



RISK & RESILIENCE IN THE BUILT ENVIRONMENT

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Melbourne School of Design and Faculty of Science

Briefing #2

METHODS & TOOLS

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Much of Australia is vulnerable to natural hazards – drought, fire, flood, storm or sea-level rise. There's a dangerous and growing combination of climate change, urban change, technology hazard and community fragmentation. While the techniques for risk reduction are better than ever, the physical challenges are greater, and the social fabric is stretched further. We need to understand the dynamics of 'resilient communities' in the face of these complex and increasing challenges.

2 SYNERGISTIC MAPPING

Briefing paper #1 provided an overview of the Risk and Resilience Programme. The next step is to apply the synergistic thinking and toolkit to the challenges of a Risk and Resilience-III.

Present day risks emerge in a world which is more and more inter-connected, and tend to be more global, existential, systemic and endemic. We urgently need ways to look beyond linear type risks, beyond the boundaries of scientific fields, professional skills and government mandate. Synergistic thinking allows a way to deal/cope/work with the inter-connectedness of risks through the Mode-I, Mode-II and Mode-III framework.

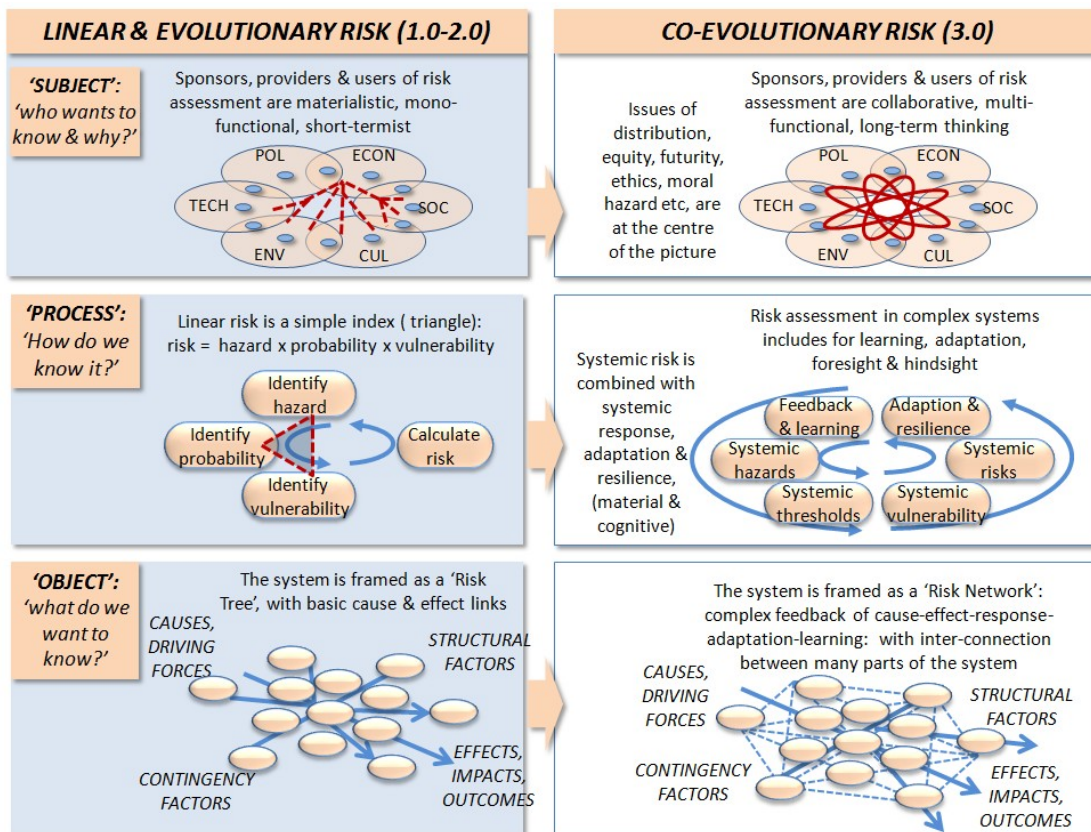
Figure 1 shows on the left side the Mode-I 'linear' and Mode-II 'evolutionary' risk model: while on the right hand side is the Mode-III 'co-evolutionary'. At the upper layer is the 'subject' ('*who wants to know & why?*'), in the middle is the process ('*how do we know it?*'), and at the lower layer is the object ('*what do we want to know?*').

