

Building to Recover
Natural Hazards Research Platform
Programme Summary

Key Lessons for Building Back Better

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Final Report

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Executive Summary

This report examines the design, testing and refining of the Build Back Better Tool for reporting on disaster recovery as recovery develops. The report is part of the analysis under the research project, Building to Recovery (2015-2019), funded by the Ministry of Business, Innovation & Employment through the Natural Hazards Research Platform (NHRP). The research programme built on earlier work examining Building Back Better concepts and ways of implementing Building Back Better, especially as articulated under the Sendai Framework for Action (2015-2020). Design, testing, refining and re-testing of the tool has led to a robust and detailed methodology for assisting with planning, implementing and managing disaster recovery, including a suite of indicators to use for recovery evaluation. This report discusses the tool, and the tests conducted on recovery environments in Christchurch and Canterbury regions. This report is a companion report to the OPUS 2020 report on Building to Recover.

1. Introduction

Disaster management is commonly represented by four phases: mitigation or reduction, preparedness or readiness, response or emergency, and recovery. Governments use disaster management to pre-plan for disaster events, and plan for recovery after disaster events. Build Back Better fits within the pre-event and post-event planning for recovery. This report examines Build Back Better tools and application as developed by a team of New Zealand researchers under the Ministry of Business, Innovation & Employment, Natural Hazards Research Platform (NHRP) funding.

The Canterbury earthquake sequence provided a testing ground for the Build Back Better framework and the development of Build Back Better indicators. The framework allows policy and recovery advisers to manage and alter the recovery trajectories, as the recovery unfolds, but also provides a framework from which to understand how to make the recovery more resilient post-disaster. The subsequent key lessons from the development, testing and refinement of the tool are provided in this report. More recent testing and analysis in Kaikoura has allowed the tool to be further used in practice, to give policy makers a means of understanding how recovery should be planned, and what is needed for implementation and evaluation of recovery.

1.1 The Build Back Better Framework

The “**BBB Framework**” was developed in 2014 by Mannakkara and Wilkinson at The University of Auckland during PhD funded research and subsequently refined to incorporate the final framework in 2016.

Disasters create opportunities including to rebuild the physical, social, environmental and economic infrastructure to be more resilient for future disasters. Rebuilding for resilience is at the heart of building back better. Build Back Better is a concept that emerged following the 2004 Indian Ocean Tsunami, where post-disaster recovery was to be considered an opportunity to recover, reconstruct and rehabilitate affected communities better than they were before by incorporating disaster risk reduction and development activities, making them resilient towards future disasters (Clinton, 2006, Christoplos, 2006, UNISDR, 2015). Pre-disaster preparedness for BBB is one of the four priority actions in the Sendai Framework for Disaster Risk Reduction

(UNISDR, 2015). Integrating the various proposed guidelines and approaches for effective Building Back Better, Mannakkara and Wilkinson (2014a) developed the “Build Back Better Framework” (Figure 1) which encapsulates all the key features identified for resilient post-disaster recovery. The key features of BBB being *risk reduction* via structural and non-structural measures, such as the improvement of structural designs and land use planning; *community recovery* through social recovery and economic recovery; mechanisms to improve the efficiency and effectiveness of post-disaster activities through better management of stakeholders; use of legislation and regulation; and *effective implementation* through better monitoring and evaluation. BBB aims to create stronger and more resilient communities by reducing future risk and improving community resilience.

The Build Back Better Framework presents a holistic approach to reconstruction and recovery identifying it as a three-pronged approach including Disaster Risk Reduction, Community Recovery, and Effective Implementation.



Figure 1: Build Back Better Framework © Mannakkara and Wilkinson, 2014,2016

The Disaster Risk Reduction (DRR) dimension of the Build Back Better Framework includes improving the community’s built environment by enhancing structural resilience; re-thinking land-use based on multi-hazard risk; and providing effective early warning systems and Disaster Risk Reduction education for the community and all stakeholders involved in managing a disaster (Mannakkara and Wilkinson, 2013, Mannakkara and Wilkinson, 2014a,

Mannakkara et al., 2018). Community recovery is the central part of BBB, which aims for psychosocial and economic recovery of communities. Psychosocial recovery can be achieved by educating and empowering communities to cope with the disaster impact and better management of stakeholder relationships. Good relationships among stakeholders lead to better coordination, and clearly established roles and responsibilities help to create synergies.

