Meta decision-making and the speed and quality of disaster resilience and recovery

Stephen Platt

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Chapter 6

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Introduction

Recovering from a disaster involves different decisions as disaster managers and long-term planners respond to the myriad of cascading problems. What is unique in post-disaster situations is that decisions must be made in a compressed period of time. Communities must rebuild as quickly as possible to maintain existing social networks and get the economy back on their feet. But they must also be deliberate in trying to maximize the opportunities disasters provide for improvement (Olshansky and Johnson 2010). Disaster decision-making is typically posed as a series of dilemmas, for example: balancing short term and long term needs (Ingram et al 2006), speed or deliberation (Olshansky 2006) or focusing on restoration or reform (Davis 2006). This chapter envisages these dilemmas as meta decisions. It defines meta decisions as trade-offs between opposing strategies that need to be made by the authorities in charge of managing recovery. It tests the idea that meta decision-making is a factor in the speed and quality of post-event recovery and contributes to the future resilience of vulnerable places.

The chapter begins by defining resilience, recovery and meta decisions and describing how these terms are used in relation to disasters. It uses comparative data collected by the author from fieldwork after 10 major disasters to analyse the meta decisions taken. Finally it assesses the speed and quality of recovery after each event and relates this to meta decision-making. The aim of studying recovery in this comparative way is to try to identify the underlying causes of speedier and higher quality recovery. The author argues that better (meta) decision-making will result in faster and better quality recovery, which also potentially leads to more disaster resilient places. A key aspect of better decision making, this chapter argues, is that meta decisions are thought through and made before the disaster event. The precise questions the chapter seeks to answer are therefore: (1) Do countries that make meta decisions quickly recover faster? (2) Do countries that achieve a balance of meta decisions build back better?

Resilience and Recovery

The word resilience derives from the Latin word *resiliens* meaning to rebound. In engineering, resilience is defined as a measure of how easily a material returns to its original shape after elastic deformation (Hollnagel et al 2006; Oxford Dictionary of Construction, Surveying and Civil Engineering 2013). In ecology Holling (1973) and Perrings (2001) defined resilience as the capacity to absorb shock and linked resilience to the idea of systemic stability. In social science resilience is considered as the complex web of social interactions, characteristics and capacities that enable a community to live with the hazards they face (Porter and Davoudi, 2012). Keck & Sakdapolrak (2013) argue that social resilience consists of three dimensions: coping capacities, adaptive capacities and transformative capacities.

All the above qualities are relevant for places affected by disasters. It is therefore not surprising that the concept of resilience has been used extensively in disaster research (Tierney 1997; Comune di L'Aquila 1999; Petak 2002; Bruneau et al. 2003). Zhou el al (2010) define disaster resilience as the capacity to resist loss during disaster and to recover after disaster in a specific area in a given period. Resilience can therefore be conceived as both the loss potential and the biophysical/social response. Zolli and Healy (2012, p 7) define resilience as "the critical ability to anticipate change, heal when damaged, to reorganize … to maintain core purpose, even under radically changed circumstances".
In the context of disasters, resilience encompasses a society's capacity to bounce back after a disaster, its level of preparedness to confront or deal with a disaster and its ability to recover quickly and successfully (Alexander 2013). The UNISDR (2004 p 16) in their Global Review of disaster risk reduction define resilience as "the capacity of a system, community or society exposed to hazards to resist, absorb, accommodate to 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".

Societal resilience, the level of preparedness and rapid and successful recovery depend, to a large extent, on good decisions (Coles and Zuang 2011). This chapter explores what effect, if any, meta decision-making had on earthquake resilience and recovery in 10 major disasters. Rose (2004) defines economic resilience as the inherent and adaptive responses to hazards that enable individuals and communities to avoid potential losses. He distinguishes between *static economic resilience* (the ability of a system to maintain function when shocked), and *dynamic economic resilience* (the speed at which an entity or system recovers from a severe shock to achieve a desired state).

Bruneau et al. (2003) define seismic resilience as the ability of a system to reduce the chances of a shock, to absorb such a shock if it occurs and to recover quickly after a shock. They argue that a resilient system is one that shows reduced failure probabilities, reduced consequences from failures, in terms of lives lost, damage, and negative economic and social consequences, and reduced time to recovery (restoration of a specific system or set of systems to their "normal" level of functional performance). Bruneau et al. (2003) define community resilience as the ability of families, organizations and communities to meet hazards, contain the effects of disasters when they occur, and carry out recovery activities in ways that minimize social disruption and mitigate the effects of further earthquakes.

Resilience is therefore a multi-dimentional concept encompassing social, economic, physical, technological and natural dimensions. A paper by Tierney and Bruneau (2007) used resilience to measure disaster loss reduction and Chang (2009) made an important advance in elaborating a conceptual resilience framework for physical, financial, human and natural capital.

Recovery is a complex process that starts immediately after a disaster. Recovery is defined in this chapter as "the act or process of returning to a normal state after a period of difficulty" (Merriam-Webster). Most (lay) people think about disaster recovery as a return to normality although this raises the question of what is "normal". The "normal" may not be a return to the status before the event; in fact this may be undesirable. Quarantelli (1999) suggests that the word recovery implies an attempt to bring the post disaster situation to some level of acceptability. Bruneau et al. (2003) include restoration of the system to its normal level of performance in their definition of recovery.

Recovery overlaps with the period of immediate response and relief, which depending on the nature of aftershocks and cascading crises, may last from a month to more than six months. It also merges into the long-term development processes that may even be accelerated by the disaster. The UN Office of Disaster Risk Reduction (UNISDR 2015, p. 25) defines disaster recovery as "decisions and actions aimed at restoring or improving livelihoods, health, as well as economic, physical, social, cultural and environmental assets, systems and activities, of a disaster-affected community or society, aligning with the principles of sustainable development, including build back better to avoid or reduce future disaster risk". The Cluster Working Group on Early Recovery (CWGER) of the UN Development Program) in their Guidance note on early recovery define the aim of disaster recovery as restoring the capacity of national institutions and communities to recover from a disaster and to "build back better" (UNDP 2008, p. 9).

Kates (1977a) addresses the question of the pace of recovery and argues that it is principally related to the magnitude of the damage. However, the resources available for recovery, the prevailing pre-disaster economic and demographic trends and factors such as the quality of leadership, planning and organization are also important and exceptional performance can reduce recovery time by as much as half (Kates 1977b).

Researchers at the University of Buffalo (MCEER 2006) showed how disaster recovery typically follows an s-shaped curve and developed the idea of the "resilience triangle" (Tierney 2007). Resilience-enhancing measures aim to reduce the size of this triangle by making the society more robust i.e. resistant to the impact of the disaster, and by reducing the time to recover. Chang and Shinozuka (2004) suggest that it is useful to consider robustness and rapidity as distinct ends of resilience-enhancing measures. Chang (2010) went on to apply a framework to measure urban disaster recovery from the 1995 Kobe earthquake.