A mode-I linear model of risk looks at how far 'A causes B', calculates the risk as 'impact x probability', or the risk triangle: '*Risk = hazard x exposure x vulnerability*'.¹ We insert the best available numbers, then design one-off fixes for each risk, calculate the benefits over costs, and then set a list of priorities for action. If numbers aren't forthcoming then we get 'high-level' expert panels to produce multi-criteria star ratings, which is how the National Risk Assessment works in the UK and elsewhere. If we scale up to the global level, then the numbers hang together as statistics, enough to fine-tune the insurance sector calculations and write the global risk reports.²

For the 'subject' of a linear type risk assessment, on the upper left hand side, the sponsors, providers and users of such information are mono-functional and short-termist: flood defence would be the immediate task, but with no other interest in the community. In contrast, the co-evolutionary 'subject' on the right hand side, shows how issues of distribution, equity, futurity, ethics, moral hazard and other human concerns are at the centre of the picture. The sponsors, providers and users of these assessments are collaborative, multi-functional, long-term thinkers: the risk depends not only on the 'hard' defences but on the responses from local businesses, schools and communities.

For the 'process' (on the middle layer), the linear version on the left shows how risk is framed as a simple index of the 'risk triangle', calculated from the cause-effect type event trees, in a straightforward 'Mode-1' kind of learning. In contrast, a synergistic and systemic risk method, as on the right hand side, is combined with systemic response, adaptation and resilience, both material & cognitive. The risk assessment includes for learning, adaptation, foresight & hindsight: the knowledge path is more like the organizational learning framed as 'Mode-2 or Mode-3'.³

Figure 1: risk models: from evolutionary to co-evolutionary



For the 'object of enquiry' at the bottom layer, on the left is a conventional linear type risk tree. For instance, there are storms upstream, so the river overflows, houses or businesses are flooded, some being prepared but others not, with total damage caused to the value of 'X'. We can enquire into contingencies and details such as the locations of blocked drains, or whether the river wall is maintained: or we look more towards of the context, for instance (in the UK floods of 2007), governance which isn't trusted, or organizations which can't communicate.⁴ But so far, these are just discreet factors each on its branch of the risk tree.

In contrast on the lower right, is a 'risk network', or even a 'risk constellation'. Here many more things are interconnected, in a more complex web or tapestry of cause and effect. This can be about both material issues and cognitive factors. For example, maybe the drain was blocked, as an indirect result of a declining neighborhood: or the upstream catchment was more prone to flash flooding, due to perverse incentives in farm subsidies.

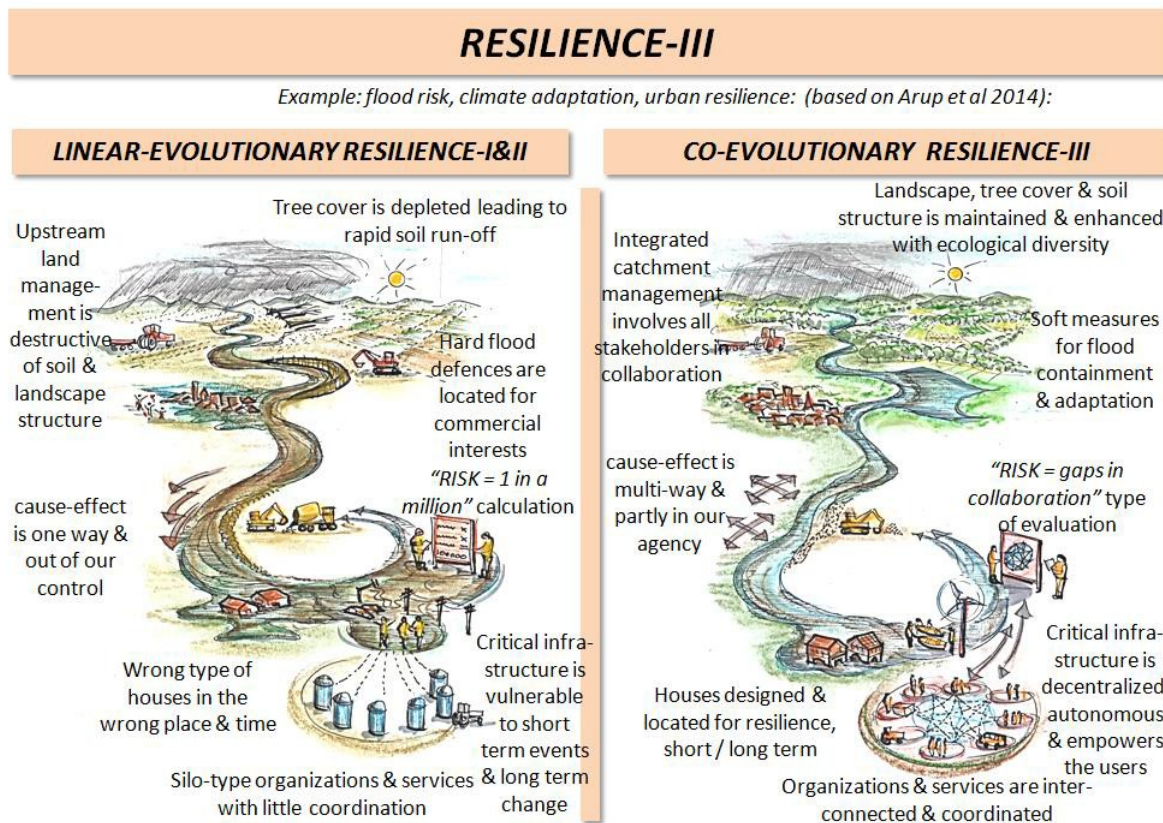
This is where risk assessment overlaps into resilience strategy. The reality of climate change impacts, is more than a technical equation, it's a complex set of systems and relations. People's attachment to 'home' and 'place' seems to override technical calculations or policies on flood or fire risk.⁵ Such factors seem to compound each other, in self-reinforcing feedback: this is not only material (the height of a flood wall can be a tricky question) - but more cognitive and collaborative (how organizations learn and communicate, or not).

