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RESILIENCE FORUM 2017 REPORT

Resilience of what for whom: on the possibility of fitting solutions to problems

Joe Ravetz, Ruth Beilin, Angela Connelly, Ioanna Tantanasi,

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ABSTRACT

There is a growing critique of the typical ‘engineering’ or ‘functional’ approach to resilience, which ignores or exacerbates ‘socio-political’ resilience with issues of power or inequality. However there is tension between the two: while the functional approach is practical but often myopic, the socio-political approach can be too open-ended and challenging to the system. In principle, it seems crucial that the resilience models for the ‘problem’ and ‘solution’ should fit closely, whichever way these are framed: but in practice the framing on each side is often contested and problematic.

This highlights the over-arching aim of this paper: to explore ways to bridge the gap or tension between ‘functional’ and ‘socio-political’ resilience models, so that the framing of ‘problems’ can be better fitted to the framing of ‘solutions’.

To explore this gap or tension, we examined a range of resilience ‘models’, i.e. various combinations of conceptual models / practical toolkits / policy programs. Each can be framed in terms of the critical questions of ‘resilience for who, what, where, why, and how’. Such questions then form the basis of an analytic framework. Each of the models has certain gaps and limits, and can only approximate the complexity of real world challenges. But in looking for commonalities and differences between them, new combinations can emerge, in practice or theory, which could be more effective for such real world challenges.

The paper is drawn from a Manchester-Melbourne exchange program in 2017, which held workshops and explored a range of case studies in both cities.

1. INTRODUCTION

For the international Sendai Framework, resilience is: *“The ability of a system, community or society exposed to hazards to resist, absorb, accommodate and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions.”*¹

But what if the ‘community or society’, and its basic structures, are based on inequality and exploitation? In that case resilience would simply continue the trends and gaps in power and wealth. Meanwhile resilience has become a new cover-all word, used for many things by many people. Many cities now have resilience units, and both Greater Manchester (GM) and Melbourne are in the Rockefeller 100 Resilient Cities. Each is a successful city in many ways, but also contains rising inequality and deprivation, and is increasingly vulnerable to climate change effects of heat, drought, fire, storm and flooding. So the question comes up in each – ‘resilience of what and for who’? For example, it seems that high-carbon industries and brutal dictatorships are each quite resilient in their own terms.

Recent events in the UK and in Australia have highlighted the many dimensions of the term ‘resilience’. The 2015 floods in Northern England were concentrated in small towns in the Pennine hills, on the edge of the Greater Manchester (GM) city-region. One factor in such ‘disasters waiting to happen’ is where towns are built over watercourses in steep-sided valleys, naturally prone to flash flooding. Looking upstream, another factor is the upland catchment management regime, with peat bog drainage designed for grouse shooting by high-income visitors on privatized land, a fact which seems uncomfortable for the government agency Natural England.² So if we ask about flood resilience ‘of what for whom’, there are many unanswered questions.

Downstream it seems that some urban flood projects are not welcomed by some residents.³ In context, it seems that 15% of households in GM are on the breadline, with only charitable ‘food banks’ to keep them from starvation.⁴ Local workers pay their pension contributions into City institutions, which count their profits quarterly, so they disinvest from the jobs of those same workers. A national ‘austerity spike’ resulted in 120,000 ‘excess mortalities’, (pro rata for GM would be 6,000 mortalities), attributed by medical researchers to UK government policies in healthcare systems, welfare and disability support.⁵ The system, in many ways for many people, seems in disarray and dysfunction, again raising questions on resilience to what for whom?

In London, the Grenfell Tower disaster of June 2017 was a result of many factors on many levels, in both the event and the follow up. The specification of inflammable cladding, was a result of cost pressures combined with a dilution of building regulation, combined with a top-down management which ignored the concerns of tenants. A long public inquiry is in progress (2018), but many argue

¹ Sendai Framework, UNSDR 2011: Sendai Framework for Disaster Risk Reduction 2015 – 2030. NY, UNSDR

² Monbiot 2018 ??