Figure 1 shows a theoretical cumulative frequency graph of one indicator of recovery – Regional GDP. Immediately after a catastrophic event there is a decline in GDP as local businesses are unable to maintain output. The survival rate, the proportion 'undamaged' and functioning, in this case GDP, is a measure of robustness. In the green scenario there is a 30% drop in GDP i.e. Robustness R1 is equal to 70%. In the red scenario there is a 50% drop in GDP i.e. a Robustness level of 50%. Slowly the local economy recovers, perhaps in steps, until the curve flattens and stability returns. Recovery takes 5 years in the green scenario and twice as long in the red. If GDP remained constant the loss in Regional GDP over ten years would be approximately 7.5% in the green scenario and three times higher at 25% in the red scenario. Resilience in Regional GDP is therefore 92.5% the pre-disaster in the green scenario and 75% in the red.

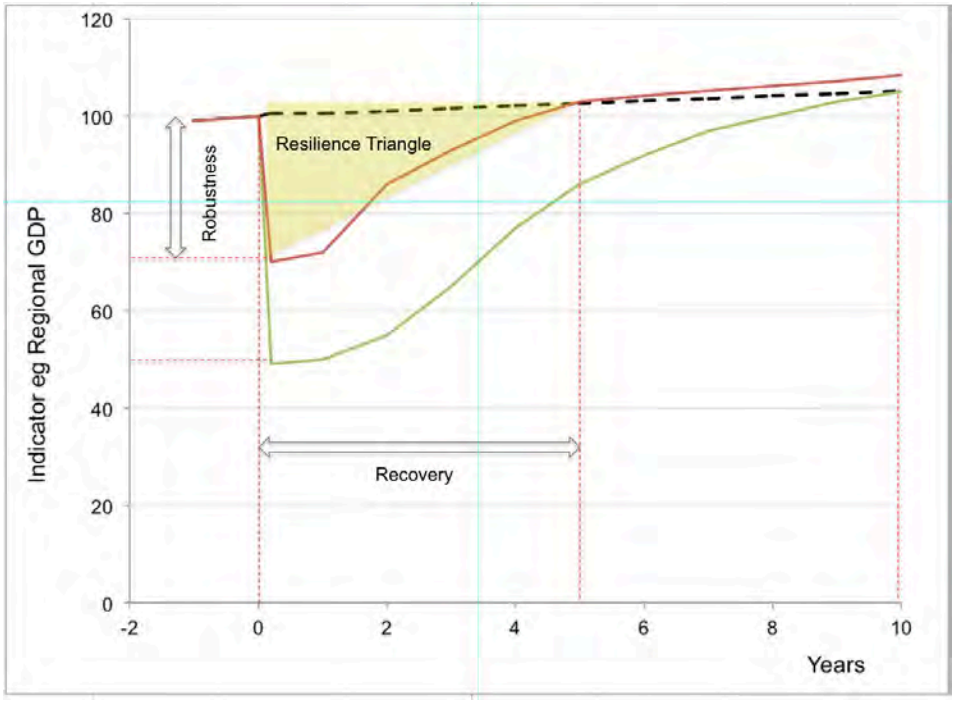

Figure 1. Recovery curves: green is more 'resilient' than red because recovery was twice as fast; R1 is more 'robust' than R2 because the loss was 20% less. (Source: Platt et al., 2016)

Meta decisions

Understanding resilience is important because it helps guide post-disaster decision-making (Tierney 1997; Webb et al. 2000; Rose and Liao 2004). Kottemann (1986) suggests that three different types of disaster decision-making can be distinguished: problem recognition, meta-decision making and primary decision-making. Meta-decision making is the process of deciding how to make decisions i.e. establishing the high level criteria under which alternative courses of action are taken, for example vesting responsibility for disaster recovery in existing ministries or in a new special authority (Boureau et al. 2015). Meta decisions are relevant to disaster recovery planning when people are faced by cascading crises and need to think calmly and strategically because they establish a framework for subsequent operational decision-making and because they can save time and mental anguish by eliminating whole areas of indecision (Platt 2015). The importance of meta decisions in strategic thinking has been recognised for at least twenty years (Singer 1996). They are usually the responsibility of the Office of President, Prime Minister or the Cabinet and are generally taken by high-ranking politicians and senior civil servants, and typically made in response to media pressure and reports of failure to take effective action (Davis 2006).

Davis (2014) defined six issues he called disaster decision "dilemmas" (Figure 2). A dilemma is defined as a difficult choice between two or more alternatives, especially ones that are equally undesirable (Oxford Dictionaries 2016). The choices Davis (2014) outlined, however, are not necessarily mutually exclusive; a country can opt for a mix of strategies, and in this sense they are not true dilemmas. In disaster recovery an optimum or desirable solution might be a balance or mix of alternative approaches. These meta-decisions are akin to a balancing act in which policy makers have to weigh trade-offs between contradictory approaches or strategies. For example, in Chile in the coastal settlements devastated by the 2010 Maule

earthquake, critical facilities were relocated to higher ground whilst housing and commerce, apart from buildings right next to the coast, were rebuilt on the same sites, albeit in more tsunami proof ways. This planning strategy aimed to increase resilience by achieving a balance between increased safety on the one hand and business continuity and economic recovery on the other.