To understand and work with this extended reality we have to look at whole systems not just the parts. Figure 2 shows this in cartoon form. On the left, a linear / evolutionary model of low resilience: farmers destroy the retentive capacity, engineers design flood walls which send the waters downstream, houses are in the wrong place with the wrong design and government is organized in silos which don't communicate. On the right, a synergistic community of farmers, foresters, engineers, residents, community leaders, architects, insurers and financiers, public services and emergency services. The technocrats are out of their silos and into the street parties...

But where to draw the line and boundaries – are we looking at a flooding problem, or a whole urban system problem? This is where the technocratic / expert-driven institutions of Resilience-III have to confront the challenges & contradictions, of social and economic and political power and inequality. At the same time there are opportunities in the hybrids and inter-connections of social, economic, ecological or cultural innovations. One

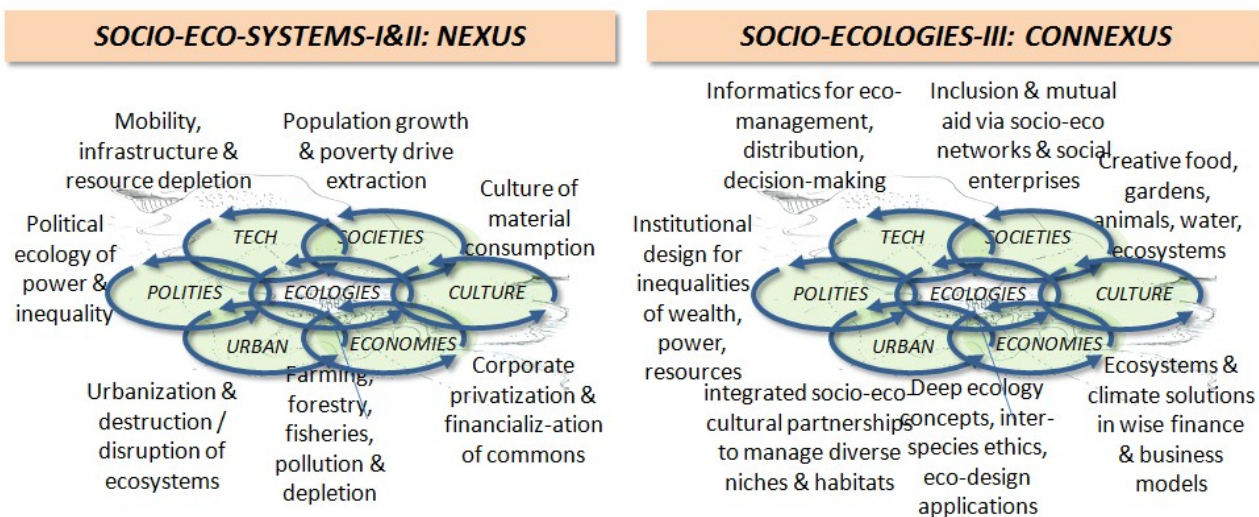
example, an integrated socio-cultural-ecological adaptation scheme from the Murray-Darling basin⁶: another, an urban social innovation in the Netherlands.⁷ Countless other examples show the potential for synergistic thinking, as innovation and experimental seeds which may or may not grow into trees.