Effective Implementation in the BBB Framework refers to implementing the principles of Disaster Risk Reduction and Community Recovery in an effective and efficient way (Mannakkara and Wilkinson, 2013). Effective Implementation is achieved by involving key stakeholders in the recovery plan with an appropriate institutional mechanism (Mannakkara and Wilkinson, 2016, Mannakkara et al., 2018), enforcing BBB concepts and facilitating recovery processes through legislation and regulations, and putting in place effective monitoring and evaluation systems to manage ongoing recovery in-line with BBB and improve the future recovery (Mannakkara et al., 2018, Brown et al., 2008).

BBB resilience indicators have been developed under each of the above three dimensions through conducting international case study research to identify best-practices (Mannakkara et al., 2019). The BBB indicators provide guidance to stakeholders for planning and implementing resilient post-disaster reconstruction and recovery and deal with common encounters often overlooked in the past. Due to the straightforward, comprehensive and holistic approach of this framework, the concepts of BBB can be applied successfully to any post-disaster recovery scenario (Mannakkara et al., 2014a).

2. Research Aims

The overall NHRP research aims were to:

Apply the Build Back Better (BBB) recovery framework to 6 recovery cases.

Evaluate the application of the BBB framework across 6 recovery cases

3. Building Back Better – Key Lessons for Recovery

The key research findings from each of the major components are presented below:

The build back better framework was applied to the following New Zealand case studies:

SCIRT, Sydenham, New Brighton, Waimakariri, Christchurch City, Kaikoura.

In addition, the research team applied the build back better framework internationally to:

Nepal, Vanuatu, Cook Islands and Fiji.

This research reports on the New Zealand case studies and key lessons learnt.

The research is continuing through further development and application of the Framework, including an online tool for assessment in post-disaster environments.

The collective research culminated in the book “Resilient Post Disaster Recovery through Building Back Better”, which identifies the build back better framework, build back better indicators and national and international case studies where the build back better framework has been applied.

Below identifies the three key lessons from the New Zealand case studies under each of the 8 key themes of the Build Back Better Framework: 1. Structural Resilience; 2. Multi-hazard based land-use planning; 3. Early warning and DRR education; 4. Psychological and social recovery; 5. Economic recovery; 6. Institutional mechanism; 7. Legislation and regulation; 8. Monitoring and evaluation. Much of the lessons have been published in the book “Resilient Post-disaster Recovery through Building Back Better” written by the key research team on the project, Sandeeka Mannakkara, Suzanne Wilkinson, Regan Potangaroa, and published by Routledge in 2018. Below is a summary of the key lessons learnt from the Build Back Better research.

3.1 Lessons Learnt

3.1.1 Structural Resilience

- (a) When rebuilding ensure that an accurate all hazards approach is taken to rebuilding.
- (b) Legislate for new codes, but ensure that these new codes are sufficiently well designed to take into account consequences of code changes.

(c) Restrict building on high-risk lands and provide funding mechanism for structural upgrading.

3.1.2. Multi-hazard Based Land-use Planning

(a) Update hazards maps and create clear risk zone maps.

(b) Consider land-swap and buy back schemes for hazard prone land.

(c) Consider where community could relocate and provide access, resources and facilities for smooth transition.

3.1.3. Early Warning and DRR Education

(a) Provide communities with frequent and easy to understand hazard information.

(b) Training and resources to organisations with responsibility for assessments.

(c) Use local knowledge and community involvement in the planning and implementation of early warning systems.

3.1.4. Psychological and Social Recovery

(a) Establish community advisory services, with identification and assistance to particularly vulnerable communities.

(b) Bring community together through activities and supported groups.