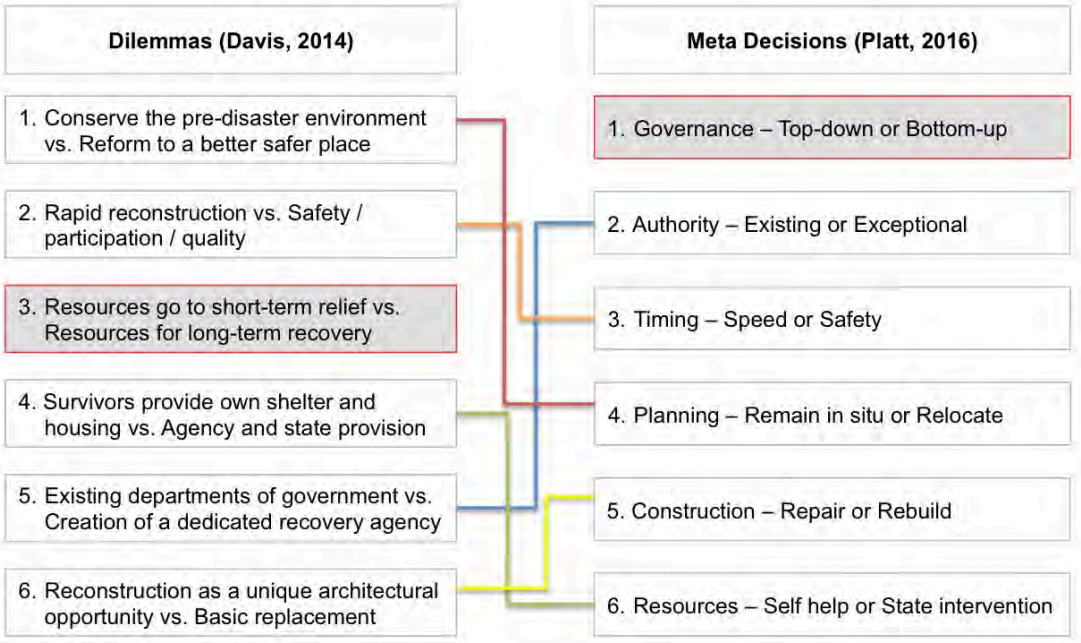

Figure 2. Comparison of dilemmas and meta decisions. (Source: Author)

Figure 2 compares the six dilemmas identified by Davis (2014) with the six suggested meta-decisions. Five of them coincide. The dilemma Davis poses of whether resources should go to short-term relief or long-term recovery was omitted since spending on immediate relief is quite separate to recovery and long-term development and no government in the case study countries confounded the two decisions. Governance, whether decision-making should be top down or bottom up, was not considered by Davis but was found to be important in recovery decision-making.

Methodology

The author has studied recovery in 10 places affected by earthquakes (See Table 1). Insights from these case studies are used to illustrate the relevance of meta decisions for resilience and recovery

Table 1. Data from 10 major earthquakes (Platt 2015)

Country	Name	Year	Date	Mw	Displaced	Deaths	Loss US$ bn	Size
USA	Northridge	1994	Jan-17	6.7	125,000	61	44	0.1
Iran	Bam	2003	Dec-26	6.6	75,000	26,271	1.5	82
Thailand	Indian Ocean	2004	Dec-26	9.2	1,690,000	276,025	14	3,979
Pakistan	Kashmir	2005	Oct-08	7.6	3,500,000	100,000	2.3	1,313
China	Wenchuan	2008	May-12	8.0	1,940,000	90,000	75	1,393
Italy	L'Aquila	2009	Apr-06	5.8	67,000	309	16	0.7
Chile	Maule	2010	Feb-27	8.8	800,000	550	30	45
New Zealand	Christchurch	2011	Feb-22	6.3	25,000	185	16	39
Japan	Tohoku	2011	Mar-11	9.0	130,927	18,499	235	5,502
Turkey	Van	2011	Oct-23	7.1	50,000	604	1	0.4

Table 1 provides a comparison of the scale of the disaster in different countries. For clarity, this chapter focuses on case studies of 6 of the most recent of these major earthquakes and tsunami, highlighted above. One can see immediately what a huge disaster the Tohoku earthquake was in Japan both in terms of fatalities and economic loss. Size is measured by the formula: $Size = deaths * loss/gdp$. *(Dacy & Kunreuther 1969; Padli et al. 2010; Barton & Nishenko 2015)*

Data collection

Three types of data collection methods were used in a complementary way to provide both quantifiable and qualitative data and to improve the reliability of the evidence. The methodology of measuring recovery and resilience is reported in more detail in Platt, Brown & Hughes (2016).

1 Remote sensing: Manual and semi-automatic analysis of satellite imagery was used to provide accurate quantifiable measure of recovery of relatively small sample areas in Pakistan, Thailand, China, and Turkey. Twelve indices of recovery were identified covering transport, housing, shelter, services, environment and livelihoods (Platt, Brown & Hughes 2016). However, the satellite imagery analysis was partial. The analysis covered only part of the affected area for specific snapshots over the first two years of recovery.

2 Interviews: Semi-structured interviews and focus groups were conducted with decision-makers, planners, stakeholders and residents. Typically 30 key informants were interviewed in each location and about half of them attended a focus group workshop to explore issues in greater detail. Their perceptions and opinions formed the basis of the meta decision analysis reported below. No specialised software was used but interview quotes were coded into a thematic framework using a standard ethnographic procedure.

3 Surveys: Household surveys of a small sample of residents were used in 6 of the 10 disaster locations (Chile, Japan, New Zealand, Pakistan, Thailand and Turkey) to collect data about the timing and quality of recovery plus many other qualitative aspects of the process. Household surveys of 50 households chosen randomly were used to collect data about the timing of recovery. People were asked by what percentage different aspects of society (access, debris clearance, environmental recovery, schooling, healthcare, mains water and livelihoods) had recovered at given intervals after the disaster. Other resilience factors such as governance, leadership, planning, science and construction were derived in part from published sources and in part from the interviews.

4 Analysis of published material: As much use as possible was made of reports, statistical data and documents produced by government departments and international agencies. This helped provide base line data on population, housing and economic activities and was used to validate the extent and timing of various aspects of recovery, for example school and health provision. There was, however, limited data about rehousing, business continuity, funding recovery and regional GDP was available for some of the case studies. Published sources also provided data about the impact of the disaster in terms of deaths, displaced persons and economic loss, and pre-disaster resilience attributes for example demography, economic product and socio-economic factors such as equity and education. It would have been most helpful to have obtained published data about the timing of recovery, for example about population movements, housing and the local economy, but it was extremely difficult to get any useful information.

Measuring the speed and quality of recovery

Speed of recovery was measured using key informant interviews in every case and satellite imagery analysis in Pakistan, Thailand, Turkey, Italy, China and New Zealand. The timings reported by key informants was compared to that from remote sensing and was found to correlate closely (Platt, Brown & Hughes 2016).
10 indicators were used to calculate a single measure of the speed of recovery, "return to normality", based on the number of months taken to return and comply with all the conditions listed in Table 2.

Recovery quality was assessed using interviews data, field observations and published material. 7 indicators were used (see Table 2) to calculate a composite measure of quality of recovery based on the concept of "building back better" (Kim & Olshansky 2015). Each indicator was assessed in terms of whether the recovered state was worse, the same or better than the pre-disaster state and assigned a score (-1, 0, or 1). These scores were summed to give a single composite measure of the quality of recovery in each country.

Table 2. Indicators of speed and quality of recovery.