Figure 2: Resilience-III - from smart to wise



Another way to frame this is with a 'nexus-connexus' model (Figure 3). The inter-connections of social, technical, economic, environmental etc, can be seen as an inter-locking **nexus**. This looks like intractable, hyper-complex, wicked and controversial societal challenges, shown on the left side. We can look for 'trading zones', 'boundary objects', or 'inter-path-dependencies' between the domains. The application of synergistic thinking, with co-learning and co-creation, can be seen as a **connexus**, (i.e. cognitive nexus'), on the right, based on synergistic value-added between each of these domains. And to realize the potential depends on a process of co-learning, co-creation and co-production between all involved, i.e. an overall collective intelligence. The synergistic toolkit helps to analyse and map this systematically, and then co-design and co-innovate with all concerned.

Figure 3: from nexus to connexus



2.1 SYNERGISTIC TOOLKIT IN PRACTICE

In practice the synergistic toolkit is a combination of interactive process and desk analysis. For the Melbourne R&R programme it aims at the overall question: *'how to improve the resilience of this city / region / landscape / place, to climate change, in present and future?'* This kind of enquiry can take place in the realm of analysts, policy-makers and academics. It can also take place in the public realm, as a 'democratic, collective problem-solving process', in which such problems and potential solutions look wider and deeper and further.⁸ The Melbourne workshop is followed up by a consultation programme of interviews and small groups. Each session takes a similar format based on the 4 stages of the synergistic toolkit. What could be the result?

The first contribution of the toolkit is to open up the boxes and silos of disciplines and departments. For this, the scenario approach is a good way in. Simply by asking the questions, 'what will our city look like in 2040, and what's to be done', the uncertainty of change and potential opportunities are raised into the open (preferably helped with creative media).

A more structural contribution of the toolkit is to explore the different framings of problems and responses. We explore the parallel systems and their implications. A Resilience-I model sees flood walls in response to direct threats: and Resilience -II looks for innovations, incentives, markets etc. Resilience-III looks towards the cognitive level, with co-learning, co-innovation and co-creation between actors, stakeholders, institutions and so on. And then, the climate futures / resilience agenda then combines with urban futures / resilience, economic futures / resilience, and so on. The format of results could be stories, pictures, narratives, scenarios, recommendations, practical guides etc, depending on the stakeholders & context.

These can be structured by the toolkit:

- Actor types: public / private / civic / knowledge etc;
- Factor and territorial types: urban / rural: micro / macro: growth / decline: robust / vulnerable
- Domain types: social / technical / economic / ecological / policy / cultural, vulnerability or resilience.

This Resilience-III checklist is a useful summary and navigation aid:

C) FURTHER>>>	Mode-I Linear	Mode-II Evolutionary	Mode-III Co-evolutionary
	'CLEVER': (complex)	'SMART': (emergent complexity)	'WISE': (conscious complexity)
A) 'WIDER': actors/factors			
Flood & storm	Hard defences	Insurance / markets	Co-evolution with water
Heat, drought,	Regulation & rationing	Water / health markets	Co-learning, co-production
One-Planet-City	CO2 flows in tonnes	CO2 as market opportunity	Urban CO2 in global cycles
Climate mitigation	Bio-geo-physics frame	Adaptive-innovation frame	Human development frame
Climate adaptation	Flood defences	Flood resilience	Urban transformation
Food & agriculture	Farming as production	Farming as markets	Farming as way of life
B) DEEPER: domains/values			
Social resilience	Social units	Social networks	Social intelligence
Technical resilience	Mono-functional	Multi-functional	Integrated systems
Economic resilience	Industrial production	Extractive capital	Holistic livelihoods
Environment resilience	Green-space area	Green-space functions	Green-space in society
Political resilience	Institutional structures	Power games & processes	Political intelligence
Cultural resilience	Cultural niches	Cultural markets	Cultural civilizations
Spatial resilience	City as machine	City as jungle	City as multi-versity
D) SYSTEM LEVEL:	<i>functional-mechanical?</i>	<i>entrepreneurial-biological?</i>	<i>cognitive-human?</i>
Super-systems	<i>Capitalist modes of production</i>	<i>Capitalist modes of exploitation</i>	<i>Post-capitalist 'co-opolist' modes of collaboration</i>
Structural archetypes / myths	<i>Defending against hostile nature</i>	<i>Evolutionary competition & innovation</i>	<i>Co-evolution / co-learning for socio-eco-systems</i>