(c) Empower communities to rebuild, including incorporation into key decisions

3.1.5. Economic Recovery

(a) Understand local needs and develop economic strategy to cater for these needs

(b) Encourage re-establishment of livelihoods by providing appropriate access to funding and facilities

- (c) Provide business recovery grants and access to recovery advisory services

3.1.6. Institutional Mechanism

- (a) Develop a local-level mechanism for managing recover including clear roles, responsibilities and lines of communication
- (b) Involve central services at appropriate level of engagement for scale of event and encourage partnerships between agencies
- (c) Involve local community in recovery decision making

3.1.7. Legislation and Regulation

- (a) Revise building codes based on up-to-date multi-hazard assessments and resource availability.
- (b) Incorporate local technologies and materials and provide incentives to promote resilience improvement strategies
- (c) Provide education on risk reduction and building regulation revisions prior to rebuilding.

3.1.8. Monitoring and Evaluation

- (a) Measure and Monitor the quality and compliance of recovery
- (b) Use monitoring and evaluation to create improvements
- (c) Create lessons learnt for future event response and recovery

4. Project Outcome: A Tool for Building Back Better.

The research case studies allowed the development of an online tool for building back better which can be used for pre-planning in disasters and also used for monitoring and evaluation of the recovery. The tool can be found at: www.buildbackbetter.co.nz. Below is an illustration of the outcomes from a test example.

Online Tool for Planning and Implementing Post-Disaster Recovery using Build Back Better Indicators										
BBB Principle	Low Resilience Indicator	Weight	ANSWER				High Resilience Indicator	Your Rating	Max Rating	Indicator
			N/A	Low		High				
			0	1	2	3	4			
1. Disaster Risk Reduction										
1.1 Structural Resilience <small>Rebuilding the built environment cost-effectively and in an integrated way with better resilience to withstand and recover from anticipated disaster risks.</small>	SR1	Poor or outdated understanding of hazards affecting physical assets. Little to no accurate knowledge of disaster risks and		3			Accurate, up-to-date understanding of all hazards affecting physical assets and resulting disaster risks and vulnerabilities	22	40	1.1 Structural Resilience <small>Rebuilding the built environment cost-effectively and in an integrated way with better resilience to withstand and recover from anticipated disaster risks.</small>
	SR2	No or outdated structural codes. Structural codes and guidelines specifying materials and technologies that are scarce, unavailable or unaffordable		2			Legislated structural codes based on up-to-date multi-hazard assessments with design and construction specifications aligned with local resource availability and affordability			
	SR3	Disregard of traditional technologies and local knowledge and skills		2			Building codes and regulations that incorporate traditional technologies and aligned with local knowledge and skills			
	SR4	No or little communication and education to stakeholders on post-disaster building regulation changes and updates		1			Education provided to stakeholders on post-disaster building regulation changes prior to commencing rebuilding work			
	SR5	No or little planning with regards to how structural improvements can be funded		1			Long-term funding mechanisms in place to fund extra costs incurred for structural improvements			
	SR6	No incentives to promote the adoption of structural improvements		1			Incentives planned and in place to promote adoption of structural improvements to homes, buildings and infrastructure			
	SR7	Construction of physical assets on high-risk lands disregarding future impacts		2			Construction on high-risk lands restricted			
	SR8	High pressure for fast, reactive rebuilding with no time for innovative thinking and improvements due to the lack of redundancy and transitional arrangements		3			Redundancies and transitional arrangements in place to relieve pressures on fast and reactive rebuilding (e.g. transitional accommodation, alternative travel routes etc) and implement well-planned rebuild projects			
	SR9	No quality assurance in place, or complicated inefficient quality assurance mechanisms in place that are inappropriate for high pressure post-disaster environments		4			Practical, uncomplicated and efficient quality assurance measures in place appropriate for post-disaster environments			
	SR10	Use of unskilled, uncertified builders for reconstruction due to inability to meet reconstruction demands		3			Incentives or special arrangements (e.g. alliance or public-private partnerships) planned and in place to attract skilled certified builders to meet reconstruction demands			
	Owner-building of homes with no supervision, training or quality assurance		0			Provide professional supervision for owner-building of homes for quality assurance				
	SR10	Home-owners isolated in the rebuilding process with no support or advisory services available		0			Rebuilding advisory service with rebuilding advisors in place to support, educate and assist home-owners needing to rebuild			
	LP1	Poor or outdated knowledge of hazards, or focusing only one hazard type		4			Accurate, up-to-date understanding of all hazards in the area by conducting multi-hazard assessments and creating clear risk zone			
	LP2	Land-use plans not updated in response to modified risk levels or land-use plans modified but not enforced		3			Land-use plans revised with appropriate land-uses determined from analysing the new risk zone maps AND relevant updated building regulation and enforced using appropriate legislation			