SPEED INDICATORS		QUALITY INDICATORS	
Access	fully restored		worse (-1) same (0) better (1)
Debris	completely cleared	Safety	-1, 0 or 1
Environment	≥90% restored	Amenity	-1, 0 or 1
Temporary housing	completely cleared	Environment	-1, 0 or 1
Permanent housing	≥90% displaced rehoused	Infrastructure	-1, 0 or 1
Schooling	≥90% children in school	Housing	-1, 0 or 1
Local admin.	fully functional	Urban design	-1, 0 or 1
Power	fully restored	Local economy	-1, 0 or 1
Mains water	fully restored		
Livelihoods	≥90% back in work		
Return to "normality" = time taken for all above conditions to be met		Recovery quality = sum of indicator scores	

This was a similar approach to that adopted by Burton (2012) in research that aimed at measuring the multi-dimensional nature of disaster resilience. He asked "what set of indicators provide the best comparative assessment of disaster resilience and to what extent do these indicators predict … disaster recovery" (Burton 2012, p. 3).

The balance of meta decision making was measured using a five-point Likert scale in which the mid-point indicated a balance between the two alternatives, for example between top-down or bottom-up governance structures. This assessment was made principally on the basis of the key informant interviews. It should be stressed that there is no 'right answer'. Higher scores are not better than lower scores and a balanced mix of strategies devised to suit particular circumstances may be the 'best' approach in terms of balancing speed and quality. Finally a single measure of balance was calculated for each country summing the absolute deviations from the mid value of 3 using the formula Balance = $\sum_{n}^{1} 12 - (Abs\ score - 3)$.

In the following sections evidence from the remote sensing, interviews, surveys and document analysis is used to illustrate aspects of the 6 meta decisions. Of necessity these examples are in no sense comprehensive but have been chosen to highlight different aspects of meta decision-making.

Governance – top-down or bottom-up

Governance is defined in this chapter as the extent to which control and decisions about recovery are "top-down" and centralised or "bottom-up" and delegated to regional and local authorities with a degree of community consultation and involvement. In 5 of the 10 countries (China, Iran, Pakistan, Thailand and Turkey) there is a top-down governance structure. There are, however, differences of detail.

In Pakistan governance is conducted through military institutions and government departments. Turkey also has a centralised top-down structure with little tradition of

community involvement. Van is in the far east, away from the centres of power in Ankara and Istanbul, and local involvement of stakeholders was hampered by political tensions of the Kurdish separatist movement. Decisions about reconstruction were taken by AFAD, the Prime Minister's Office for Disaster Management, and Toki, the Government Housing Agency. Interviews with personnel in AFAD revealed that geologists made planning decisions in Van on the basis of distance from a known fault and whether the land was government-owned; there was no public consultation (Platt and Durmaz Drinkwater 2016). Iran, Thailand and China have similar autocratic top-down governance structures.

In Italy decision-making was initially top-down, but after the first phase there was a failure of governance and a lack of coordination between regional, provincial and municipal authorities. There was little genuine community involvement and consultation even by local architects, engineers or academics. Governance after the L'Aquila earthquake might be characterised by chaos and failure of government. The many people who spoke at the Forum organised by the OECD (OECD, 2012) and Groningen University (Brezzi & McCann 2012) on recovery in L'Aquila, attended by the author of this chapter, related how the national, regional, provincial and municipal authorities had failed to cooperate effectively, with each accusing the other of being the cause of delay. This judgement is supported by Alexander (2010) and Daziel (2012).

In contrast governance in the USA, Japan, New Zealand and Chile was more balanced with delegation of authority to regional and local government and with stakeholder involvement and community consultation. In Chile the government appointed a national coordinator to develop a reconstruction plan. The plan was based on the premise that "*the State is unable to reconstruct everything or even control the process of recovery centrally from Santiago. With the support of the state, it is the responsibility of each region, town council and community to develop its own plans*" (MINVU 2010 p. 108; English translation MINVU 2013 p. 2). This meant that authority was delegated to the regional government. The distinctive aspect about recovery in Chile, however, was the quality of the participation process that involved the community in decision-making and kept them informed about progress (See Figure 3). The architects heading the three teams master planning recovery in the eighteen coastal settlements, visited their areas at least once a week, briefing residents groups and business people and walking the streets to monitor progress and meet residents. Maps, sketches and plans were used throughout this process to communicate ideas and get feedback. The main objective was to get business up and running again. So restaurants and fish processing plants operated in temporary structures while permanent accommodation was planned and built.

Figure 3. Architect Carolina Arriagada showing plans to the residents at a community association meeting in Tubul, Chile, 15 December 2011. (Source: Author)

Similarly in Japan after the Tohoku disaster in 2011 the central government took control providing the resources and setting the agenda and the regional and municipal authorities interpreted this policy and implemented plans. There is also a legal obligation in Japan to consult members of the community. But there are cultural differences between Chile and Japan that impacted the speed and quality of recovery. The political structure in Japan is more strongly centralized and the national government maintains a closer oversight over the prefectures, cities and other local government institutions so there is much less delegation of decision-making (Sorensen 2004). Public consultation in Japan was therefore more formalised, less inclusive and gave priority to a smaller section of opinion. One of the interviewee Miura Tomayukin, a residents' association leader, claimed that elderly men dominated decision-making in Tohoku and tended to be conservative and safety conscious.

In New Zealand the Canterbury Earthquake Authority (CERA) and Christchurch City Council (2011) made efforts to involve citizens in the debate about the future of the city. CERA conducted community workshops and public consultation on the Recovery Strategy for Greater Christchurch (CERA 2011). The City Council planning department's focus was on re-planning the central business district and it ran the *Share an Idea* campaign that involved residents through an interactive website and an exhibition attended by over 10,000 people (Carlton 2013). However, despite these initiatives more power lay with the Minister for Canterbury Earthquake Recovery and CERA than with the city council or local citizens and stakeholders.

Authority – existing or exceptional

There were considerable differences in who had responsibility and authority for decisions in each researched country. Authority is defined as whether existing ministries and local government are in charge or a dedicated body has been constituted and a minister or committee is in control. Typically creation of a dedicated body may need special legislation.

In 6 of the 10 case studies (China, Iran, New Zealand, Pakistan, Thailand and Turkey) authority was vested in a special body.

The Government of Pakistan established the Earthquake Reconstruction and Rehabilitation Authority (ERRA) on October 24, 2005, two weeks after the disaster, to control all aspects of relief and recovery. ERRA is a military led organization comprising armed forces personnel, civil servants and technocrats. ERRA's mission is to "convert adversity into opportunity" by "building back better" (GFDRR 2014 p. 4). In coordinating the many organisations involved in relief and recovery ERRA adopted the UN cluster approach response that grouped humanitarian organisations into specific areas or 'clusters' of responsibility, for example health and water/sanitation. This cluster approach was developed in 2005, after the Indian Ocean tsunami, when the UN under Secretary General for Humanitarian Affairs, Jan Egeland, commissioned a review of failure in the international response to humanitarian crisis (United Nations 2005). The early performance of clusters in Pakistan was uneven, responsibilities not clearly defined and some clusters struggled until government departments were involved, but it provided a framework for coordination in a chaotic operational environment (Hidalgo, 2007).