This provides a kind of master template for the synergistic analysis & design of the R&R programme, in Manchester, Melbourne or any other place:

- The earlier stages of the toolkit (i.e. Systems Mapping & Scenario Mapping) provides the baseline information and analysis, mainly on Mode-I and Mode-II issues.
- The later stages (i.e. Synergy Mapping & Strategy Mapping), is the main creative focus of the workshop and consultation, with synthesis and design. This works mainly on the Mode-III issues, using some further templates.

Typical questions to be addressed: -

<p>Flood resilience – what’s possible?? (synergy mapping).</p>	<ul style="list-style-type: none"> • What are the visions and can they be shared? • What potential for synergies & transformations? 	<p>Explore the potential for synergies, i.e. new institutions, new value-chains, etc. Data capture: - template for actors synergies - 3 columns – ‘clever / smart / wise’ - 3 layers (if needed): Melbourne / AU / world:</p>
<p>Flood resilience – what’s to be done?? (pathway mapping).</p>	<ul style="list-style-type: none"> • Which are the most likely pathways towards them? • Who is involved in the road-maps 	<p>Focus back to pathways, strategies, actions, i.e. who could do what, how, when, how much... Data capture: - template for horizon 1, 2, 3 - template for STEEPC (as above) - 3 layers (if needed): public / private / civic:</p>

Further templates can be used to track the synergies of actors, of factors, of domains: either mode-I, mode-II or mode-III synergies.

2.2 NEXT STEPS

Overall the R&R programme aims at visionary yet practical results - ‘synergistic pathways from smart to wise’ - to enhance the overall resilience of the future city. It’s possible to envisage technical solutions – sealed air-con buildings, surveillance cameras feeding into control centres – but mono- functional technology seems to exacerbate other kinds of gaps and vulnerabilities. With the combination of co-learning, co-creation and co-production of all stakeholders, this all adds up to a urban shared-mind, a collective intelligence. This isn’t a solution, more like an experimental space or collaboratorium, where creative forward looking responses can emerge and flourish. The synergistic thinking and toolkit outlined here can help to design and explore this space.

* Bowler, N (1972) *Flood image: Floods in central Melbourne. Looking up Elizabeth Street from Flinders Street*, The Age, 17 February, 1972. Neg: A 6589 CN.

¹ Crichton, 1999: Crichton, D. 1999. The risk triangle. In: *Natural Disaster Management*, ed. J. Ingleton. London, Tudor Rose, 102-123.

² Swiss Re 2014: Swiss Re (2014) *World Risk Report*. Geneva, Swiss Re

³ Argyris C, and Schon, D (1996): Argyris C. and Schön D.A. (1996) *Organizational Learning II: Theory, Method, and Practice*. New York: Addison-Wesley

⁴ Pitt 2007: Pitt, M, (2008) *Learning lessons from the 2007 floods: an independent review by Sir Michael Pitt*. Cabinet Office, London

⁵ Reid & Beilin 2015: Reid, K, and Beilin, R, (2015): Making the landscape “home”: narratives narratives of bushfire and place in Australia. *Geoforum* 58:95-103

⁶ Vanclay et al 2004: Vanclay F. Lane R., Wills J., Coates I., Lucas D. (2004), “Committing to place and evaluating the higher purpose”. *Journal of Environmental Assessment Policy and Management*, vol 6, n. 4, pp. 539-564.

⁷ Ravetz, J (2015): *The Future of the Urban Environment & Ecosystem Services in the UK*: (Report to the Government Office of Science, Future of Cities programme): London, Government Office of Science. Available on: <https://www.gov.uk/government/publications/future-of-cities-ecosystem-services>

⁸ Wagenaar & Wilkinson 2013: Wagenaar H and Wilkinson C (2013) Enacting resilience: A performative account of governing for urban resilience. *Urban Studies*. DOI: 10.1177/0042098013505655.