Figure 2: Tool for Building Back Better

5. Project Descriptions

5.1.1 Project SCIRT

Build Back Better Analysis of SCIRT's Water Infrastructure Rebuild in Christchurch

Masters Thesis:

Basset, M. (2015) Build Back Better: Rebuilding Water Infrastructure following the 2010-2011 Canterbury Earthquakes

The aims of this project were to:

- Identify how the BBB Framework and BBB Indicators can be applied to the rebuilding of horizontal infrastructure
- Evaluate SCIRT's horizontal infrastructure rebuild process in Christchurch following the 2010/2011 Earthquakes and identify successes and gaps
- Developed tailored BBB Indicators for resilient horizontal infrastructure rebuilding

Methodology:

The research used the following methodology:

- Literature review and document analysis
- Semi-structured interviews with SCIRT staff (senior staff from each delivery team and four owner participants)
- Data analysis using Grounded Theory on Nvivo

Lessons Learnt:

- Lesson 1 – The BBB Framework is versatile, universal and easily adaptable

The BBB Framework is a robust tool and is universally applicable to assist with sector-specific recovery

- Lesson 2 – BBB needs to be contextualized

BBB should not be prescriptive. This study developed modified indicators suitable for post-disaster water infrastructure rebuilding. BBB is successful when it is tailored to the local context and modified to take into account practical constraints.

- Lesson 3 – Creating an alliance for rebuilding was a success

The alliance model of SCIRT which included the owner and delivery participants together led to extensive learning, easy access to information and exchange, diverse skills and experience, and innovation

- Lesson 4 – SCIRT’s water infrastructure was built back better

Amidst time and budget constraints and complexities faced SCIRT’s water infrastructure rebuild applied nearly all BBB Framework components well or really well. The rebuild led to better structural performance and redundancy, and did well in considering social and economic aspects.

5.1.2 Project New Brighton

Build Back Better Analysis of Business Recovery in New Brighton following the Canterbury Earthquakes

Student Project Reports:

Kim, I (2017) Evaluating the International Build Back Better Framework in the Post-Disaster Recovery Effort in Christchurch, University of Auckland.

Kang, R. (2017) Evaluating the International Build Back Better Framework in the Post-Disaster Recovery Effort in Christchurch, University of Auckland.

The aims of this project were to:

- Identify how the BBB Framework and BBB Indicators can be applied to small business recovery
- Analyse the post-earthquake recovery recovery of businesses in New Brighton under the BBB Framework

- Determine BBB best practices to assist with business recovery and pre-disaster planning for future resilience

Methodology

- Literature review
- Semi-structured interviews with small businesses, non-profits and community organisations located in New Brighton (7)
- Semi-structured interviews with Christchurch City Council and Development Christchurch Limited (2)
- Survey questionnaires from all participants
- Data analysis using Grounded Theory on Nvivo

Key Lessons:

- Lesson 1 – Building back safer and business recovery go hand in hand

Structurally upgrading damaged buildings in the rebuild was hindered by the lack of funds as a result of public and private organisations being hesitant to invest in New Brighton. Investors were deterred by the uncertainty of business and economic recovery and prosperity in the area in the future. Businesses/residents/tourists are attracted by a safe built environment, but investment for a safe built environment cannot be attracted without businesses/residents!

