



Resilience – definitions, concepts and measurement

This document summarises a literature review which examines key definitions, concepts and measurement approaches about 'resilience'.

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Highlights

This literature review:

- is motivated by growing interest in 'resilience' due to recent events such as the COVID-19 pandemic and Cyclone Gabrielle, in combination with trends like climate change
- examines key definitions, concepts and measurement approaches about resilience
- is focused on resilience in an economic context
- finds that:
 - resilience is about dealing with shocks, disturbances and (some argue) long-term trends
 - definitions and concepts about resilience are not yet settled, the study of resilience is highly context-specific, and resilience concepts seem hard to operationalise and measure in practice
 - despite these challenges, resilience *is* a useful concept, as it makes us think carefully about the nature of disruptions or shocks and how they affect the relevant system, how the system responds to these disruptions or shocks, and the essence of a system that needs to be maintained through time
 - in particular, the evolutionary perspective of resilience is seen as valuable in an economic context. This perspective emphasises the capacity of a system to adapt and fundamentally change over time in the face of numerous disturbances and shocks. This seems helpful when dealing with long-term challenges like climate change and with unexpected shocks and areas of deep uncertainty
- implies that, rather than aspiring to control change in systems assumed to be stable, policy should aim to manage the capacity of systems to adapt to change.



Background

Policymakers worldwide have long asked what makes one country or economy more resilient than another, or one region, industry or sector more resilient than another. Resilience seems particularly relevant to a small, open economy like Aotearoa New Zealand, with limited influence on the world stage, and prone to earthquakes and other natural hazards.

Recent events such as the COVID-19 pandemic, the Russian-Ukrainian war, and Cyclone Gabrielle have brought resilience to the fore, as these shocks have disrupted supply chains, food security and other activities, and affected the lives and wellbeing of many New Zealanders. These shocks, in combination with trends like climate change, have led to a heightened interest in resilience.

If policy work aimed at improving resilience is to be effective, policymakers need to be clear about what they mean by, and how they understand, 'resilience'. This was the motivation for our literature review which examined definitions, concepts and measurement approaches about resilience. The full paper is at www.mbie.govt.nz. The review mainly focused on resilience in an *economic* context, but also drew on insights from other disciplines where relevant. The ultimate purpose is to contribute to understandings of resilience as a backgrounder for policymakers and others interested in the topic.

Resilience definitions

Resilience is about dealing with 'shocks' (unexpected large-scale events) and other disturbances.

Definitions of resilience can include the following elements:

- **Bouncing back** – a system's speed of recovery or return to its pre-shock position. This emphasises efficiency, constancy and predictability in the face of a disruption or shock.
- **Absorbing shocks** – how much disturbance a system can take and remain within critical thresholds. This raises questions about how much reorganisation is permitted for a system to be regarded as having 'absorbed' the shock.
- **Positive adaptability/bouncing forward** – learning, adaptation, and preparation for future shocks. This emphasises continuity and change in self-organising systems subject to internal or external perturbations, and the capacity of systems to adapt to such pressures.
- **System transformation** – fundamental reorientation of a system in anticipation of, or in response to, shocks. This assumes that the scale or nature of a shock is such that the very viability or sustainability of a system is brought into question.

However, definitions are not yet settled, and many alternative definitions are available. Importantly, tensions across definitional elements can affect the interpretation of resilience studies. One tension is the degree of change a system can undergo for it to be deemed 'resilient'. For example, the first two elements above generally see the retention of a system's structure and function as a goal of resilience, whereas this is not the case for the final element or possibly even the penultimate one.

Partly because of the lack of agreement around definitions, some question the usefulness of resilience as a concept. An alternative view is that resilience *is* a valuable concept, as it can aid understanding about the ability of a system to cope with challenges and change. Resilience makes us think about the essence of a system and what, if anything, needs to be maintained through time, reflecting factors such as what societies value now and in the future.



Resilience concepts

Equilibrium and evolutionary perspectives

Resilience concepts can broadly be grouped into two schools of thought or perspectives – equilibrium and evolutionary.

Equilibrium-based theories of resilience emphasise the return to a single previous state or equilibrium following a shock, or the shift to alternative multiple equilibria. This perspective is valuable in contexts like engineering which is concerned with consistent non-variable performance in which slight departures from the performance goal are immediately counteracted. Maintaining consistent performance seems important when considering the resilience of things like bridges, aircraft, nuclear reactors and so on.

Evolutionary-based theories emphasise the capacity of a system to adapt and fundamentally change over time in the face of numerous shocks and disturbances. This view sees resilience as a dynamic process, not just a characteristic or property. The aim is to maintain the long-run health of the system.