In New Zealand initially the local authorities, Christchurch City Council and Waimakakiri District Council, were in charge. The state of emergency was lifted two weeks after the September 2010 earthquake. The Christchurch Mayor said this represented *"a move closer to business as usual*" (BBC News 2010 p. 1). Damaged buildings were evacuated but the centre remained open (Platt 2012a). This changed after the second more devastating earthquake the following February 2011. Two weeks after the February quake the Government passed emergency legislation, the Canterbury Earthquake Recovery Act 2011, by order in Council. The act granted extraordinary powers to the Canterbury Earthquake Recovery Authority (CERA) as a department of government with a Minister, Gerry Brownley, to coordinate recovery and to make recommendations to Government. Instead of working to strengthen the City Council, CERA took over its core recovery functions and the City Council was, initially, side-lined. However, despite the tensions, CERA and the municipal authorities managed to cooperate. In January 2015 CERA was downgraded from a department to an agency within the Department of the Prime Minister. Over time the balance of power gradually reverted to the City Council.

After the disaster in Tohoku in 2011 the Japanese government immediately sought to broaden the recovery strategy by setting up an advisory council. Within two months the council issued 'seven principles for the reconstruction framework', that became the basis for the government guidelines that were decided by the National Policy Unit three months after the disaster (Government of Japan 2012). The new governmental Reconstruction Agency, reporting to the Cabinet, was established in February 2012. Its aim was to plan and coordinate all national reconstruction policies and measures and to support the efforts of afflicted local governments by serving as a 'one-stop shop'. The role of the central government was therefore to provide guidelines for reconstruction and support in terms of finance, human resources and know-how but the main administrative actors were the municipalities.

In Chile the central government recognised it would be unable to reconstruct everything or even control the process and national coordination was limited to defining the scale of the problem and allocating resources. Planning and implementation was the responsibility of regional government and specialist teams of experts. What distinguished recovery in Chile

was the community consultation and the desire from the bottom up to rebuild as quickly as possible but also to build back better (Platt 2016).

Timing – speed or safety

Decisions about whether the emphasis should be on rapid reconstruction or on increased safety and "building back better" are perhaps the most critical of post disaster meta-decisions (Kim and Olshansky, 2015). The key question facing the authorities is whether they should aim to reinstate livelihoods and rebuild homes as quickly as possible or is the crisis an opportunity to change – to increase safety, to strengthen the economy and to improve the urban environment. Speed of reconstruction was exceptionally fast in two of the studied countries, China and Turkey, where a large proportion of displaced families were rehoused within two years (Miao 2010; Dunford & Li 2011)

In Italy after the L'Aquila earthquake in 2009 the main issue was the slow recovery of the local economy. Most of the historic buildings were safeguarded with an exoskeleton of scaffolding however it may take years to repair them (See Figure 4).

Figure 4. Protecting cultural heritage in L'Aquila. (Source: Author)

Meanwhile, much of the city centre of L'Aquila was closed and the University, the main economic driver in the region, was operating in temporary rented accommodation. Local architects and engineers devised a master plan for the city. But Central Government rehousing projects were poorly planned, the Regional, Provincial and Municipal authorities refused to collaborate and reconstruction and economic regeneration stalled. The priorities of residents were: repair and reconstruction of their homes, reconstruction of the historic centre and re-establishing employment (OECD 2012), but the centre of L'Aquila city is still not

repaired or rebuilt, although the process of rebuilding had begun by 2012 on the outskirts of the town (EEFIT 2013). Instead of repairing existing homes the government built 12,000 new homes in 19 new settlements 15 kilometres from the old city centre (Alexander 2010). These were built in only 8 months and the idea was that they would have a transitional use and as soon as the reconstruction was complete, they would be used as university accommodation.

Chile achieved a better balance of speed and deliberation. There was intense pressure from the residents to rebuild homes, restore facilities and get the economy moving (Comerio 2013). But there was also a desire on the part of the authorities to develop new urban plans that would improve these communities and make them safer. Master Planning of the 18 coastal settlements affected by the disaster was completed within 10 months by a team of architects and planners seconded from the University of Bio-Bio. The main thrust of these master plans was to restart business, rehouse residents and to improve safety. This involved relocating critical facilities such as the fire station and moving buildings back from the beach. The sea defences included a setback for buildings of 50-80 metres, a 20-30 meters band of trees and a promenade forming a sea wall. The teams also produced designs for tsunami resistant housing. The houses have a reinforced concrete ground floors and timber frame second storey. These were nearing completion when the author visited the area 18 months after the disaster (Platt 2012b)

Japan was traumatised by the unanticipated scale of the 2011 Tohoku earthquake and tsunami. The Japanese government's top priorities were also economic revival and safety. In contrast to Chile, however, these two aims seemed to be at odds and were causing delay in rehousing people and revitalising business. The safety imperative in Japan meant that ways of life and people's relationship to the sea had to change and this was painful and caused dissent. Up to 9 metre high tsunami protection levees are being built (See Figure 5). Homes were moved to higher ground along the fiord-like Rias Coast and on the Sendai Plain, where there are no natural hills, housing was concentrated on raised platforms (Platt 2013). By law the authorities have to consult people and it is in the nature of Japanese society to try to reach consensus rationally (Heath 1995; Kopp 2012). This takes time, which undermined the possibility of recovery in places that were already in economic and demographic decline.

Figure 5. Shibitachi, near Kesannuma, Japan 5 June 2013 (The banner indicates the height of the proposed sea wall). (Source: Author)

In Turkey the imperative was speed, particularly to rehouse people in permanent housing. In the days immediately after the earthquake 300,000 people were housed in temporary shelter, mainly tents, and 200,000 out of a population of about 1 million left Van and Ergis to stay with relatives (Basburg et al. 2015). Transitional shelter in containers was provided within 3 months. A total of 35 camps comprising 30,000 containers and 175,000 inhabitants were established in Van and Ergis (Erdik et al. 2012). The 21 m^2 temporary container houses were smaller than those provided in Japan and housed much bigger families, but people didn't have to stay in them nearly as long as people did in Japan. The author visited Van 10 months after the earthquake and all the tents had been replaced with containers and the temporary camps were full. They were well policed and contained shops, schools and play facilities. The author visited again 18 months after the disaster and the camps were nearly all empty. Within 15 months, the Ministry Housing Development (TOKI) had built 10,000 dwellings in Van, and 5,000 in Erçis. This rate of reconstruction is unprecedented (Platt & So 2016). The new TOKI housing (Figure 6) is more earthquake-proof than previous homes and new hospitals, schools and government buildings were built to code. This was part of a nation-wide policy known as 'urban transformation' aimed at upgrading construction after the 1999 İzmit earthquake (Elincin, 2014). All buildings must be inspected before they can be repaired and, in theory, dangerous buildings that cannot be repaired will be demolished.