³ Richard 2014

⁴ GM Food Poverty Alliance 2014

⁵ Stuckler & Basu 2015: Watson et al 2017

that there are clear links between the previous government's 'bonfire of the regulations', austerity and the squeezing of public / social housing finances, and general trends towards privatization and gentrification of London. Further challenges are raised by the emergence of social media as a powerful force, both in the mobilization of aid and volunteer help, and also in the spread of rumour and misinformation: again, questions are raised, resilience of what for whom?

Meanwhile, in Melbourne, the South Bank development area is already vulnerable, with increasing risks of combined storm surge / pluvial flooding.⁶ High rise and high-spec developments are constructed with the assumption that technology will respond to any hazard. However the majority of apartments are now sold as financial commodities, and rented to foreign students or migrant workers, with few if any community connections or cohesion. Meanwhile Melbourne is planning to double in size over the next 25 years, putting extra pressure on its resilience to climate change among other factors, in a context of rural area depopulation due to extreme drought and wildfire risk. Questions can be asked, on resilience of locations 'where', to risks over timescales 'when'?

RESEARCH AIM AND QUESTIONS

These examples illustrate the key theme of this paper: the tension between a typical 'engineering' or 'functional' resilience model, and a 'socio-political' resilience model for issues of power and inequality. In the example above of upland flooding, the functional approach has limits, which can only be resolved with a socio-political approach: while for urban flooding, the functional approach cannot get started without a socio-political approach, but that raises challenges beyond its scope.

This all points to the main aims of this paper: *to explore the tension between 'functional' and 'socio-political' in a range of current resilience models: and to look for ways to bridge between them.* This leads to three research questions: -

- which resilience models are more effective for which types of problem? (from a sample of six in this paper)?
- What are the gaps and contradictions between them?
- Are there new combinations which could better fit the framing of 'problems' to the framing of 'solutions'?

The ideas for this paper originated from the Manchester-Melbourne collaboration on 'risk and resilience in the built environment' in 2017.⁷ Both cities are locations for the Rockefeller100 Resilient Cities program, a valuable point of comparison. A practice-focused workshop with the 'Resilience-III' methods was held in Melbourne:, and then a return event in Manchester took a methodological focus. This brought together 24 academics and practitioners, to explore a wide portfolio of 'resilience models', i.e. combinations of practical tools, policy programs and theoretical concepts, focused on four main types of questions:

⁶ Beilin et al forthcoming.

⁷ <https://msd.unimelb.edu.au/experiential-adaptive-learning-tools-for-a-resilient-built-environment>
- and - <http://manchester.ac.uk/synergistics/projects/risk-resilience/>

- **questions of strategy / agency:** how can a city-level resilience programme respond to systemic challenges, within limited resources? (what could Manchester learn from the Melbourne Rockefeller100RC program?)
- **questions of system and scale:** how to cope with multi-level and multi-sector inter-connections? E.g. how to manage flood resilience at both local and regional scales, now and for 50 years?
- **questions of scope and purpose:** is the focus on climate-related risk missing more vulnerabilities in other areas, such as food insecurity, energy poverty, housing crisis or mental illness?
- **questions of process and learning:** following recent fires and floods in the UK, how can those involved learn from experience and think ahead: more regulation, smart technology, or a wider-deeper 'collective intelligence'?

With these questions on the table, the workshop reviewed a range of contrasting resilience models. This paper now follows up systematically on six of these models. We focus mainly on the climate-related flood and fire, but with implications for other areas of vulnerability and resilience, such as financial or technology breakdown. Our working shortlist now includes:

- RESIN ('Resilient Cities'): an EU-funded consortium project, which sets up a framework / typology for climate related risk, vulnerability, resilience and adaptation planning in cities and regions.
- IMPROVER: a parallel EU funded project, focusing on the resilience of critical infrastructure, including social media.
- 100 Resilient Cities ('100RC'): an international network of cities, supported by good practices, consultancy input, knowledge exchange etc.
- RABIT: ('Resilience Assessment Benchmarking & Impact Toolkit') : a rural village scale application, working closely with local stakeholders, using participative systems mapping in the developmental process.
- Socio-ecological systems: a broad cluster of theories and practices, drawing from literatures on complex systems, ecological modelling, transition management, social practice theory and political ecology.
- Resilience-III: a focus on 'cognitive complexity', or the collective intelligence of urban and/or ecological systems, which can help to map risk and vulnerability, and the forward dimension of adaptation and resilience.