- Lesson 2 – Local businesses have high social resilience but lack DRR education and support

Local businesses had strong ties with the area and each other which drove them to rebuild and attempt to recover, but they were not provided education and guidance on business rejuvenation, business continuity planning, preparedness, early warning etc. which will recreate vulnerabilities. Much more support in terms of education and training for DRR needs to be provided to local businesses so that they can be resilient to future events

5.1.3 Project Sydenham

Build Back Better Analysis of Business Recovery in Sydenham following the Canterbury Earthquakes

Student reports:

Jarvis, E. (2017) Build Back Better Framework Case Study: Sydenham Businesses, University of Auckland.

Buckman, C. (2017) Building Back Better – A Case Study of Sydenham Business Recovery, University of Auckland.

The project aims were to:

- Identify how the BBB Framework and BBB Indicators can be applied to small business recovery
- Analyse the post-earthquake recovery recovery of businesses in Sydenham under the BBB Framework
- Determine BBB best practices to assist with business recovery and pre-disaster planning for future resilience

Methodology

- Literature review
- Semi-structured interviews with micro, small and large businesses located in Sydenham (7)
- Subsequent online validation survey with businesses located in Sydenham (6)
- Data analysis using Grounded Theory on Nvivo

Lessons Learnt

- Lesson 1 – Small businesses need more support for DRR and disaster planning

The study showed that small businesses had no education and awareness on business continuity planning, disaster management, preparedness or recovery practices. Small businesses seemed to have been left to fend for themselves and relied on insurance. Larger businesses were more connected to information and had disaster management plans and

evacuation procedures in place. All businesses preferred better links with the council and clearer information on funding and support available for recovery and DRR.

- Lesson 2 – The flexibility of small businesses is a strength

As compared to larger businesses, small businesses had an advantage in being able to be flexible in terms of relocating or operating from home and online. Many businesses CBD businesses had relocated to Sydenham following the earthquakes. Large businesses tended to locate themselves based on the needs of their clients.

- Lesson 3 – Making Sydenham attractive

The businesses understood that Sydenham does not have the allure of the CBD, but has positives such as cheaper parking and better access to shops. The new Colombo mall was a great boost, and better transport/PT access to Sydenham will help.

5.1.4 Project Waimakariri

Resilience through Building Back Better: Assessing Christchurch Recovery following the 2010/2011 Canterbury Earthquakes

PhD thesis: Tinu Rose Francis

Resilience through Building Back Better: Assessing Christchurch Recovery following the 2010/2011 Canterbury Earthquakes

- Understand recovery mechanisms in Waimakariri
- Analyse Waimakariri recovery under the BBB Framework

Methodology

- Semi-structured interviews with Waimakariri staff
- Data analysis using Grounded Theory on Nvivo

Lessons Learnt

- LESSON 1 – Involve Community

Waimakariri's recovery aimed to give involve the community on all key recovery decisions. Of focus was the need to rebuild quickly to give confidence to the community.

- LESSON 2 – Detailed planning

Planning in Waimakariri was particularly detailed and involved a multi-stakeholder and community approach. This led to good community outcomes and a sense that the rebuild was with community as central.

- LESSON 3 – Reducing future Risk

Alongside Christchurch, Waimakiriri considered how to reduce future risk and provide more detailed information to communities to improve building resilience to future events.

5.1.5 Project: Christchurch City

Resilience through Building Back Better: Assessing Christchurch Recovery following the 2010/2011 Canterbury Earthquakes

PhD thesis: Tinu Rose Francis

Resilience through Building Back Better: Assessing Christchurch Recovery following the 2010/2011 Canterbury Earthquakes

The project aims were to:

- Test the BBB framework on recovery organisation CERA
- Analyse Christchurch recovery under the BBB Framework
- Determine BBB best practices and improvements for future recovery

Methodology

- Literature review and CERA documentation analysis
- Semi-structured interviews with CERA staff (11)
- Data analysis using Grounded Theory on Nvivo

Lessons Learnt

- LESSON 1 – Created confidence

CERA's recovery policy aimed to give confidence to the community and renew and revitalise the damaged city. CERA initially created confidence in the community that there was a recovery structure and processes to manage recovery.