The table below summarises some of the main concepts and ideas about resilience, grouped under the equilibrium and evolutionary perspectives.

Table1: Equilibrium and evolutionary perspectives of resilience		
	Equilibrium perspective	Evolutionary perspective
Basic concept	Emphasises the return to a single previous state or equilibrium following a shock or the shift to alternative multiple equilibria	Emphasises the capacity of a system to adapt and fundamentally change in the face of numerous shocks and disturbances
Definitional elements	Bouncing back Absorbing shocks	Positive adaptability/bouncing forward System transformation
Main fields of use	Engineering, ecology (re absorbing shocks), economics (mainstream)	Psychology, socio-ecological systems, economics (evolutionary, ecological)
The resilience of what?	Tends to take a fairly narrow view eg regional employment	Tends to take a systems view eg ecological systems, regional economic systems
To what?	Examines a single shock eg recession Tends to view shocks in a negative light	Examines multiple shocks, disturbances and long-term trends eg climate change Tends to view shocks as a learning opportunity
By what means?	Risk mitigation, impact absorption, recovery	Resilience is a long-term <i>process</i> including ongoing adaptation and learning
With what outcome?	Return to the original pre-shock state – the system structure and function are unchanged Avoiding the shock altogether	Long-run performance or health of the system (which needs to be defined) – the system structure and even function may change The survival of the system
Measurement approaches	Approaches that focus on single shocks Indicators of time to recovery and avoidance of losses, and models of how long it takes for a shock to dissipate, or where a system would have been in the absence of a shock	Approaches that take a long-term, systemic view System dynamic models, case studies, mixed methods, indicator frameworks, and other methods to gain a broad picture of system performance in the long term

Source: Author based on various studies included in the paper



Many authors contend that evolutionary-based theories are more useful than equilibrium-based ones for studying the resilience of economic systems. The line of reasoning includes that the likelihood of economic success being sustained over the long term crucially depends on an economy's ability to adapt to changing circumstances and adjust to external shocks as and when these occur.

Some concepts from te ao Māori seem to broadly align with the evolutionary perspective of resilience. For example, kaitiakitanga (sustainable guardianship and protection) resonates with the evolutionary perspective's goal of maintaining the health of a system in the long term. Māori also tend to see the natural world as inextricably linked with human wellbeing, per the evolutionary perspective. Note, however, that Māori hold wide-ranging perspectives on the topic of resilience.

The resilience of what?

Despite the grouping of resilience concepts into the two broad perspectives above, the study of resilience is highly context-specific and begs a four-part question: *resilience of what, to what, by what means, and with what outcome?*

Regarding *resilience of what*, the first thing to clarify is what it is that needs to be resilient. 'System' is often used as a generic term for this entity, especially in relation to evolutionary-based theories of resilience.

Regarding *economic systems*, resilience can take place at three broad levels:

- Microeconomic – individual behaviour of businesses, households, or organisations.
- Meso-economic – economic sector, individual market, or cooperative group.
- Macroeconomic – all units and markets combined, including interactive effects.

The unit of analysis in studies about the resilience of economic systems can therefore be people, businesses, communities, regions, countries etc.

To what?

Resilience is concerned with the effects of shocks, disturbances and other perturbations. Understanding the nature and causes of these shocks is central to studying resilience.

Much of the focus of resilience studies is on sudden, 'out-of-the-ordinary' events like recessions or natural disasters. These events tend to be seen in a negative light. Some (but not all) authors also include 'slow-burn' pressures that cumulate over long periods of time, such as climate change, technological change and other long-term trends. These slow-burn pressures and trends are often highlighted in the context of the resilience of rural communities facing decline.

Ideally, the study of resilience involves considering these various pressures in combination and over the longer-term, per the evolutionary perspective. In fact, an evolutionary perspective tends to see shocks and disturbances as a learning opportunity and as a means of improving resilience.

By what means?

There are many different concepts about the determinants of, and/or strategies or actions to improve, resilience. These strategies tend to be context-specific. Important contextual factors include both the type of system or entity that needs to be resilient, and the nature of the shock or disturbance. However, it is possible to identify some common threads by looking across different concepts about resilience strategies.

Resilience is often seen as a process. Pre-disruption strategies include planning and prevention, strategies during the disruption include mitigating and absorbing the disruption's effects, and post-disruption strategies include recovering and learning in preparation for future disruptions. For



example, in the context of resilience to supply chain disruptions, pre-disruption strategies might include ones about preparedness, such as holding strategic reserves, storage, and internal stock. Strategies during the disruption include information-based ones, such as having a detailed view of supply chain inventories and other supply chain parameters and sharing information. Recovery strategies post-disruption might include ones about re-structuring supply chains, such as re-shoring, back-shoring, near-shoring, and localising.