Figure 6. New Toki housing in Van, Turkey. (Source: Author)

However, despite aiming to rebuild a better Van, it was almost impossible for the urban planners to produce plans to improve the city centres of Van or Erciş. Senior planners in the Ministry of Environment and Urban Planning in Ankara responsible for planning Van said in an interview that it is difficult to 'expropriate' private land in Turkey and owners don't want to give up land for parks or public space.

Planning – Remain in situ or Relocate

An aspect of the wider question about speed and safety is whether homes and activities should be reconstructed in the same place or relocated to safer areas. Relocation is generally considered as a last resort because of land ownership issues and public opposition (Gonzalez Muzzio 2012). Although the policy decision to relocate is taken at high levels, detailed implementation involves local land-use planning decisions about which built-up land should be abandoned and new green-field or agricultural land be taken into use.

In Christchurch, in neighbourhoods bordering the lower River Avon and along the River Waimakariri in Kaiapoi to the north, there was widespread liquefaction (Quigley et al. 2012; Ballegooya et al. 2014). The water table raised nearer the surface and the crustal thickness was reduced and less able to support the weight of built structures. Severe widespread liquefaction affected many of the Christchurch suburbs, especially Avonside, Avondale, and Bexley, and its central business district. This meant a loss of large areas of the city. Approximately 20,000 houses were seriously affected by liquefaction, out of which between 6,000-7,500 were damaged beyond economic repair and were abandoned (Cubrinovski 2012). Buried pipe networks suffered extensive damage and the wastewater system was particularly affected resulting in loss of service to large areas (MacAskill 2016). Extensive areas along the lower River Avon and around the estuary and coastal zones, and in the town of Kaiapoi, were

deemed as unsuitable for rebuilding, and the government 'bought' the affected properties, and cleared the land. Complete neighbourhoods and some communities were displaced (Swaffield 2013).

In Pakistan, after the 2005 earthquake, the Government of Pakistan decided to relocate the city of Balakot. In the North-Western Frontier Province (NWFP), Balakot was the area worst hit by the earthquake. Situated on the conjunction of major fault lines, Balakot city was declared a "red zone" and unfit for the reconstruction (Quzai 2010). ERRA instituted a new reconstruction project named "New Balakot City Development Project" at Bakarial, a site 23 Km south, where, it was claimed, most of the land was government owned (Ismail 2012). Yet owners of some of the land designated for the new city refused to leave (Shafique & Warren 2015). When the author visited the town nine months after the disaster new inhabitants had already migrated to the town because of its strategically important location and had set up businesses and were building homes. The key issue seems to have been a failure to involve the local community (Asad, 2014). Shafique (2016, p .77) reports that "due to severe clashes between government agencies and local land owners, the work on project was suspended on various occasions and the completion dates revised from 2010 to 2012 and then to 2013. In 2016, the project has achieved less than 15% of its targets".

Construction – Repair or Rebuild

Unless the decision is to relocate the whole city or settlement, governments and building owners need to decide whether to repair or rebuild after a disaster. Two case study countries – Iran and China - opted for complete rebuilding. The remaining countries opted for a mixed strategy.

In New Zealand there was a feeling amongst engineers that some decisions to demolish were unjustified and that demolition was driven by the high level of insurance penetration and by a conservative approach to safety (Lynch 2012). The engineers the author interviewed at Canterbury University in Christchurch and GNS Science in Wellington confirmed this. One of the key issues was that few cities hit by recent earthquakes had suffered such a high intensity of aftershocks and this had influenced decisions about reinsuring buildings in Christchurch (Merkin 2012; Watson 2012). Owners had to lodge an application to demolish, but permission seems to have been automatic. It is possible that some buildings were under-insured and were seen as too costly to repair. The most profitable option may have been to demolish and reinvest the insurance pay out, especially since the Christchurch City Council constrained the number of storeys they can rebuild. The main policy outlined in the Christchurch City Council's Central City Plan was for a more compact, low-rise, greener city centre, in which building heights would be strictly controlled (Christchurch City Council, 2011). City centre businesses were relocated to the periphery.

The City Council was also engaged in a debate about saving historic buildings, the most heated concerned the Anglican Cathedral (Burdon 2015). Christchurch was unusual for the quality of its Gothic Revival public buildings and the city's Victorian and Edwardian character (Lockhead 2012). A serious architectural loss was the collapse of the Canterbury Provincial Council Chamber (1865), a remarkable colonial example of High Victorian Gothic by the local architect, Benjamin Mountfort (New Zealand Historic Places Trust 2012). This example from New Zealand, an advanced country that values its historic buildings, illustrates the importance of decisions about repair or demolition and how, unless these issues have been

debated and decided in advance the is a risk that irreplaceable cultural heritage will be lost in the heat of the moment.

Emergency legislation removed all statutory protection for heritage buildings and over 150 listed heritage buildings were demolished in Christchurch. In contrast in L'Aquila, over 3,000 medieval buildings were damaged, many as badly as those in Christchurch, but were subsequently supported with scaffolding (Comune di L'Aquila 2011). Over half of the city centre was demolished, many historic buildings were lost and extensive areas of residential land were taken out of use. There is clearly a tension between a desire to conserve the familiar and repair damage, usually the preferred option of residents, and the ambition to make safer and 'build back better, often led by government (Contreras et al. 2014). Balancing these competing goals is one of the main aims of meta decision-making.

In Pakistan, after the earthquake in 2005, the federal government directed the Housing Ministry to upgrade building codes to match international standards and in March 2006, the Ministry, in collaboration with National Engineering Services Pakistan Limited (NESPAK) drafted new building codes. But in the years following the release of the codes there was evidence that few people had followed recommended construction practice (Hasseb et al. 2011). The high cost of standard building materials, especially steel and cement, the lack of understanding about sound concrete construction and the lack of adequate site supervision meant that reconstruction was not as safe as supposed. "Owing to the complicated design and high cost of construction material, the victims were forced to abandon ERRA's technical architectural plan, depriving majority of the victims with the third and fourth instalments of compensatory payments" (Sadaqat 2012, p. 2).