While academic debates continue, it may be that events are forcing the issue. The current incidence in 2018 of record heatwaves, wildfires and flooding are highlighting the existential scope of the challenge. It may be that the engineering 'bounce-back' concept model is hardly relevant, in the face of lethal heatwaves or catastrophic flooding and sea level rise, which lead to mass climate migration and unprecedented upheaval.⁸ In that case there is little alternative than to seek practical forward-looking resilience models which are both functional and socio-political.

⁸ World Bank 2018

REVIEW OF KEY QUESTIONS

A brief review follows of current thinking on each of these key questions:

Questions on functional versus socio-political: some current directions in resilience as ‘adaptive pathways’ were reviewed in *Global Environmental Change* (Wise et al., 2014). The complexities of sustainability and its pathways point beyond a reductive science approach, towards the role of social learning and stakeholder deliberation. There are many layers of uncertainty on risks, hazards and vulnerabilities, from the simple to the profound. Likewise, concepts of resilience need to build in longer term system change and transition / transformation: together with better understanding of multi-level impacts and causalities. Such thinking has made rapid advances in a short time, from a previous rationalist-reductive ‘engineering resilience’ approach, to a more systemic and holistic approach (White and O’Hare, 2014).

This raises wider questions on knowledge. Knowledge for functional resilience may be complex but is framed as a reductive problem, e.g. flood defence knowledge including engineering, hydrology, project management and so on. But a framing of socio-political resilience raises many other kinds of knowledge, on communities, cultures, psychologies, technologies, innovation and so on, which by nature is more controversial, uncertain, inter-subjective and process-oriented, all of which calls for a new paradigm of ‘synergistic science’ (Ravetz and Ravetz, 2017).

Further questions on strategy / agency (resilience for who / by who?): there are political challenges raised, where engineered resilience is framed by the elite, as that which maintains existing structures and hierarchies. Counter-narratives which challenge the status quo, (asking why the poor live in the most flood-prone areas with the least protection), are framed by the elite as irrelevant or dangerous. Such narratives are likely to be tested to its limits by climate-related risks such as sea-level rise, which may require whole cities to be physically relocated, with political and economic challenges which are unprecedented (Clark et al., 2016). The growing likelihood of global climate tipping points, or the crossing of planetary boundaries, puts the notion of strategy into a new dimension of existential challenge (Steffen et al., 2018). Again, a functional framing of strategic planning will struggle to cope, and socio-political alternatives will be called for, in fields such as foresight or experimental governance (Ravetz and Miles, 2016).

Further questions of system and scale (resilience where and when?): The notion of scale, hierarchy, dynamic change and succession is at the core of ecological systems thinking and thereby concepts of resilience, but this is not always apparent in the resilience models. The classic example is the forest fire, one stage on a dynamic cycle of succession, which calls for strategic controlled burning, and active learning between residents, forestry and fire services, as part of larger changes in land-use, climate, urbanization and infrastructure.⁹ When a house floods in the UK, an insurance company will typically aim to reinstate the house to the original state: an engineered resilience, or ‘bounce back’ approach, even in the case of repeated flood events. A more intelligent approach (a ‘bounce-forward’ model), would seek to put in measures, such as resistance products or resilient materials or electrical systems (O’Hare et al., 2016).

⁹ Beilin & Wilkinson ??