- LESSON 2 – CERA aimed for community driven recovery
The initial community-driven recovery strategy and the multi-stakeholder approach worked well.
- LESSON 3 – Reducing future Risk
Although there was uncertainty about and-use, critical risk reduction decisions were taken which include re-land zoning for future risk reduction.
- LESSON 4 –
BBB can be used as a tool for the implementation of recovery and restoration measures following a large disaster.

5.5.6 Project Kaikoura

Resilience through Building Back Better: Assessing Kaikoura's Social and Economic Recovery following the 2016 Kaikoura Earthquake

PhD thesis: Neeraj Shankar

The project aims were to:

- Test the BBB framework on recovery of Kaikoura with a focus on the social recovery
- Analyse Kaikoura recovery under the BBB Framework, Social Dimensions
- Determine BBB best practices in Kaikoura Social Recovery and improvements for future recovery

Methodology

- Literature review and documentation analysis
- Semi-structured interviews in Kaokoura with recovery staff (13)
- Data analysis using Grounded Theory on Nvivo

Lessons Learnt

- LESSON 1 – Consultation Worked

Kaikoura District Council actively consulted the community to seek input on the recovery and rebuilding decisions.

- LESSON 2 – Transparency Created Trust

Transparency was deliberate to create better relationships between the council, schools, hospital and the public.

LESSON 3 – Support Livelihood Recovery

- Supporting locals to rejuvenate business and empowering locals to re-establish their traditional livelihoods and upgrading facilities and technologies for business

rejuvenation was very important for successful overall recovery.

- LESSON 4 – Timely Information

Providing information to the community and keeping the community informed about economic recovery plans and support available for businesses helped the community move forward with their own recovery.

6. Project Team

The Project Team consisted of the following:

Team Leader: Suzanne Wilkinson (University of Auckland and Massey University)

Key Researcher: Professor Regan Potangaroa (Victoria University)

Post-doctoral Fellow: Sandeeka Mannakarra (University of Auckland)

Research Student Team

Tinu Francis – PhD student, (University of Auckland)

Neeraj Shankar – PhD student (University of Auckland)

Mark Bassett – ME student (civil engineering), (University of Auckland)

Year 4 Civil and Environmental Engineering Project Students (University of Auckland):

Isaac Kim, Ryan Kang, Emma Jarvis, Claudia Buckman

7. Research Outputs

The key outputs from the research included:

1 book

Resilient Post Disaster Recovery through Building Back Better, Sandeeka Mannakkara, Suzanne Wilkinson, Regan Potangaroa, Routledge, 2018

1 PhD thesis (1 PhD forthcoming in 2020)

Tinu Rose Francis - Resilience through Building Back Better: Assessing Christchurch Recovery following the 2010/2011 Canterbury Earthquakes.

1 Masters Thesis

Basset, M. (2015) Build Back Better: Rebuilding Water Infrastructure following the 2010-2011 Canterbury Earthquakes

4 student reports

Kim, I (2017) Evaluating the International Build Back Better Framework in the Post-Disaster Recovery Effort in Christchurch, University of Auckland.

Kang, R. (2017) Evaluating the International Build Back Better Framework in the Post-Disaster Recovery Effort in Christchurch, University of Auckland.

Jarvis, E. (2017) Build Back Better Framework Case Study: Sydenham Businesses, University of Auckland.

Buckman, C. (2017) Building Back Better – A Case Study of Sydenham Business Recovery, University of Auckland.

4 journal papers

Francis, T. R., Wilkinson, S., Mannakkara, S. & Chang-Richards, A. (2018). Post-disaster reconstruction in Christchurch: a “build back better” perspective. *International Journal of Disaster Resilience in the Built Environment*, 9, 239-248.

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1 Book Chapter

A Aryal, S Wilkinson, A Chang-Richards (2018) Community Participation to Build Back Better: Evidence from the 2015 Nepal Earthquakes in Resettlement Challenges for Displaced Populations and Refugees, 175-183

Development and establishment of a website

<https://buildbackbetter.co.nz/>

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