Resources – Self-help or State intervention

The final meta-decision is about financing business continuity and reconstruction. These are decisions about whether businesses should fend for themselves or receive support, whether individual households or the state should rebuild homes, and whether government should try to control resource allocation and price or leave demand and supply to market forces. In part these decisions depend on sovereign wealth and insurance penetration. Insurance penetration ranged from near 100% in New Zealand to virtually zero in Pakistan. Chile was somewhere between these extremes. Nevertheless insurance played a major role in Chile in facilitating the financial means for recovery and reconstruction (Franco & Siembieda 2010). Although insurnace penetartion was low (30% of the residential properties in the Santiago metropolitan area and 10% elsewhere, and about 60% for commercial and industrial properties throughout the country) the insurance system worked well and provided financial coverage for between 20-30% of the monetary losses.

All the countries studied, with the possible exception of Iran, prioritised business continuity and some gave significant amounts of assistance to help business continue. In Chile, Japan and New Zealand the local government financed the construction of temporary shops and restaurants and these became local tourist attractions (see Figure 7).

Figure 7. Business continuity and temporary retail outlets (ReStart shopping mall, Christchurch New Zealand 9 May 2012). (Source: Author)

In terms of housing reconstruction, most reconstruction in China was done by the state and in Japan and New Zealand funding for reconstruction came from the state or the global insurance industry (OECD 2015). In Turkey and Italy a proportion of new homes were also built by the state but to facilitate construction they were built far from where people would have chosen. In contrast, in Pakistan, to ensure that homes were rebuilt the way people wanted, the policy was for people to self-build on the same plot with government advice about safer construction (Bajwa 2007). It was hoped that this approach would more adequately match people's detailed needs than state rebuilding, but it was only partially successful for two reasons: the financial assistance was insufficient, the technical advice was unclear and people lacked understanding of safe construction practice.

Figure 8 profiles the 10 countries in terms of the 6 meta decisions. The top of the graph indicates centralised state control and intervention. The bottom of the graph implies people fare for themselves. The middle implies a balanced approach. Of the 10 countries, only Chile achieved a completely balanced approach. This is reflected in the graph below where meta-decision making in Chile is shown as a flat light green line. (A failure to take a decision would be represented by a break in the graph line).

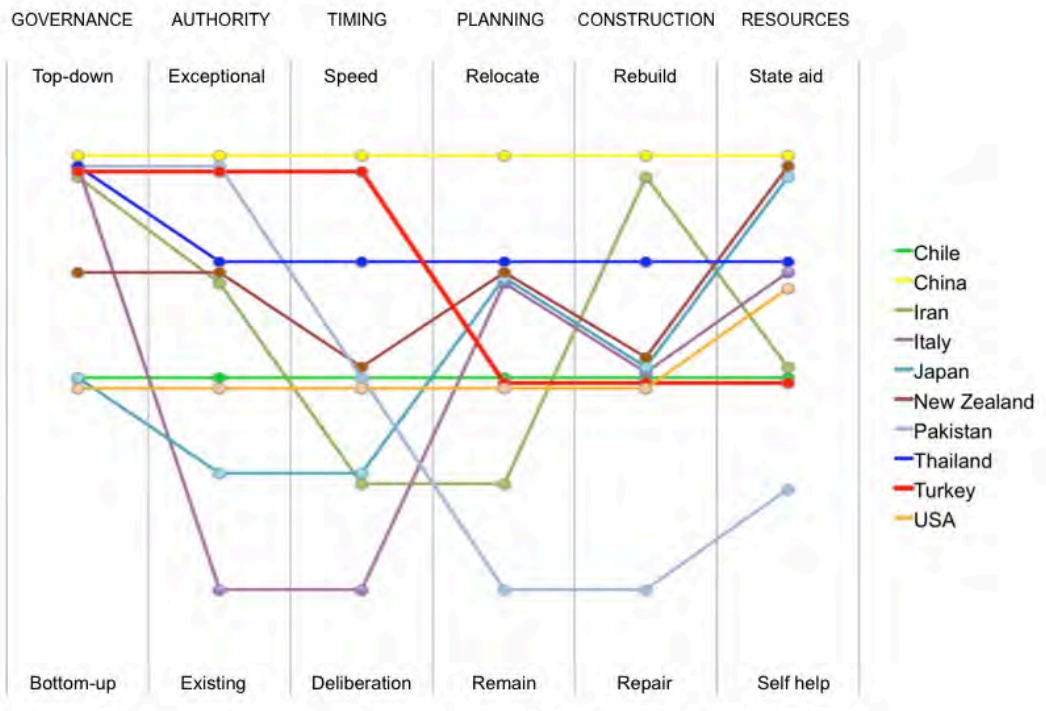

Figure 8. Comparison of meta-decision making in 10 countries. (Source: Author)

At first sight there appears to be no pattern; each country has a quite different profile. China's state control is reflected in the flat yellow line at the top of the graph. Thailand is similar but not so extreme. Japan and Italy have a similar shaped profile, but Japan is closer to middle. New Zealand might have been expected to have a similar profile to Japan, but the failures by the city authorities lead to the central government taking more control than might have been expected. Chile and USA have similar balanced profiles and in middle of the graph. Pakistan's profile looks like a ski jump, reflecting the high level of state planning but people still having to largely reconstruct themselves. Turkey is similar to Pakistan but there was more state aid for reconstruction. In Iran the almost total collapse of mud brick structures in Bam meant that, apart from repairing the Arg of Bam, the government decided on a complete rebuild. This will significantly improve safety and resilience, but the new built form is unsympathetic to the local vernacular or climatic conditions.

As described earlier a single measure of balance of meta decision-making was devised for each country. Figure 9 shows that using this subjective measure Chile had the most balanced meta decision-making and China the least. This measure will be used to attempt to answer the questions posed at the beginning of this chapter.

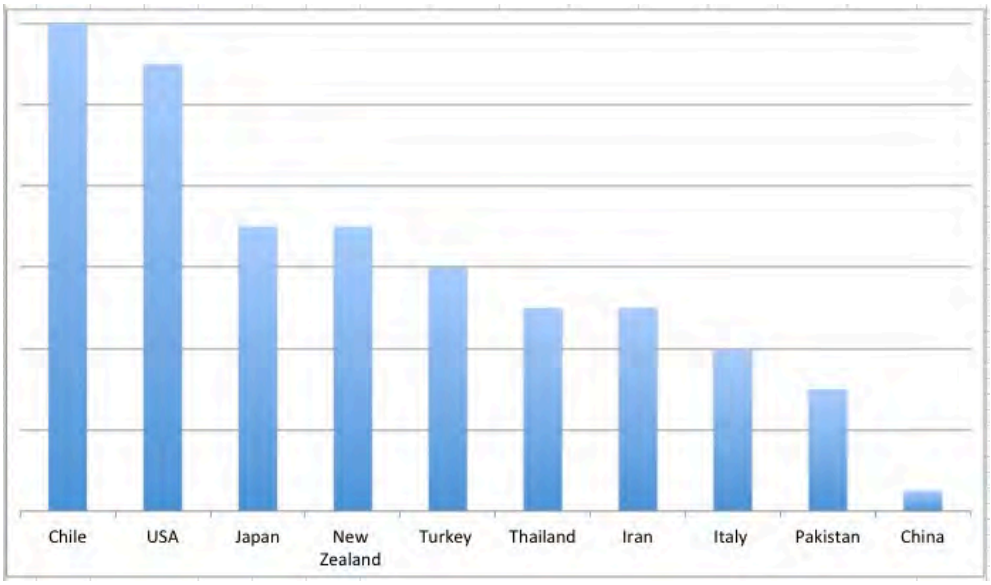

Figure 9. Balance of meta-decision making. (Source: Author)

Do countries that are able to make meta decisions quickly recover faster?