Further questions of scope (resilience of what, and why?): if a fire risk / flood resilience problem is framed not as a technical issue in a political context, but a political issue with technical detail, can these various approaches help? And if a flood resilience problem is framed not only as engineering fix, but as co-evolution of urban / socio-ecological systems, then how to cope with profound uncertainties? An extreme example is the debate on climate change and the Syrian war: there appears to be a causal chain from drought and crop failure, to rural-urban migration and ethnic tension, which exacerbated the factors which led to open war. While this may seem obvious, it could be very difficult to prove or disprove, with too many variables and contingencies: in security and defence terminology, climate is a ‘threat multiplier’ in an already hyper-stressed and hyper-complex global system (Kelley et al., 2015). In that case, the resilience model needs to be framed in a way which reflects that: one approach is that of ‘anti-fragility’, i.e. systems which not only cope with disorder but gain from it.¹⁰

Further questions of learning (resilience - how?): this is more about the process dimension, of how a resilience strategy or program is formed and managed. With a functional approach, information is gathered and analysed, key actors are briefed and resources are found: this tends to ignore issues of power and inequality, where one group expropriates the resources and resilience of others. With a socio-political approach, various strands of social learning, knowledge exchange, co-creation and co-production would aim towards bridging such gaps. Arguably, the existence of a resilience strategy with its baggage of indicators and ‘best practices’ can be a patronizing disempowerment of the already vulnerable (Kaika, 2017).

The frame of learning here draws on thinking on ‘learning loops’, whether single, double or multiple.¹¹ This overlaps in some ways the various ‘modes of scientific knowledge’, whether pure or applied:¹² and the emerging concept of ‘post-normal science’, which deals with .¹³ Each of these feeds into the synergistic concept of a *Science-III* or Science 3.0, suited to highly uncertain, controversial societal challenges with multiple truths.¹⁴

STRUCTURE OF THE PAPER

This introduction sets out the context, with reference to the UK and Australia, and the agenda and research questions. The second part explores the analytic framework of functional versus socio-political’, and the analytic fields of ‘scope, scale, process and strategy’.

The third part is a systematic mapping of different resilience ‘models’, with this framework and in the light of the above questions. The range of case studies in methods and tools starts with two parallel EU funded projects. The RESIN aims to set the agenda with detailed typologies on climate risk, vulnerability and resilience at the urban-regional scale. The IMPROVER focuses on critical infrastructure and includes the emerging potential of social media.

¹⁰ Taleb 2015

¹¹ Argyris and Schon 2006

¹² Nowotny et al 2006

¹³ Funtowicz and Ravetz 2003

¹⁴ Pielke 2014

Each of these is contained in the strategic programs of the Rockefeller 100 Resilient Cities, currently active in both GM and Melbourne. This contrasts with a village scale application for developing countries, the RABIT (Resilience Assessment Benchmarking & Impact Toolkit). Wider questions come up on a system level societal-ecological interactions, as in 'socio-ecological systems studies', with examples from Australia. Finally we look at Resilience-III, which explores the scope of a 'cognitive resilience', based on collective intelligence in governance and communities.

The fourth part is a discussion, with review of the mapping, and of the implications for practical hazard management and societal resilience. The conclusions wrap this up with the implications for future research and future practice.

2. METHODOLOGY AND FRAMEWORK

Our methodology starts with the main aims of this paper: *to explore the tension between 'functional' and 'socio-political' approaches in a range of current resilience models: and to look for ways to bridge between them.* In this section we first visualize this tension: then we construct an analytic framework around it, with the questions of resilience for 'who, what, where, how and why': thirdly we use the framework to map the range of resilience models.

