebuild its functions up to a sufficient level of performance?
- 04** How can a system reconfigure the flow of services and change its biophysical topology to become more robust and fault-tolerant?
- 05** How can we improve the system's capability to cope with unexpected disruptions?
- 06** How to acquire and remember emergency response capabilities that significantly reduce degradation?
- 07** How to maintain people's awareness over a long term?
- 08** How can we best detect or anticipate unexpected critical events or regime shifts?
- 09** How can we best remember (store and retrieve) actions that successfully dampened past critical events and mitigated regime shifts?
- 10** How can individuals and organisations continuously learn and adapt their behaviour to increase their capability to cope with unexpected events?