Logically recovery should be faster if meta decisions are made quickly or in advance of disaster rather than slowly after. For example Kim and Olshanky (2015) argue that recovery planning is best done before disaster strikes and cite as evidence an analysis of 87 local recovery plans in 8 US states by Berke et al. (2014). Table 3 relates the speed of meta decision making to the speed of recovery and shows a strong correlation (-0.846). Half the countries studied Chile, China, Thailand, Turkey and the USA made quick meta decisions and all "returned to normality" in 5 years. The other half, Iran, Italy, Japan, New Zealand and Pakistan, made meta decisions more slowly and took longer to recover (between 10-25 years to "return to normality").

Table 3. Speed of meta decision-making and speed of recovery

	Quick meta decision making	Return to normality
Chile	yes	5
China	yes	5
Thailand	yes	5
Turkey	yes	5
USA	yes	5
New Zealand	no	10
Italy	no	15
Japan	no	15
Pakistan	no	15
Iran	no	25
	Correlation = -0.846	

Do countries that achieve a balance of meta decisions build back better?

Fig 10 shows there is also a strong correlation (R^2=0.88) between balance and the quality of recovery as measured by determining whether a range of 8 factors have been "built back better" or not. However, until there is a more robust measure of quality this finding must be speculative and tentative. It should also be noted that there are large differences in the demography, economies, politics and culture of the 10 studied countries and that what is understood by quality of recovery may vary from country to country.

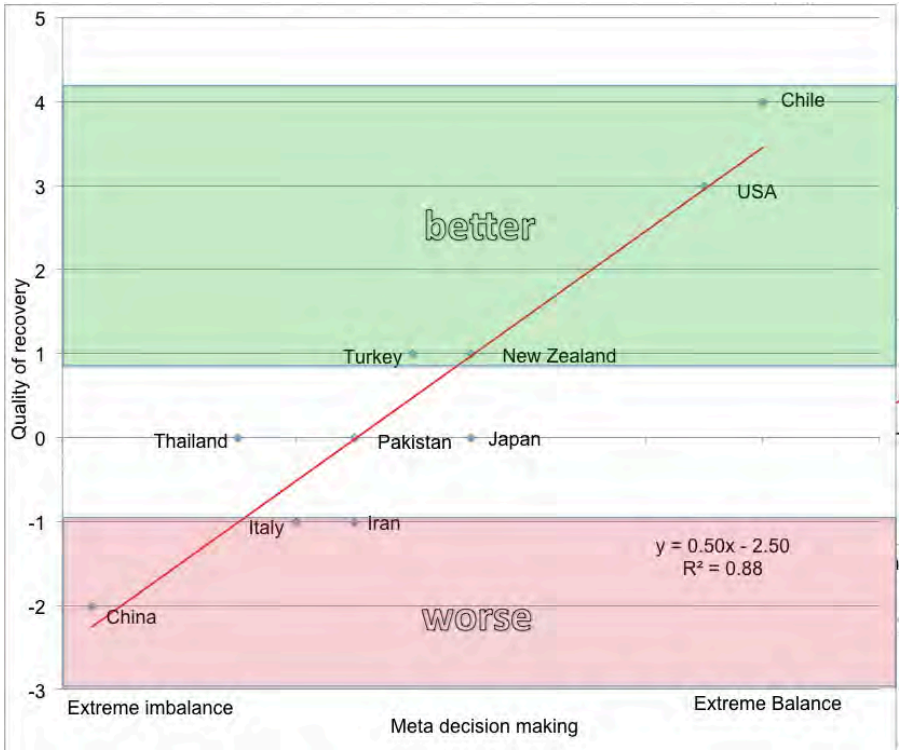

Figure 10. Correlation of balance of meta decision making with quality of recovery. (Source: Author)

This has implications for our understanding and assessment of resilience. A country like Turkey, Iran or Pakistan, with a young population, a high birth rate, strong family bonds and extended family networks, may be more "socially" resilient than a developed country like the USA, Japan or New Zealand. In contrast developed countries may be more "physically" resilient, in terms of built environment and infrastructure, more "technically" resilient in terms rescue and relief systems and disaster management institutions and more "financially" resilient in terms of sovereign wealth, insurance cover and business continuity.

Conclusions

This chapter defined resilience and recovery as they are currently used in the disaster management field. Resilience was defined as the ability to both resist hazard and to recover from loss. Recovery was defined as reaching a stable state of "normality. The chapter also discussed 6 meta decisions or strategic trade-offs and analysed recovery after 10 major earthquakes in terms of these decisions. The purpose was to explore whether meta decision-making affects the speed or the quality of recovery.

Two main conclusions can be drawn from the preceding analysis. Firstly, that the combination of pre-existing robustness and post-event response determines recovery outcomes. This means that resilience can be determined by how well a society resists the impact of a disaster and by how quickly it recovers. But the analysis also suggested that speed is not everything and that as well as "returning to normality", "building back better" is also important in assessing recovery since it increases resilience to future disasters. The key issue for governments and decision makers should therefore be to explore what factors increase resilience and improve recovery outcomes.

Secondly, the chapter explored the effect of meta-decisions in guiding recovery and suggested that better recovery is achieved by striking a balance between the opposing strategies implied in meta decision-making. For example, recovery seemed to be quicker and better in countries with both strong leadership and citizen involvement. And the quality of recovery outcomes appeared to be better for example in countries that adopted a judicious combination of relocation and in situ rebuilding and repair. Only Chile achieved this balanced strategy on all the 6 dimensions of meta decision-making and this concurs with the author's observation that recovery in Chile was the most successful of the 10 case study countries.

Finally the chapter attempted to measure the effect of meta decision-making on the speed and quality of recovery. It found evidence that timely decision making did speed up recovery and that balancing meta decisions significantly improved the quality of outcomes in terms of "building back better". However, the speed of recovery was principally influenced by the size of the disaster and pre-existing socio-economic conditions and that a balance of meta decision making had no effect on the speed of recovery.

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