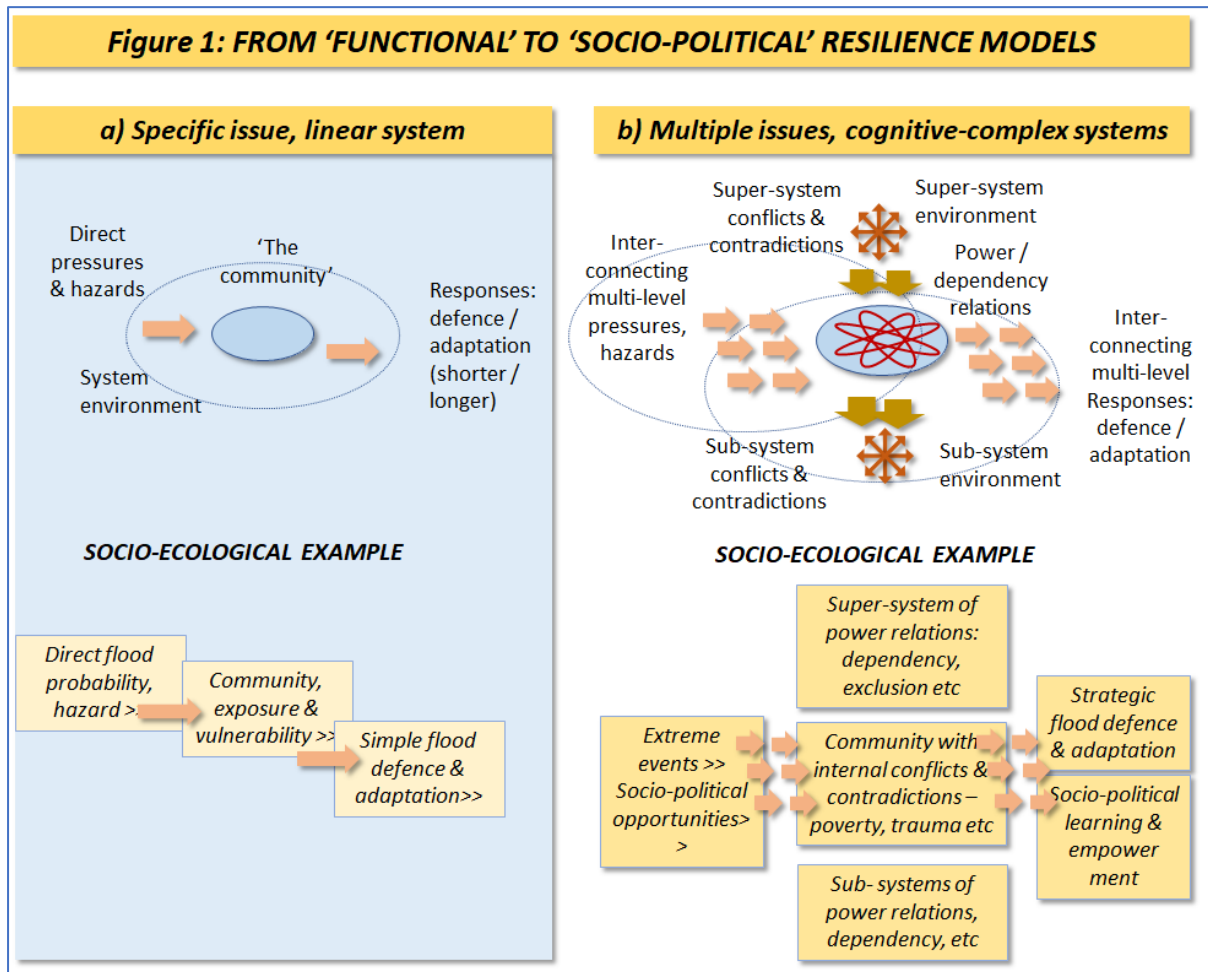
Firstly, we visualize the difference and typical tensions between the functional and socio-political, in Figure 1:

- The functional approach on the left shows a single issue and linear system frame. Direct external pressures or hazards impact on the 'community' or 'receptor', which then makes direct responses or recovery in the short term, or adaptation in the longer term.
- The socio-political approach on the right (Figure 1b) shows multiple issues and a complex system frame. The pressures and hazards are complex and inter-connected: there are inbuilt power relations and conflicts in the super-systems (dominant regimes outside the frame), and the sub-systems (dependent regimes). The 'community' itself may be conflicted and fragmented, so that any resilience by its nature is socio-political, generating winners and losers.

The example below illustrates this, based on the flooding in GM as above. The functional approach may work in the shorter term for direct material problems: in practice we find the reality is more like a socio-political problem. Within the community there are conflicts and traumas, upstream risks come from systems of power and wealth, and downstream responses are stymied by the insurance industry.

Overall, there is continuing tension between these extremes. The functional is easier to manage and assess, but likely to fall short for complex problems: the socio-political is ultimately more effective, but more challenging to manage and assess.