Resilience strategies that span many different contexts include:

- Variety – draws on Darwinian theory which stresses the role of variety in species in enabling them to adapt to changing environments.
- Dispersity – refers to the distribution of important system components and functions over space, scale, and time.
- Redundancy – involves intentionally duplicating critical components or functions of a system.
- Optionality – involves building options which can be exercised as more information comes to light.

Various ‘capitals’ or assets are often seen as sources of resilience, especially in the context of regional and community resilience. These capitals include financial, human, natural, physical, political, and social capital. Resilience based on capitals essentially revolves around the idea that the more resources from which a community is able to draw, the greater its resilience. In New Zealand, these ideas are picked up in Treasury’s Living Standards Framework – a wellbeing framework predicated around the concept that New Zealand’s wealth (capitals) can be used to improve current and future wellbeing. As well as wellbeing, wealth or capitals can enhance resilience.

The role of governance and institutions also features prominently in many theories about regional resilience. This reflects the role of human agency and decision-making in social systems; community resilience is not just a matter of the amount and type of resources that communities have at their disposal, but also the awareness of and effective use of those resources. This might involve developing a collective and forward-looking position on how to survive disruptive shocks, and determining the ultimate goal of resilience or what is important in terms of the long-run performance of a regional economy. This local effort needs to be supported by central government, especially in regions that lack the necessary resources and capabilities.

With what outcome?

The desired outcome in equilibrium-based views of resilience is a return to the pre-disruption state following a shock or avoiding the shock altogether. However, critics of the equilibrium view argue that the desire for a return to ‘normal’ risks a lack of questioning of what normality entails. One oft-cited example is the 2005 Hurricane Katrina. The hurricane not only destroyed the physical fabric of New Orleans, but also revealed social processes which residents did not find acceptable, and a pre-disaster normal to which they did not want to return.

The evolutionary perspective of resilience sees the long-run performance, health or integrity of the system as the desired outcome of resilience. Importantly, ‘performance’ and ‘health’ need to be defined for resilience work to be useful. The survival of the system is also generally seen as a desirable outcome based on the evolutionary perspective. Otherwise, little else is assumed – or deemed as desirable – to remain the same.



Approaches for measuring resilience

Unsurprisingly given the ambiguity around resilience definitions and concepts, there is a lack of agreed approaches to measuring resilience. While many different approaches are available, the concept seems hard to operationalise in practice. This implies that care should be taken when interpreting resilience studies.

In general, the measurement approaches used in studies about economic resilience tend to be equilibrium-based ones – they assume some sort of ‘return to normal’ following a single shock. Indicators include time to recovery for the relevant variable, and avoidance of losses following the particular shock.

The evolutionary perspective of resilience, while valuable, is hard to measure as it requires a long-term, systemic view of system performance. *Assessing* the resilience of a system, by drawing on a range of different data and methods, seems to be more useful and practical than *measuring* resilience via a single metric or model.

Encouragingly, studies of rural resilience and other aspects of resilience in New Zealand have tended to use mixed methods approaches and to take a long-term view, per the evolutionary perspective. Other New Zealand studies, while not labelled as resilience ones, have examined the nature and effects of specific shocks.

Conclusions

Resilience is a valuable but contested concept. The study of resilience, with its focus on shocks and disturbances, can shake up our thinking and make us question some of our basic assumptions and measures of success and failure. In particular, studying resilience makes us question what aspects of a system should be maintained through time, and ultimately makes us think about the long-term viability of an economic system.

The evolutionary perspective of resilience, which takes a long-term, systemic view, and encompasses various shocks and disturbances, is generally seen as the most valuable in an economic context. This reflects that it is very hard to predict where the next shock will come from, and that different economic systems may deal with some types of shocks better than others, so focusing on the adaptability and long-run health of a system seems useful.

One insight from the evolutionary perspective of resilience is that, rather than aspiring to control change in systems assumed to be stable, policy should aim to manage the capacity of systems to adapt to change. In the context of regional resilience, building such capacity might involve developing strong local governance arrangements and institutions supported by central government policies, as well as making effective use of the region’s resources. Also important is local communities identifying for themselves what matters to them in terms of the long-term economic performance of their region. Insights from te ao Māori and kaupapa Māori may be instructive in developing such a long-term, collective view.

Read the full version of the paper at www.mbie.govt.nz or call us on 04 901 1499.