Figure 1: From 'functional' to 'socio-political' resilience models



ANALYTIC FRAMEWORK

To pursue this further, we set up an analytic framework: this reflects the above tension of 'functional / socio-political', with each of the key questions above: 'resilience of who, where, when, what, why and how'. This forms a framework of analysis: each of the questions is placed on an axis which reflects the basic tensions between a 'functional' and 'socio-political' approach:

- Main actors: questions of strategy / agency: '*resilience for who / by who?*': the axis runs from simple resilience – versus – resilience within regimes of power and dependency.
- Main concepts: questions of system / scale: '*resilience where and when?*': single issue / horizon – versus – multiple issues / horizons;
- Fields & domains: questions of scope / purpose : ('*resilience of what kind of system, and why?*'): linear systems – versus – cognitive complex systems;

- Cognitive process: questions of learning: (*resilience as how?*): mode-1 direct learning – versus – mode-3 collective intelligence.

These fields are summarized at Table 1 in the Appendix. To visualize the implications, in the typical flood risk / resilience example from GM:

- *Resilience for who*: it seems that risk was transferred to the valley communities in order to protect the business investments of the upland landowners.
- *Resilience for where and when*: in the nature of a narrow valley, it is difficult for flood alleviation work in one town not to transfer flood water downstream, if not now then in the coming decades.
- *Resilience of what and why*: these towns are in a state of flux, with a precarious post-industrial economy and rising inequality, and effective flood resilience would address the whole of the catchment landscape in social economic and environmental terms.
- *Resilience how*: local governance here is externalized, there is an active civil society, but lack of effective communication and feedback for adaptive pathways.

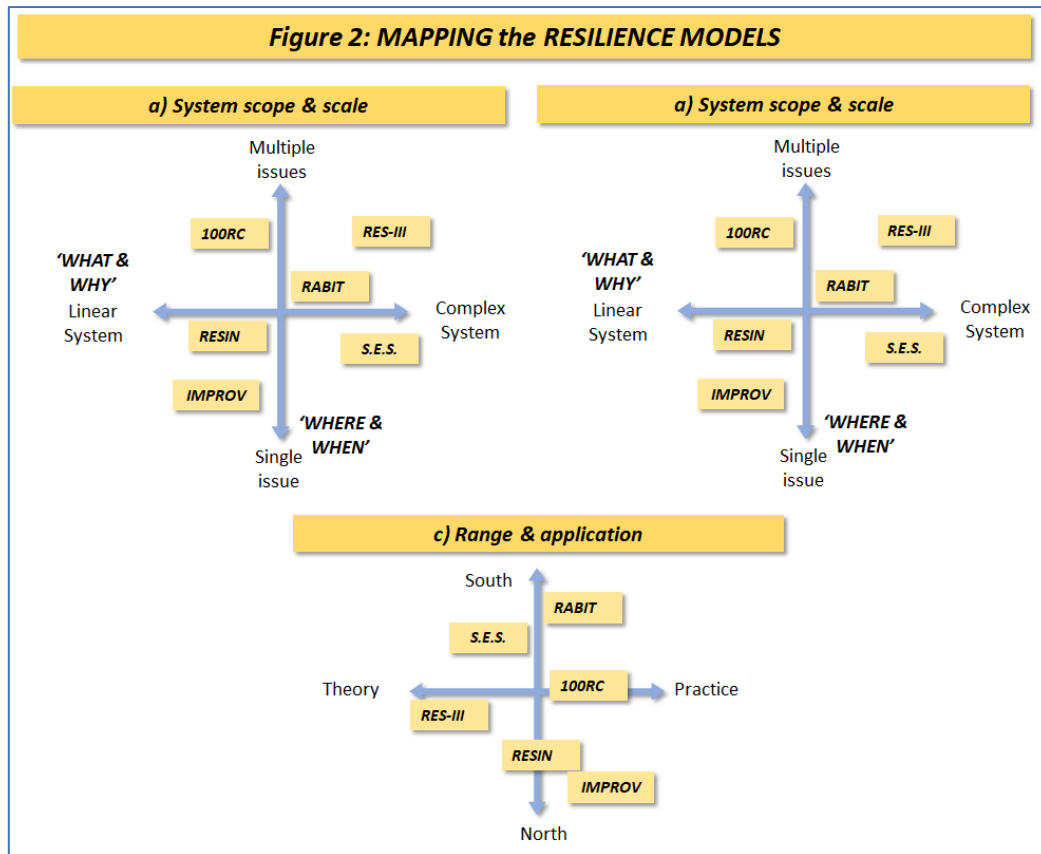
CASE STUDY MAPPING

Resilience models (combinations of theory, policy and practice) were selected for a cross-section of this landscape. The various examples are shown on a simple mapping at Figure 2:

- RESIN model: various issues, medium adaptive complexity (provides data-oriented typology with policy linkages)
- IMPROVER model: low complexity, single issue, mainly technical approach, with extensions to emergent complexity of social media
- 100 RC: multiple issues, low-medium complexity (provides policy framework & international network)
- RABIT model: various issues, medium adaptive complexity (provides working toolkit in development policy)
- Socio-Ecological Systems: generally more grounded, can be wider or narrow issues, generally more aware of complexity (provides embedded empirical material).
- Resilience -III model: potentially multiple issues, cognitive complexity: (provides a conceptual foundation for wide range of applications).

We can take the above framework axes, to visualize a conceptual landscape, as in Figure 2a and 2b. The case studies can also be located on a range from theory to practice, with their current applications in the global South or North, at Figure 2c:

Figure 2: mapping the resilience models



3. DISCUSSION

Each of the resilience models on this shortlist seems to be pointing in a different direction, but none of them yet seem sufficient for the coming challenges. However this could be turned around, to envisage a combined portfolio or integrated toolkit, where each has a role to play. The RESIN provides the template for the adaptive planning process, and the IMPROVER takes it to the practicalities of critical infrastructure. The 100RC brings systems thinking applied to a city-wide a institutional model: and the RABIT brings it to the grassroots community scale. Meanwhile, socio-ecological systems thinking widens the scope and includes super- and sub-systems at multiple scale levels. The Resilience-III approach brings in the process dimension of cognitive complexity, so that the collective learning and thinking can respond to the societal challenges.

Looking again at the flooding example from GM, we can track how this plays out in the current socio-political situation, of risk transfer and 'resilience expropriation', at different levels of a system:

- In functional terms the flood risk in the narrow valleys is amplified by upstream land-use management, lack of regulation and democratic accountability, which calls for a '**socio-political resilience**' and strengthening of governance.

- In political terms the state is short of resources, denies responsibility for welfare or public infrastructure, and aims for '**local resilience**', as a means of risk transfer from national to local levels;
- In socio-economic terms the community may be deprived or excluded, by state policies or implicit structures, and so '**community resilience**' is called for in ways of coping with adversity;
- The conflicts / contradictions in the community manifest in sub-system power relations, such as gender, ethnic, or generational divides: in which case '**personal resilience**' is needed in the face of oppression.

In such a socio-political context, it seems even more important to be clear on the difference and tension between functional and socio-political models, and the possibility to bridge between them. Here the framework should be able to contribute.

Questions of strategy, suggest that climate adaptation / resilience strategies will only be effective where fully integrated to other strategies with greater priority, social or economic or political. This assumes the existence of effective governmental strategies, in contrast to a reality of strategies which are sparse or ineffective, which is arguably the case in the UK today. The implications for such initiatives as the Rockefeller 100RC, are for strategic choices: either, follow the policy narrative with amelioration of short-term problems and inevitable routines of self-justification, or, to play a critical friend and/or dissident role.

The questions of system and scope, seem to suggest that socio-ecological resilience, such as with fire or flood, is often entangled with the political and economic forces which shape the system around. While the emerging risks from climate-related disasters are real and growing, the event pathways and adaptive pathways are contingent on the political institutions, economic capacities, social and cultural worldviews. For example the total fatalities due to climate change and terrorism in GM appear to be less than 0.1% of those due to traffic or domestic accidents: in turn these are a small proportion of the estimated impacts of austerity policies, estimated 2010-2015 pro rata for GM at 6,000.¹⁵ A conclusion could be drawn for climate adaptation policies, that the first priorities are to address a dysfunctional and hostile system of welfare, social care and public services, which can then respond more effectively to flood or storm.

Questions of process and learning, suggest to look beyond the assumptions of stakeholders around the table. They look towards the reality of inbuilt systems of power, hierarchy, corruption, and expropriation. The Grenfell Tower fire is a stark reminder of how the technicalities of fire resistant design and building regulation were systematically skewed by a political regime, basically hostile to the practice of social housing in inner London. It follows that a resilience pathway approach has to address such uncomfortable realities. This example also shows that social learning now takes place in parallel channels such as social media and online platforms, at the moment almost completely uncoordinated and possibly ungovernable: both a massive challenge and possible opportunity.

¹⁵ Stuckler and Basu 2012; Watkins et al 2017

CONCLUSIONS & NEXT STEPS

Finally we can revisit the overall aims of this paper: to explore ways to bridge the gap between ‘functional’ and ‘socio-political’ resilience models, so that the framing of ‘problems’ can be better fitted to the framing of ‘solutions’.

Each of the resilience models here bridges this gap in its own way, or at least has the aim of bridging the gap. These are some notes on ways forward:

- It would be useful for each model to build in explicitly a procedure for bridging the gap. For instance the 100RC could have guidance on managing socio-political conflict: or the Resilience-III model could address the functional requirements more directly.
- It would be

We do not expect some ‘super-model’ to emerge as a combination of these examples, which have arisen from quite different corners. But we can expect further rapid development of resilience models, which responds to the increasing flux and turbulence in many parts of the world. For instance, the flooding in southern India (at the time of writing) points towards a near future of catastrophic flooding combined with lethal heatwaves and sea-level rise, resulting in mass migration and upheaval. In that case, we can anticipate that new and creative resilience models will be needed urgently to steer through the likely chaos and mass destruction.

We can now bring together these examples to map a forward research agenda, which includes:

- system thinking on cognitive complexity / collective intelligence in communities or governance or socio-technical systems;
- context of system-wide change and transition, where climate adaptation / resilience is only one of many competing priorities and power games.
- practical experience from flood and fire situations, where DRR is dominated by political economic and social forces.
- Uses of digital technology (info platforms, social media, machine learning etc)

SUMMARY OF FRAMEWORK / CASE STUDIES

The table here shows each of the case study methods with the relevant key questions.

Table xx: summary of framework & case studies

	MAIN ACTORS: QUESTIONS OF STRATEGY	MAIN CONCEPTS: QUESTIONS OF SYSTEM & SCALE	FIELDS & DOMAINS: QUESTIONS OF SCOPE	COGNITIVE PROCESS: QUESTIONS OF LEARNING	GAPS & OPEN QUESTIONS
RESIN					
EU consortium developing a spatial typology of risk & vulnerability	Urban planners, city resilience planners, infrastructure providers	Urban system metabolism & adaptive planning cycles	Climate, urban development	Research-policy exchange	Reality checks in policy cycle & risk assessment?
IMPROVER					
ROCKEFELLER 100-RC					
Strategic global program for capacity building.	Policy & civil society: with business opportunity	Resilience goals based on systems qualities:	All urban systems	Capacity building Policy linkages	structures of power & inequality?
RABIT					
Local & village scale program for capacity building.	Village stakeholders; development workers	'resilience attributes' based on general systems principles	Governance focus	RABIT toolkit; from benchmarking to co-creation	Upscaling to higher level governance?
SOCIO-ECO-SYSTEMS					
Methods suitable for rural / urban areas of water stress & fire risk	Communities, emergency serv, policy makers	Socio-ecological systems, panarchy & dynamic renewal EM/DRR/DRM	Climate & natural hazard, rural communities, governance	Shared responsibility & co-creation	Power relations & multi-level urban systems?
RESILIENCE-III					
Concepts & toolkit for cognitive resilience with collective intelligence	All	collective intelligence & cognitive complexity systems principles	All	Synergistic Toolkit - cycle of co-learning & co-design	Co-intelligence may be intangible & tricky to identify or assess

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